

ภาคผนวก ง
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	Office Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Jirantee 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 CM08130002	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778115	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920012	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920015	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
12	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 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									
14	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48C-65506-348	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 24	-
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
16	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05N91E15A0014	6 Jun 23	6 Jun 31	-
17	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0105	Thai Meteorological Department	120/24	13 Mar 24	12 Mar 25	-
18	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0106	Thai Meteorological Department	102/24	27 Feb 24	26 Feb 25	-
19	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	390/23	1 Nov 23	31 Oct 24	-
20	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	-
21	Sound Level Meter	$L_{Aeq, 24 hrs}$ L_{A90} L_{A10} L_{Amax} เสียงรบกวน	Larson Davis	LxT1 0007304	Innovative Instrument Co.,Ltd.	23-SLM-285	29 Aug 23	28 Aug 24	-
22	Sound Level Meter	$L_{Aeq, 24 hrs}$ L_{A90} L_{A10} L_{Amax} เสียงรบกวน	Larson Davis	LxT1 0007311	Innovative Instrument Co.,Ltd.	23-SLM-296	6 Sep 23	5 Sep 24	-
23	Sound Level Meter	$L_{Aeq, 24 hrs}$ L_{A90} L_{A10} L_{Amax} เสียงรบกวน	Larson Davis	LxT1 0007313	Innovative Instrument Co.,Ltd.	24-SLM-039	8 Feb 24	7 Feb 25	-

E. L. M. C. 1993 24-81, 15, 1993

Request No. : Request 176

เอกสารไม่ควบคุม



Certificate of Calibration

Certificate No.: 24P1251
Page: 1 of 2

Equipment: U Tube Manometer
Manufacturer: Dwyer
Model: 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.077/2566

Condition As-Received: Used Item
Received Date: 03 April 2024
Calibration Date: 11 April 2024

Reference: 2404-0118WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1012 mbar

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phraekhanong, Bangkok 10280

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P04, 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) Pressure Calibrator	PC106P	1189	MP-0176-23	12 Sep 2024

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

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

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

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

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

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

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

-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

Calibrated by: Suksan Khankaew
Issue Date: 17 April 2024

Approved Signatory :

[] Phallinee Prabpalpal
[] Sura Suwannasri
[✓] Attapol Panurach

เอกสารไม่ควบคุม



Cert.No.: 24P1251
Page: 2 of 2

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

Range: 0 inHg to 36 inHg
Scale Interval: 0.1 inHg (The Second Estimate)

Applied Pressure	High-port side	Low-port side	ΔP	Error
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.00	6.00	0.00
8.00	4.00	-4.00	8.00	0.00
10.00	5.00	-5.00	10.00	0.00
12.00	6.00	-6.00	12.00	0.00
14.00	7.05	-7.05	14.10	0.10
16.00	8.05	-8.05	16.10	0.10
18.00	9.05	-9.05	18.10	0.10
20.00	10.05	-10.05	20.10	0.10
22.00	11.05	-11.05	22.10	0.10
24.00	12.05	-12.05	24.10	0.10
26.00	13.05	-13.05	26.10	0.10
28.00	14.05	-14.05	28.10	0.10
30.00	15.05	-15.05	30.10	0.10
32.00	16.05	-16.10	32.15	0.15
34.00	17.05	-17.10	34.15	0.15
36.00	18.00	-18.00	36.00	0.20

The uncertainty of measurement was ± 0.11 inHg

* ΔP = High-port side - Low-port side

* 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 %.

-00-

เอกสารไม่ควบคุม



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
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar

Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phraekhanong, Bangkok 10280

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	DPI142	1422505046	MP-0094-23	03 May 2024

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suksan Khankaew
Issue Date: 23 April 2024

Approved Signatory :

[] Phallinee Prabpalpal
[] Sura Suwannasri
[✓] Attapol Panurach

เอกสารไม่ควบคุม



Cert.No.: 24P1367
Page: 2 of 2

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

Range: 980 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

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	-0.68	-1.28	-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 %.

-00-

เอกสารไม่ควบคุม



Certificate of Calibration

Certificate No.: 24H753
Page : 1 of 2

Cert. No.: 24H753
Page.: 2 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

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong, Bangkok 10250

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	231238	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 Waewwanjua
Issue Date : 18 April 2024

Approved Signatory :

[] Chakrit Waewwanjua
[✓] Vipom Tanitayawutti
[] Unnopphol Harechal

เอกสารไม่ควบคุม

Result of Calibration:-

Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%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	1.6

Result of Calibration:-

Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°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 base on standard uncertainty multiplied
by coverage factor k = 2.00, providing confidence level approximately 95%.

-o0o-

เอกสารไม่ควบคุม



United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phraekhanong, Bangkok 10250
Tel. 0 2763 2628 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com



United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phraekhanong, Bangkok 10250
Tel. 0 2763 2628 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM08130002

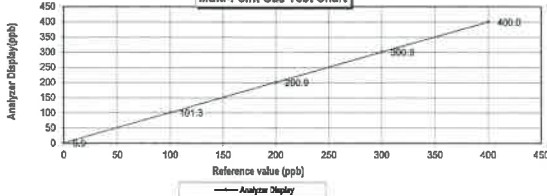
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.68 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.94 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 984.8 PPM	
Cylinder No. : EB0143262	
Expiration Date : Jun 21, 2024	

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero 0.0	0.9	0.90	0.90	0.90
Level 2 20.00% 100.0	101.3	1.30	1.28	1.28
Level 3 40.00% 200.0	200.9	0.90	0.45	0.45
Level 4 60.00% 300.0	300.9	0.90	0.30	0.30
Level 5 80.00% 400.0	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb
:Acceptable Limit ± 5%
Average Difference (%) 0.59

Multi-Point Gas Test Chart



Calculate by

01 Nov 2023

Approve by

01 Nov 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

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

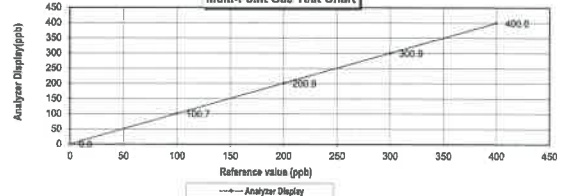
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.68 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.94 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 984.8 PPM	
Cylinder No. : EB0143262	
Expiration Date : Jun 21, 2024	

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	0.80
Level 2 20.00% 100.0	100.7	0.70	0.70	0.70
Level 3 40.00% 200.0	200.9	0.90	0.45	0.45
Level 4 60.00% 300.0	300.9	0.90	0.30	0.30
Level 5 80.00% 400.0	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb
:Acceptable Limit ± 5%
Average Difference (%) 0.45

Multi-Point Gas Test Chart



Calculate by

13 Nov 2023

Approve by

13 Nov 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : CM19050149

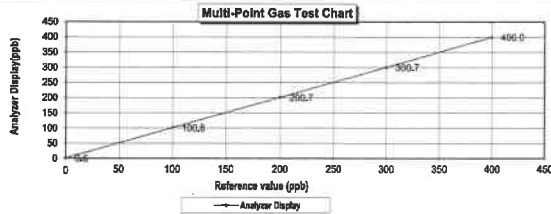
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 994.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.60	0.60	0.60
Level 2	20.00%	100.8	0.80	0.79	0.79
Level 3	40.00%	200.7	0.70	0.35	0.35
Level 4	60.00%	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	0.00	0.00	0.00

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



Calculate by
01/Nov/2023

Approve by
01/Nov/2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

Part Number: E35491E15A0014
Cylinder Number: E80162121
Laboratory: 124 - Phrakhanong - PA
PQE Number: A10223
Gas Code: CG-002-NO, NOX, SO₂, BALN
Reference Number: 160-00272205-1
Cylinder Volume: 144.0 CF
Cylinder Pressure: 2015 PSIG
Valve Orifice: F80
Certification Date: Jul 06, 2023
Expiration Date: Jul 06, 2031

General Analytical Information: This Certificate is valid for the period of 30 days from the date of certification. It is not valid for use as evidence of compliance with any regulatory requirement. The user is responsible for ensuring that the gas is used in accordance with the intended purpose and for any safety precautions. The user is also responsible for ensuring that the gas is used in accordance with the intended purpose and for any safety precautions. The user is also responsible for ensuring that the gas is used in accordance with the intended purpose and for any safety precautions.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Date
NO ₂	100.0 PPM	100.1 PPM	C1	+1.00% (1.00 PPM)	19/02/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	C1	+1.00% (1.00 PPM)	19/02/2023
SULPHUR DIOXIDE	100.0 PPM	100.0 PPM	C1	+1.00% (1.00 PPM)	19/02/2023
CARBON MONOXIDE	100.0 PPM	100.2 PPM	C1	+1.00% (1.00 PPM)	19/02/2023
CARBON DIOXIDE	100.0 PPM	100.2 PPM	C1	+1.00% (1.00 PPM)	19/02/2023

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GAIS	194232301	00764324	66.26 PPM NITRIC OXIDE/NITROGEN	+1.64%	Jun 04, 2031
PRM	00219131	APR 1114040	100.10 PPM NITRIC OXIDE/NITROGEN	+1.03%	Feb 28, 2026
GAIS	0021942525	00764324	66.26 PPM NITRIC OXIDE/NITROGEN	+1.64%	Jun 04, 2031
PRM	12409	0010360	100.10 PPM NITRIC OXIDE/NITROGEN	+1.03%	Feb 28, 2026
GAIS	1940020202	0010360	100.10 PPM NITRIC OXIDE/NITROGEN	+1.03%	Feb 28, 2026
PRM	12409	0010360	100.10 PPM NITRIC OXIDE/NITROGEN	+1.03%	Feb 28, 2026
GAIS	1940020202	0010360	100.10 PPM NITRIC OXIDE/NITROGEN	+1.03%	Feb 28, 2026
PRM	12409	0010360	100.10 PPM NITRIC OXIDE/NITROGEN	+1.03%	Feb 28, 2026
GAIS	1940020202	0010360	100.10 PPM NITRIC OXIDE/NITROGEN	+1.03%	Feb 28, 2026

Instrument/Make/Model	Analytical Principle	Last Multi-Point Calibration
Fluorier SED FTR AUP-2010A2-00P	FTR	Jun 15, 2023
SIEMENS ULTRASAT-101-01-010	UHR	Jun 14, 2023
Fluorier SED FTR AUP-2010A2-00P	FTR	Jun 29, 2021
Fluorier SED FTR AUP-2010A2-00P	FTR	Jun 10, 2023
Fluorier SED FTR AUP-2010A2-00P	FTR	Jun 07, 2023

Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo Scientific Serial Number : 1201778115

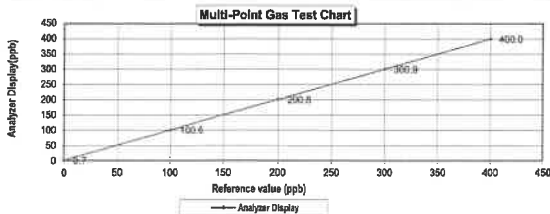
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 994.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.70	0.70	0.70
Level 2	20.00%	100.6	0.60	0.60	0.60
Level 3	40.00%	200.8	0.80	0.40	0.40
Level 4	60.00%	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00

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



Calculate by
09/Nov/2023

Approve by
09/Nov/2023

MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 431
Manufacturer : Thermo Scientific Serial Number : 1182920012

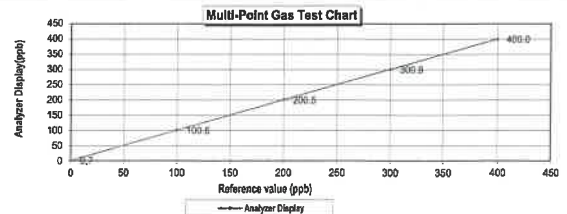
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 994.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.70	0.70	0.70
Level 2	20.00%	100.6	0.60	0.60	0.60
Level 3	40.00%	200.5	0.50	0.25	0.25
Level 4	60.00%	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00

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



Calculate by
03/Nov/2023

Approve by
03/Nov/2023

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO₂) Model : 43
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920015

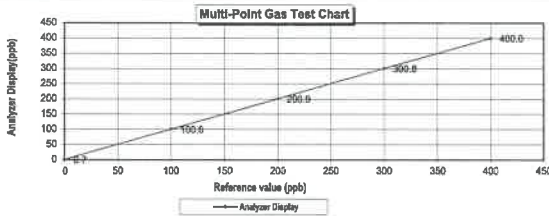
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

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

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.70	0.70	0.70
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.9	0.90	0.45
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 (%) 0.40



Calculate by

Approve by

9/11/2023
9/Nov/2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer : AIP LIQUIDE (THAILAND) LTD.
Part Number : E66N91E13A0314
Cylinder Number : 124 - Philtrheadville - FA
PGVP Number : A15233
Gas Grade : CO, CO₂, NO, NO₂, O₂, BALN

Reference Number : 163 432772125-1
Cylinder Volume : 144.9 CO₂
Cylinder Pressure : 2015 PSIG
Valve Outlet : 560
Certification Date : Jul 06, 2023
Expiration Date : Jul 06, 2031

This certificate is valid only for the gas and grade specified. It does not constitute a warranty. The user must follow the instructions for use and safety. The user must also follow the instructions for the use of the gas and grade specified. The user must also follow the instructions for the use of the gas and grade specified. The user must also follow the instructions for the use of the gas and grade specified.

Component	Requested Concentration	Actual Concentration	Percent Error	Total Relative Uncertainty	Assay Dates
NO ₂	15.00 PPM	15.00 PPM	0.0	$\pm 0.2\%$ (ASTM E1362-19a)	06/07/2023 - 06/07/2023
NITROGEN	100.00 PPM	100.00 PPM	0.0	$\pm 0.2\%$ (ASTM E1362-19a)	06/07/2023 - 06/07/2023
SULPHUR DIOXIDE	100.00 PPM	100.00 PPM	0.0	$\pm 0.2\%$ (ASTM E1362-19a)	06/07/2023 - 06/07/2023
CARBON MONOXIDE	200.00 PPM	200.00 PPM	0.0	$\pm 0.2\%$ (ASTM E1362-19a)	06/07/2023 - 06/07/2023
CARBON DIOXIDE	500.00 PPM	500.00 PPM	0.0	$\pm 0.2\%$ (ASTM E1362-19a)	06/07/2023 - 06/07/2023

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
GAIS	04219101	0074304	60.00 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Jun 04, 2024
PRM	04219101	0074304	100.00 PPM NITRIC OXIDE/NITROGEN	$\pm 0.3\%$	Jun 28, 2024
GAIS	04219101	0074304	50.00 PPM NITRIC OXIDE/NITROGEN	$\pm 0.3\%$	Apr 25, 2024
PRM	04219101	0074304	150.00 PPM NITRIC OXIDE/NITROGEN	$\pm 1.8\%$	Apr 17, 2023
GAIS	04219101	0074304	100.00 PPM NITRIC OXIDE/NITROGEN	$\pm 1.8\%$	Apr 25, 2024
PRM	04219101	0074304	100.00 PPM SULFUR DIOXIDE/NITROGEN	$\pm 1.8\%$	Apr 25, 2024
GAIS	04219101	0074304	240.00 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.3\%$	Jun 01, 2024
PRM	04219101	0074304	10.00 PPM CARBON DIOXIDE/NITROGEN	$\pm 0.3\%$	May 14, 2024

Instrument/Make/Model	Analytical Principle	Last Multi-Point Calibration
TRACER 550 FID FOR AIR/2015/45 CTR	FID	Jun 10, 2023
TRACER 550 FID FOR AIR/2015/45 CTR	FID	Jun 10, 2023
TRACER 550 FID FOR AIR/2015/45 CTR	FID	Jun 10, 2023
TRACER 550 FID FOR AIR/2015/45 CTR	FID	Jun 10, 2023
TRACER 550 FID FOR AIR/2015/45 CTR	FID	Jun 10, 2023

Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Dec 8, 2023

Equipment : Gas Analyzer (CO) Model : APMA-370
Manufacturer : HORIBA Serial Number : YRLHT87G

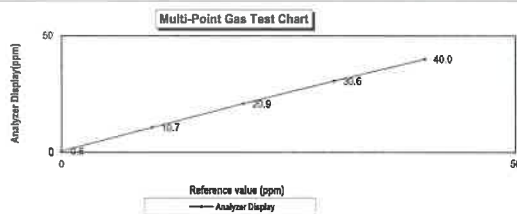
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.6	0.6
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.9	0.9	4.3
Level 4	60.00%	30.0	30.6	0.6	2.0
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm
Acceptable Limit $\pm 5\%$ Average Difference (%) 2.68



Calculate by

Approve by

8/12/2023
8/Dec/2023

MULTI-POINT GAS TEST REPORT

Test Date : Dec 8, 2023

Equipment : Gas Analyzer (CO) Model : 48C
Manufacturer : Thermo Environmental Instruments Serial Number : 48C-55506-348

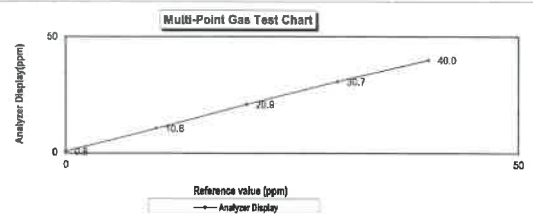
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.8	0.8
Level 2	20.00%	10.0	10.6	0.6	5.7
Level 3	40.00%	20.0	20.9	0.9	4.3
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm
Acceptable Limit $\pm 5\%$ Average Difference (%) 2.61



Calculate by

Approve by

8/12/2023
8/Dec/2023



MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

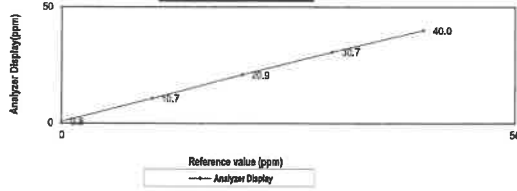
Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : CM08140004

Standard Gas Concentration		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	0.8	0.8	0.8
Level 2 20.00%	10.0	10.7	0.7	6.5
Level 3 40.00%	20.0	20.9	0.9	4.3
Level 4 60.00%	30.0	30.7	0.7	2.3
Level 5 80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range 50.0 ppm		Average Difference (%)		
: Acceptable Unit ± 5%		2.79		

Multi-Point Gas Test Chart



Calculate by

13 / 11 / 2023

Approve by

13 / Nov / 2023

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR L QUIDE (THAILAND)

Part Number: E05M51E15A0014 Reference Number: 180-42677205-1
Cylinder Number: E05150121 Cylinder Volume: 144.0 G
Filling Station: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG
PGVP Number: A101023 Valve Outlet: 650
Gas Code: CO, CO₂, NO, NO₂, SO₂, BALN Certification Date: Jul 08, 2013

Expiration Date: Jul 08, 2031

This certificate is valid only for the gas and grade specified. It is not valid for any other gas or grade. The customer is responsible for ensuring the gas is used in accordance with the intended application. The manufacturer is not responsible for any damage or injury resulting from the use of this gas.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CO	100.0 PPM	100.4 PPM	C1	+ 0.6 PPM (0.6%)
NO	100.0 PPM	100.2 PPM	C1	+ 0.2 PPM (0.2%)
NO ₂	100.0 PPM	100.3 PPM	C1	+ 0.3 PPM (0.3%)
CO ₂	100.0 PPM	100.1 PPM	C1	+ 0.1 PPM (0.1%)
SO ₂	100.0 PPM	100.0 PPM	C1	+ 0.1 PPM (0.1%)
NITROGEN	100.0 PPM	100.0 PPM	C1	+ 0.1 PPM (0.1%)

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
CO ₂	194201006	CO25434	65.26 PPM NITROGEN DIOXIDE/NITROGEN	+ 0.4 PPM
NO ₂	02219101	APR1514043	100.18 PPM NITROGEN DIOXIDE/NITROGEN	+ 0.3 PPM
SO ₂	201204250	CO25438	65.26 PPM NITROGEN DIOXIDE/NITROGEN	+ 0.4 PPM
NO	12408	CO15400	15.14 PPM NITROGEN DIOXIDE/NITROGEN	+ 0.1 PPM
CO	13340020202	CO15300	9.89 PPM NITROGEN DIOXIDE/NITROGEN	+ 0.1 PPM
NO ₂	00102101	CO15300	17.08 PPM NITROGEN DIOXIDE/NITROGEN	+ 0.1 PPM
CO	036001	CO24855	24.47 PPM CARBON MONOXIDE/NITROGEN	+ 0.1 PPM
NO ₂	133400102	CO15173	13.35 PPM CARBON MONOXIDE/NITROGEN	+ 0.1 PPM

ANALYTICAL EQUIPMENT		
Instrument Make/Model	Analytical Principle	Last Multi-point Calibration
Thermo 481 FTR 4100101045 CO ₂	FTR	Jun 14, 2023
SIEMENS ULTRAMATHE N124 NO	NDIR	Jun 14, 2023
Thermo 481 FTR 4100101045 NO	FTR	Jun 24, 2023
Thermo 481 FTR 4100101045 NO	FTR	Jun 12, 2023
Thermo 481 FTR 4100101045 NO	FTR	Jun 27, 2023

Approved for Release

เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT



4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2359-8469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Reference : 13 March, 2024

Certification No. 12024

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLETECH

Type : WL-21

Mfg Code : Wireless Receiver 220SDR0105

Wind Sensor 220SDT0105

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

81 Soi Udomsak 41, Sukhumvit Road,

Bangchak, Prachinong, Bangkok 10280.

Calibration Condition : Temperature : 29.1 °C Barometric Pressure : 1011.4 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Airtight Plotting Board

1. Micromanometer : Tabor Fraction PCM Serial No. 9110101 : HOOK GAGE NO 1425

2. N.I.S.T. Test Reference Number 701011485 : Standard Velocity 10 ± 0.01 m/sec

3. Ultrasonic Anemometer : Model DA MQ 3TV (Sensor TR-30A-1)

Serial Number 116733009 (Sensor 120809040)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 ± 2% m/sec

STANDARD THERMOMETER : Theodor (Friedrich) Dry No. 8360 54 Wet No. 8360 54

1. Sensor Serial No. 028/025 : Thermocouple No. 018552

STANDARD BAROMETER : Digital Barometer Type P1855-10 No. V1230015

Digital Barometer Serial No. P1855-10 No. V1230015

Certified by : Mr. Wachirapol Subwat

Mr. Pitsad Promsat

Authorized Signatory

for the Chief

Sub-Standard Instruments

เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT



4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2359-8469

The Result of Calibration

13 March, 2024

Certification No. 12024

Page : 2 of 5

Standard		HOOK GAGE NO 1425		TESTED ANEMOMETER	
Ultrasonic Anemometer		Pressure	Vacuum	Velocity	Correction
		m/sec	m/sec	m/sec	m/sec
1.00		-	-	1.0	0.00
3.02		-	-	3.0	0.02
5.00		-	-	5.0	0.00
7.04		-	-	6.9	0.14
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
19.02		-	-	19.0	0.02

Wind Airtight Plotting Board.	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	91
180	180
270	270

Calibrated by : Mr. Wachirapol Subwat

Mr. Wachirapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 120/24

10 March, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
1026.00	1026.1	0.58
1026.25	1026.3	0.55
1026.50	1026.6	0.50
1026.75	1026.8	0.50
1027.00	1027.0	0.54
1027.25	1027.2	0.56
1027.50	1027.5	0.56
1027.75	1027.7	0.60
1028.00	1028.0	0.60
1028.25	1028.2	0.60
1028.50	1028.5	0.60
1028.75	1028.7	0.60
1029.00	1029.0	0.60
1029.25	1029.2	0.60
1029.50	1029.5	0.60
1029.75	1029.7	0.60
1030.00	1030.0	0.60
1030.25	1030.2	0.60
1030.50	1030.5	0.60
1030.75	1030.7	0.60
1031.00	1031.0	0.60
1031.25	1031.2	0.60
1031.50	1031.5	0.60
1031.75	1031.7	0.60
1032.00	1032.0	0.60
1032.25	1032.2	0.60
1032.50	1032.5	0.60
1032.75	1032.7	0.60
1033.00	1033.0	0.60

Average

0.00

Calibrated by:

Mr. Wacharapol Subwat
Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 120/24

13 March, 2024

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
1026.00	1026.1	0.58
1026.25	1026.3	0.55
1026.50	1026.6	0.50
1026.75	1026.8	0.50
1027.00	1027.0	0.54
1027.25	1027.2	0.56
1027.50	1027.5	0.56
1027.75	1027.7	0.60
1028.00	1028.0	0.60
1028.25	1028.2	0.60
1028.50	1028.5	0.60
1028.75	1028.7	0.60
1029.00	1029.0	0.60
1029.25	1029.2	0.60
1029.50	1029.5	0.60
1029.75	1029.7	0.60
1030.00	1030.0	0.60
1030.25	1030.2	0.60
1030.50	1030.5	0.60
1030.75	1030.7	0.60
1031.00	1031.0	0.60
1031.25	1031.2	0.60
1031.50	1031.5	0.60
1031.75	1031.7	0.60
1032.00	1032.0	0.60
1032.25	1032.2	0.60
1032.50	1032.5	0.60
1032.75	1032.7	0.60
1033.00	1033.0	0.60

Average

Calibrated by:

Mr. Wacharapol Subwat
Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



The Result of Calibration

Certification No. 120/24

10 March, 2024

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	45	0.1
30.1	30	0.0
15.1	15	0.4

Calibrated by:

Mr. Wacharapol Subwat
Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



Calibration Certificate

Issued by : Calibration & Test Section, Meteorological Instruments Bureau

Date of Issue : 27 February, 2024

Certification No. 102/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : GEARRETECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0106

Wind Sensor 2265DT0106

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

91 Soi Udomsak 41, Sukhumvit Road,

Bangkok, Prachinburi, Bangkok 10000.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.2 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Axiel Profiling Board

: Micromanometer Theodor Frahm's P014 Serial No. 801137 : HOOD GAGE NO. 1425

N.I.S.T. Test Reference Number 731/241461

Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3T/1

(Sensor 1K-50AH)

Serial Number 110120029 (Sensor 120020280)

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

STANDARD THERMOMETER : Theodor Frahm's Dry No. 8350/94 Wet No. 6359/94

: Serial, Dry No. 5 Serial No. 0284057 : Thermistor No. 915502

STANDARD BAROMETER : Digital Barometer Variable Type PTE-100 No. V1220015

: Digital Barometer Variable Type PTE-100 No. V1220015

Calibrated by: Wacharapol

Signed:

Mr. Wacharapol Subwat

Mr. Prong Promon

Mechanical Engineer

Authorized Signatory

Sub-Standard Instrument

เอกสารไม่ควบคุม



The Result of Calibration



The Result of Calibration

Certification No. 10734

27 February, 2024

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOCK C556 P.O. 1423			TESTED ANEMOMETER	
	Pressure	Temperature	Velocity	Velocity	Correction
	hPa	°C	m/sec	m/sec	m/sec
3.00	-	-	3.0	3.00	0.00
3.92	-	-	3.9	3.91	0.01
5.00	-	-	5.0	5.00	0.00
7.04	-	-	7.0	7.04	0.00
9.02	-	-	9.0	9.02	0.00
11.02	-	-	11.0	11.02	0.00
13.01	-	-	13.0	13.01	0.00
15.01	-	-	15.0	15.01	0.00
17.05	-	-	17.1	17.05	-0.08
20.02	-	-	20.1	20.02	-0.08

Wind Airt Picking Board	
US DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by:
Mr. Wanchanapol Subwan
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม

Certification No. 10734

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
1010.09	1009	0.09
1012.10	1010	0.10
1014.10	1012	0.10
1016.10	1014	0.10
1018.10	1016	0.10
1020.10	1018	0.10
1022.10	1020	0.10
1024.10	1022	0.10
1026.10	1024	0.10
1028.10	1026	0.10
1030.10	1028	0.10
1032.10	1030	0.10
1034.10	1032	0.10
1036.10	1034	0.10
1038.10	1036	0.10
1040.10	1038	0.10
1042.10	1040	0.10
1044.10	1042	0.10
1046.10	1044	0.10
1048.10	1046	0.10
1050.10	1048	0.10
1052.10	1050	0.10
1054.10	1052	0.10
1056.10	1054	0.10
1058.10	1056	0.10
1060.10	1058	0.10
1062.10	1060	0.10
1064.10	1062	0.10
1066.10	1064	0.10
1068.10	1066	0.10
1070.10	1068	0.10
1072.10	1070	0.10
1074.10	1072	0.10
1076.10	1074	0.10
1078.10	1076	0.10
1080.10	1078	0.10
1082.10	1080	0.10
1084.10	1082	0.10
1086.10	1084	0.10
1088.10	1086	0.10
1090.10	1088	0.10
1092.10	1090	0.10
1094.10	1092	0.10
1096.10	1094	0.10
1098.10	1096	0.10
1100.10	1098	0.10
1102.10	1100	0.10
1104.10	1102	0.10
1106.10	1104	0.10
1108.10	1106	0.10
1110.10	1108	0.10
1112.10	1110	0.10
1114.10	1112	0.10
1116.10	1114	0.10
1118.10	1116	0.10
1120.10	1118	0.10
1122.10	1120	0.10
1124.10	1122	0.10
1126.10	1124	0.10
1128.10	1126	0.10
1130.10	1128	0.10
1132.10	1130	0.10
1134.10	1132	0.10
1136.10	1134	0.10
1138.10	1136	0.10
1140.10	1138	0.10
1142.10	1140	0.10
1144.10	1142	0.10
1146.10	1144	0.10
1148.10	1146	0.10
1150.10	1148	0.10
1152.10	1150	0.10
1154.10	1152	0.10
1156.10	1154	0.10
1158.10	1156	0.10
1160.10	1158	0.10
1162.10	1160	0.10
1164.10	1162	0.10
1166.10	1164	0.10
1168.10	1166	0.10
1170.10	1168	0.10
1172.10	1170	0.10
1174.10	1172	0.10
1176.10	1174	0.10
1178.10	1176	0.10
1180.10	1178	0.10
1182.10	1180	0.10
1184.10	1182	0.10
1186.10	1184	0.10
1188.10	1186	0.10
1190.10	1188	0.10
1192.10	1190	0.10
1194.10	1192	0.10
1196.10	1194	0.10
1198.10	1196	0.10
1200.10	1198	0.10
1202.10	1200	0.10
1204.10	1202	0.10
1206.10	1204	0.10
1208.10	1206	0.10
1210.10	1208	0.10
1212.10	1210	0.10
1214.10	1212	0.10
1216.10	1214	0.10
1218.10	1216	0.10
1220.10	1218	0.10
1222.10	1220	0.10
1224.10	1222	0.10
1226.10	1224	0.10
1228.10	1226	0.10
1230.10	1228	0.10
1232.10	1230	0.10
1234.10	1232	0.10
1236.10	1234	0.10
1238.10	1236	0.10
1240.10	1238	0.10
1242.10	1240	0.10
1244.10	1242	0.10
1246.10	1244	0.10
1248.10	1246	0.10
1250.10	1248	0.10
1252.10	1250	0.10
1254.10	1252	0.10
1256.10	1254	0.10
1258.10	1256	0.10
1260.10	1258	0.10
1262.10	1260	0.10
1264.10	1262	0.10
1266.10	1264	0.10
1268.10	1266	0.10
1270.10	1268	0.10
1272.10	1270	0.10
1274.10	1272	0.10
1276.10	1274	0.10
1278.10	1276	0.10
1280.10	1278	0.10
1282.10	1280	0.10
1284.10	1282	0.10
1286.10	1284	0.10
1288.10	1286	0.10
1290.10	1288	0.10
1292.10	1290	0.10
1294.10	1292	0.10
1296.10	1294	0.10
1298.10	1296	0.10
1300.10	1298	0.10
1302.10	1300	0.10
1304.10	1302	0.10
1306.10	1304	0.10
1308.10	1306	0.10
1310.10	1308	0.10
1312.10	1310	0.10
1314.10	1312	0.10
1316.10	1314	0.10
1318.10	1316	0.10
1320.10	1318	0.10
1322.10	1320	0.10
1324.10	1322	0.10
1326.10	1324	0.10
1328.10	1326	0.10
1330.10	1328	0.10
1332.10	1330	0.10
1334.10	1332	0.10
1336.10	1334	0.10
1338.10	1336	0.10
1340.10	1338	0.10
1342.10	1340	0.10
1344.10	1342	0.10
1346.10	1344	0.10
1348.10	1346	0.10
1350.10	1348	0.10
1352.10	1350	0.10
1354.10	1352	0.10
1356.10	1354	0.10
1358.10	1356	0.10
1360.10	1358	0.10
1362.10	1360	0.10
1364.10	1362	0.10
1366.10	1364	0.10
1368.10	1366	0.10
1370.10	1368	0.10
1372.10	1370	0.10
1374.10	1372	0.10
1376.10	1374	0.10
1378.10	1376	0.10
1380.10	1378	0.10
1382.10	1380	0.10
1384.10	1382	0.10
1386.10	1384	0.10
1388.10	1386	0.10
1390.10	1388	0.10
1392.10	1390	0.10
1394.10	1392	0.10
1396.10	1394	0.10
1398.10	1396	0.10
1400.10	1398	0.10
1402.10	1400	0.10
1404.10	1402	0.10
1406.10	1404	0.10
1408.10	1406	0.10
1410.10	1408	0.10
1412.10	1410	0.10
1414.10	1412	0.10
1416.10	1414	0.10
1418.10	1416	0.10
1420.10	1418	0.10
1422.10	1420	0.10
1424.10	1422	0.10
1426.10	1424	0.10
1428.10	1426	0.10
1430.10	1428	0.10
1432.10	1430	0.10
1434.10	1432	0.10
1436.10	1434	0.10
1438.10	1436	0.10
1440.10	1438	0.10
1442.10	1440	0.10
1444.10	1442	0.10
1446.10	1444	0.10
1448.10	1446	0.10
1450.10	1448	0.10
1452.10	1450	0.10
1454.10	1452	0.10
1456.10	1454	0.10
1458.10	1456	0.10
1460.10	1458	0.10
1462.10	1460	0.10
1464.10	1462	0.10
1466.10	1464	0.10
1468.10	1466	0.10
1470.10	1468	0.10
1472.10	1470	0.10
1474.10	1472	0.10
1476.10	1474	0.10
1478.10	1476	0.10
1480.10	1478	0.10
1482.10	1480	0.10
1484.10	1482	0.10
1486.10	1484	0.10
1488.10	1486	0.10
1490.10	1488	0.10
1492.10	1490	0.10
1494.10	1492	0.10
1496.10	1494	0.10
1498.10	1496	0.10
1500.10	1498	0.10
1502.10	1500	0.10
1504.10	1502	0.10
1506.10	1504	0.10
1508.10	1506	0.10
1510.10	1508	0.10
1512.10	1510	0.10
1514.10	1512	0.10
1516.10	1514	0.10
1518.10	1516	0.10
1520.10	1518	0.10
1522.10	1520	0.10
1524.10	1522	0.10
1526.10	1524	0.10
1528.10	1526	0.10
1530.10	1528	0.10
1532.10	1530	0.10
1534.10	1532	0.10
1536.10	1534	0.10
1538.10	1536	0.10
1540.10	1538	0.10
1542.10	1540	0.10
1544.10	1542	0.10
1546.10	1544	0.10
1548.10	1546	0.10
1550.10	1548	0.10
1552.10	1550	0.10
1554.10	1552	0.10
1556.10	1554	0.10
1558.10	1556	0.10
1560.10	1558	0.10
1562.10	1560	0.10
1564.10	1562	0.10
1566.10	1564	0.10
1568.10	1566	0.10
1570.10	1568	0.10
1572.10	1570	0.10
1574.10	1572	0.10
1576.10	1574	0.10
1578.10	1576	0.10
1580.10	1578	0.10
1582.10	1580	0.10
1584.10	1582	0.10
1586.10	1584	0.10
1588.10	1586	0.10
1590.10	1588	0.10
1592.10	1590	0.10
1594.10	1592	0.10
1596.10	1594	0.10
1598.10	1596	0.10
1600.10	1598	0.10
1602.10	1600	0.10
1604.10	1602	0.10
1606.10	1604	0.10
1608.10	1606	0.10
1610.10	1608	0.10
1612.10	1610	0.10
1614.10	1612	0.10
1616.10	1614	0.10
1618.10	1616	0.10
1620.10	1618	0.10
1622.10	1620	0.10
1624.10	1622	0.10
1626.10	1624	0.10
1628.10	1626	0.10
1630.10	1628	0.10
1632.10	1630	0.10
1634.10	1632	0.10
1636.10	1634	0.10
1638.10	1636	0.10
1640.10	1638	0.10
1642.10	1640	0.10
1644.10	1642	0.10
1646.10	1644	0.10
1648.10	1646	0.10
1650.10	1648	0.10
1652.10	1650	0.10
1654.10	1652	0.10
1656.10	1654	0.10
1658.10	1656	0.10
1660.10	1658	0.10
1662.10	1660	0.10
1664.10	1662	0.10
1666.10	1664	0.10
1668.10	1666	0.10
1670.10	1668	0.10
1672.10	1670	0.10
1674.10	1672	0.10
1676.10	1674	0.10
1678.10	1676	0.10
1680.10	1678	0.10
1682.10	1680	0.10
1684.10	1682	0.10
1686.10	1684	0.10
1688.10	1686	0.10
1690.10	1688	0.10
1692.10	1690	0.10
1694.10	1692	0.10
1696.10	1694	0.10
1698.10	1696	0.10
1700.10	1698	0.10
1702.10	1700	0.10
1704.10	1702	0.10
1706.10	1704	0.10
1708.10	1706	0.10
1710.10	1708	0.10
1712.10	1710	0.10
1714.10	1712	0.10
1716.10	1714	0.10
1718.10	1716	0.10
1720.10	1718	0.10
1722.10	1720	0.10
1724.10	1722	0.10
1726.10	1724	0.10
1728.10	1726	0.10
1730.10	1728	0.10
1732.10	1730	0.10
1734.10	1732	



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 : November 2023

Certification No. 390/23

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLETT/TECH

Type : WL-21

Mfg Code : Wireless Receiver : 005000113

Wind Sensor : 005000113

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

81 Suk Witonsuk 41, Sukhumvit Road,

Bangkok, Prachinong, Bangkok 10260

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1013.5 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 SN 91925

PROCEC QAGE NO. 1105 Wind Airt Flating Board

N.I.S.T. Test Reference Number : 701041450 : Reported Velocity at 20 : 31 m/sec

Ultrasonic Anemometer Model DA-650-STD (Sensor TR-50A-3)

Serial Number 110700000 (Sensor 170200000)

JAPAN QUALITY ASSURANCE ORGANIZATION : Reported Velocity at 0 : 0 m/sec

STANDARD THERMOMETER : Theory Precision : Dry Bulb 0.00194 Wet Bulb 0.00300

Model : 1000-05 Serial No. 702100000 : Thermistor Calibration No. 918900

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB-20 Ser. V1220013

Digital Barometer Vaisala Type PTB-20 Ser. V1220013

Calibrated by : Mr. Watchanop Subwat

Signature : Mr. Watchanop Subwat

Mr. Watchanop Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 390/23

Page : 3 of 5

Standard				TESTED ANEMOMETER	
Ultrasonic Anemometer	Pressure	Velocity	Direction	Velocity	Correction
m/sec	hPa	m/sec	Dir	m/sec	m/sec
1.00	-	-	-	1.0	0.0
3.00	-	-	-	3.0	0.07
5.00	-	-	-	5.0	0.0
7.00	-	-	-	7.0	0.04
9.00	-	-	-	9.0	0.12
11.00	-	-	-	11.0	0.01
13.00	-	-	-	13.0	0.01
15.00	-	-	-	15.0	0.11
17.00	-	-	-	17.0	0.02
19.00	-	-	-	19.0	0.12

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

Calibrated by : Mr. Watchanop Subwat

Signature : Mr. Watchanop Subwat

Mr. Watchanop Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 390/23

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1000.00	1000	0.00
1001.00	1001	0.01
1002.00	1002	0.02
1003.00	1003	-0.10
1004.00	1004	-0.09
1005.00	1005	-0.09
1006.00	1006	0.02
1007.00	1007	0.02
1008.00	1008	0.02
1009.00	1009	0.02
1010.00	1010	-0.04
1011.00	1011	-0.04
1012.00	1012	-0.04
1013.00	1013	-0.04
1014.00	1014	-0.04
1015.00	1015	-0.04
1016.00	1016	-0.04
1017.00	1017	-0.04
1018.00	1018	-0.04
1019.00	1019	-0.04
1020.00	1020	-0.04
1021.00	1021	-0.04
1022.00	1022	-0.04
1023.00	1023	-0.04
1024.00	1024	-0.04
1025.00	1025	-0.04
1026.00	1026	-0.04
1027.00	1027	-0.04
1028.00	1028	-0.04
1029.00	1029	-0.04
1030.00	1030	-0.04
1031.00	1031	-0.04
1032.00	1032	-0.04
1033.00	1033	-0.04
1034.00	1034	-0.04
1035.00	1035	-0.04
1036.00	1036	-0.04
1037.00	1037	-0.04
1038.00	1038	-0.04
1039.00	1039	-0.04
1040.00	1040	-0.04
1041.00	1041	-0.04
1042.00	1042	-0.04
1043.00	1043	-0.04
1044.00	1044	-0.04
1045.00	1045	-0.04
1046.00	1046	-0.04
1047.00	1047	-0.04
1048.00	1048	-0.04
1049.00	1049	-0.04
1050.00	1050	-0.04
1051.00	1051	-0.04
1052.00	1052	-0.04
1053.00	1053	-0.04
1054.00	1054	-0.04
1055.00	1055	-0.04
1056.00	1056	-0.04
1057.00	1057	-0.04
1058.00	1058	-0.04
1059.00	1059	-0.04
1060.00	1060	-0.04
1061.00	1061	-0.04
1062.00	1062	-0.04
1063.00	1063	-0.04
1064.00	1064	-0.04
1065.00	1065	-0.04
1066.00	1066	-0.04
1067.00	1067	-0.04
1068.00	1068	-0.04
1069.00	1069	-0.04
1070.00	1070	-0.04
1071.00	1071	-0.04
1072.00	1072	-0.04
1073.00	1073	-0.04
1074.00	1074	-0.04
1075.00	1075	-0.04
1076.00	1076	-0.04
1077.00	1077	-0.04
1078.00	1078	-0.04
1079.00	1079	-0.04
1080.00	1080	-0.04
1081.00	1081	-0.04
1082.00	1082	-0.04
1083.00	1083	-0.04
1084.00	1084	-0.04
1085.00	1085	-0.04
1086.00	1086	-0.04
1087.00	1087	-0.04
1088.00	1088	-0.04
1089.00	1089	-0.04
1090.00	1090	-0.04
1091.00	1091	-0.04
1092.00	1092	-0.04
1093.00	1093	-0.04
1094.00	1094	-0.04
1095.00	1095	-0.04
1096.00	1096	-0.04
1097.00	1097	-0.04
1098.00	1098	-0.04
1099.00	1099	-0.04
1100.00	1100	-0.04
1101.00	1101	-0.04
1102.00	1102	-0.04
1103.00	1103	-0.04
1104.00	1104	-0.04
1105.00	1105	-0.04
1106.00	1106	-0.04
1107.00	1107	-0.04
1108.00	1108	-0.04
1109.00	1109	-0.04
1110.00	1110	-0.04
1111.00	1111	-0.04
1112.00	1112	-0.04
1113.00	1113	-0.04
1114.00	1114	-0.04
1115.00	1115	-0.04
1116.00	1116	-0.04
1117.00	1117	-0.04
1118.00	1118	-0.04
1119.00	1119	-0.04
1120.00	1120	-0.04
1121.00	1121	-0.04
1122.00	1122	-0.04
1123.00	1123	-0.04
1124.00	1124	-0.04
1125.00	1125	-0.04
1126.00	1126	-0.04
1127.00	1127	-0.04
1128.00	1128	-0.04
1129.00	1129	-0.04
1130.00	1130	-0.04
1131.00	1131	-0.04
1132.00	1132	-0.04
1133.00	1133	-0.04
1134.00	1134	-0.04
1135.00	1135	-0.04
1136.00	1136	-0.04
1137.00	1137	-0.04
1138.00	1138	-0.04
1139.00	1139	-0.04
1140.00	1140	-0.04
1141.00	1141	-0.04
1142.00	1142	-0.04
1143.00	1143	-0.04
1144.00	1144	-0.04
1145.00	1145	-0.04
1146.00	1146	-0.04
1147.00	1147	-0.04
1148.00	1148	-0.04
1149.00	1149	-0.04
1150.00	1150	-0.04
1151.00	1151	-0.04
1152.00	1152	-0.04
1153.00	1153	-0.04
1154.00	1154	-0.04
1155.00	1155	-0.04
1156.00	1156	-0.04
1157.00	1157	-0.04
1158.00	1158	-0.04
1159.00	1159	-0.04
1160.00	1160	-0.04
1161.00	1161	-0.04
1162.00	1162	-0.04
1163.00	1163	-0.04
1164.00	1164	-0.04
1165.00	1165	-0.04
1166.00	1166	-0.04
1167.00	1167	-0.04
1168.00	1168	-0.04
1169.00	1169	-0.04
1170.00	1170	-0.04
1171.00	1171	-0.04
1172.00	1172	-0.04
1173.00	1173	-0.04
1174.00	1174	-0.04
1175.00	1175	-0.04
1176.00	1176	-0.04
1177.00	1177	-0.04
1178.00	1178	-0.04
1179.00	1179	-0.04
1180.00	1180	-0.04
1181.00	1181	-0.04
1182.00	1182	-0.04
1183.00	1183	-0.04
1184.00	1184	-0.04
1185.00	1185	-0.04
1186.00	1186	-0.04
1187.00	1187	-0.04
1188.00	1188	-0.04
1189.00	1189	-0.04
1190.00	1190	-0.04
1191.00	1191	-0.04
1192.00	1192	-0.04
1193.00	1193	-0.04
1194.00	1194	-0.04
1195.00	1195	-0.04
1196.00	1196	-0.04
1197.00	1197	-0.04
1198.00	1198	-0.04
1199.00	1199	-0.04
1200.00	1200	-0.04
1201.00	1201	-0.04
1202.00	1202	-0.04
1203.00	1203	-0.04
1204.00	1204	-0.04
1205.00	1205	-0.04
1206.00	1206	-0.04
1207.00	1207	-0.04
1208.00	1208	-0.04
1209.00	1209	-0.04
1210.00	1210	-0.04
1211.00	1211	-0.04
1212.00	1212	-0.04
1213.00	1213	-0.04
1214.00	1214	-0.04
1215.00	1215	-0.04
1216.00	1216	-0.04
1217.00	1217	-0.04
1218.00	1218	-0.04
1219.00	1219	-0.04
1220.00	1220	-0.04
1221.00	1221	-0.04
1222.00	1222	-0.04
1223.00	1223	-0.04
1224.00	1224	-0.04
1225.00	1225	-0.04
1226.00	1226	-0.04
1227.00	1227	-0.04
1228.00	1228	-0.04
1229.00	1229	-0.04
1230.00	1230	-0.04
1231.00	1231	-0.04
1232.00	1232	-0.04
1233.00	1233	-0.04
1234.00	1234	-0.04
1235.00	1235	-0.04
1236.00	1236	-0.04
1237.00	1237	-0.04
1238.00	1238	-0.04
1239.00	1239	-0.04
1240.00	1240	-0.04
1241.00	1241	-0.04
1242.00	1242	-0.04
1243.00	1243	-0.04
1244.00	1244	-0.04
1245.00	1245	-0.04
1246.00	1246	-0.



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10760 Tel. 081-451-2304, 0-2399-6469


The Result of Calibration

Certificate No. 190/23

1 November, 2023

Page : 5 of 5

Standard Temp °C	Temperature Sensor Reading	
	Reading °C	Correction °C
43.15	43	0.15
22.03	22	0.03
11.42	11	0.42

Calibrated by 
K. Wachugorn, Suberin
Mechanical Engineer



เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUTINKAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU KAMIT PRAKAN PROVINCE 18440 THAILAND
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



Certificate No : 24-ACT-077

Request No : Req-2024-1138

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 (%)	Measured (%)	Deviated (%)		
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

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUTINKAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU KAMIT PRAKAN PROVINCE 18440 THAILAND
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



Page 1 of 2

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

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 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

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUTINKAKORN 11 TAMBON BANG KAEU,
AMPHOE BANG PHU KAMIT PRAKAN PROVINCE 18440 THAILAND
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



Page 1 of 1

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 : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LXT1
Serial Number : 047294
ID : UAE.EFM.07/2566
Resolution : 0.1 dB
Microphone Class : 1
Microphone Model : 377802
Microphone S/N : 345213
Pre-amplifier Model : PRM1-VT1
Pre-amplifier S/N : 077629
Instrument Status : Used


Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 7 August 2023
Calibration Date : 29 August 2023
Calibration Procedure : In-house method CP-61-M-01 based on IEC 61672-1:2013 Electroacoustics - Sound level meters - Part 1: Portable sound level meters
Location of Calibration : Lab Acoustic

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	189213	9 October 2023	GRAS
Mid-frequency Calibrator	Quest	Questcal	E7-AV61234	25 July 2024	TSE
Acoustic Calibrator	Svante	Svante	121	12 October 2023	NK Electro

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
Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 29 August 2023

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

Certificate No: 25 SJM 2007
Request No: SJM-2007-1357

13. High Level Stability

End of Certificate

Approved By : Mr. P. S. Mathur
 (Chief Executive Officer)
 Issue Date : 15 September 2011

The power-law efficiency is based on standard uncertainty u defined by the Lagrange $\chi^2 = 4$ method (e.g. 4) of col. 6, measurements, table B5.

Instrument	Brand	Model	SN	Date calibration	Traceability
Standard Microscale	GRAS	4MAN	188273	6 October 2013	GRAS
Metallographic Calibrator	Quasar	Quasar	200400220	25 July 2014	TAF
Atomic Absorption	PerkinElmer	Spectra	171	12 October 2017	UKAS

The power-law efficiency is based on standard uncertainty u defined by the Lagrange $\chi^2 = 4$ method (e.g. 4) of col. 6, measurements, table B5.

[illegible]

Certificate No. .
Issued At No. Rm-2523-78

1. Indication at the calibration check frequency

Note: Absolut sensitivity was achieved by the use of Synd C for purifying SVANTL K, Model SV 3FA, SN. 0072.

2. Self-generated noise, Micrhone installed

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

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

5. Electrical signal test of frequency weighting: Weighting network response with relative to 1 Hz

5. Frequency and time weightings at 1 kHz

UUC Setting	STD	Measure(s)		UNCERTAINTY	Acceptance Limit
		UUC (dB)	ERR (dB)		
37.159 / A	REF				(± 0.8)
UUC Time Response	(dB)			(± 0.8)	
Fast	114.00	114.0	0.0		P.1
Slow	114.00	114.0	0.0	0.2	P.1
	114.00	114.0	0.0		P.1

The assays related only to the term calibration. The certificate shall not be reproduced except in full without written approval of the laboratory.

Received 14 July 2004

 $R_{1,1} = 20,000,000$ $R_{1,2} = 20,000,000$

7. Long Term Stability

UTG Setting	Measured	UNCERTAINTY	Acceptance
FSM-A: 35.19	UNC		Limit
STD Setting	0dB	(\pm dB)	(\pm dB)
Level 1	114.6		
Level 2	114.6		
Dynamic	20	0.1	0.1

2. Level linearity on the reference level range

CDF String		Antidipole	Dipole		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
1 A52 5.1 7.4 10	REF	14C	ERR			
510 dB	(dB)	(dB)	(dB)	(dB)		
130.93	130	128.0	-2.9		5.8	
134.93	134	130.0	-5.0		5.8	
138.93	137	126.0	-11.0		5.8	
142.93	134	124.0	-19.0		5.8	
149.93	119	119.0	0.0		5.8	
154.93	114	114.0	0.0		5.8	
159.93	109	109.0	0.0		5.8	
164.93	104	104.0	0.0		5.8	
169.93	99	99.0	0.0		5.8	
174.93	94	94.0	0.0		5.8	
179.93	89	89.0	0.0		5.8	
184.93	84	84.0	0.0		5.8	
189.93	79	79.0	0.0		5.8	
194.93	74	74.0	0.0		5.8	
199.93	69	69.0	0.0		5.8	
204.93	64	64.0	0.0		5.8	
209.93	59	59.0	0.0		5.8	
214.93	54	54.0	0.0		5.8	
219.93	49	49.0	0.0		5.8	
224.93	44	44.0	0.0		5.8	
229.93	39	39.0	0.0		5.8	
234.93	34	34.0	0.0		5.8	
239.93	29	29.0	0.0		5.8	
244.93	24	24.0	0.0		5.8	
249.93	19	19.0	0.0		5.8	
254.93	14	14.0	0.0		5.8	
259.93	9	9.0	0.0		5.8	
264.93	4	4.0	0.0		5.8	

This material is not to be used, in part or in whole, for any purpose other than that for which it was prepared. This information shall not be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without the prior written permission of the copyright owner.

9. Level lines: it includes the level range control

3. Data analysis including the assessment of the confidence						
UUC holding	STD	Measured		UNCERTAINTY	Assessment	
	REF	UUC	ERR		Limit	UUC
UUC Range	(dd)	(dd)	(dd)	(dd)	(dd)	(dd)
STD	11.1	4.5	6.2		5.1	0.8
	11.0	112.0	0.0			0.0

10. Tone burst response

TSC Time Response	TSC Setting		Measured		UNCERTAINTY ($\pm 2\sigma$)	Acceptance Limit ($\pm 2\sigma$)
	Turnover (ns)	Res. (dB)	UL (dB)	LRR (dB)		
Fig. 1	200	135.0	155.0	-6.2	0.5	7.5
	2	138.6	157.9	-6.3		+1.0, -0.5
	5.75	109.7	102.6	-6.4		+1.6, -3.9
	200	178.6	177.5	-6.1		0.3
Sim.	2	109.0	108.0	-6.1	0.5	+1.0, -3.0
	200	125.0	129.0	6.0		0.5
N.J.	2	109.0	109.0	0.0	0.5	+2.0, -1.5
	5.75	109.0	99.9	-6.1		+1.0, -3.5

11. Peak C Sound level

12. Peak & sound level	Analysis/used	Measured			UNCERTAINTY	Acceptance
		TYPE	TYPE	TYPE		
UCL Setting 1.651 * C ₉₀ - 140	REF	(dB)	(dB)	(dB)	1.5 (dB)	1 built
STD Setting	(dB)	(dB)	(dB)	(dB)	1.5 (dB)	1 built
Cumulative eq-1e	1.734	1.734	1.734	1.734	2.0	2.0
Provisional half cycle	1.734	1.734	1.734	1.734	2.0	2.0
Cumulative half cycle	1.734	1.734	1.734	1.734	2.0	2.0

The authors related more to the data collected. The evaluation should not be expected to provide a complete picture of the **เอกสารไม่ควบคุม**

Certifier No : 23-1N-296

Requena N. / Feb 2015, 1552

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FA57-A 17-13	1.1°C		Limit
STD Setting	(dB)		(\pm dB)
Positive one-half cycle	139.2		
Negative one-half cycle	139.9		
Desired	0.0	0.2	1.5

13. High Level Stability

UNC Setting	Measured	UNCERTAINTY	Acceptance
FASE (A = 30.429)	UNC		Limit
SEU Setting	(dB)	(\pm dB)	(\pm dB)
Initial	150.0		
Final	130.0		
Deviation	dB	0.1	0.1

End of Certificate

The results related only to the item analyzed. The certificate should be reproduced verbatim in full, without further approval or modification.

เอกสารไม่ควบคุม

(M) (S) (M) (G) (P) (S) (S) (S) (S) (S)

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Water Quality Analysis									
1	pH Meter	pH	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
2	pH Meter	Temperature	Mettler-Toledo	Seven Easy S20 / 1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
3	Conductivity Meter	Salinity	SI Analytics	La9955 / 16300356	DKSH (Thailand) Ltd.	C24240057	11 Mar 24	10 Mar 25	-
4	Analytical Balance (Readability 0.1 mg)	Conductivity	Mettler-Toledo	XSR204 / C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
5	Analytical Balance (Readability 0.01 mg)	Fat, Oil and Grease	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
6	Hot Air Oven	TDS, TSS	Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8 Oct 24	7 Oct 25	-
7	Gas Chromatography (GC)	Benzene, Toluene, Ethylbenzene Total Xylenes	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	21 Feb 24	19 Feb 25	-
8	Atomic Absorption Spectrophotometer (AAS)	Cadmium, Chromium Hexavalent, Lead, Nickel, Arsenic Selenium, Barium, Copper, Zinc, Iron, Mn, Total Cr Manganese	Perkin Elmer	PinAAcle 900F / PFB520031902	Perkin Elmer Co.,Ltd.	PinAAcle 900F Preventive Maintenance Report	14 May 24	13 May 25	-
9	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4 Nov 24	3 Nov 25	-
10	Cold Vapor Atomic Absorption (CVAAS)	Mercury	Nippon Instrument Corporation	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	9 Jul 24	8 Jul 25	-

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
11	Fluorescence Spectrophotometer	TPH (Kerosene Range Hydrocarbon C10-C14)	Perkin Elmer	LS 8500 / FL85K2062801	Perkin Elmer Ltd.	FL_3002/2024	8 Sep 24	7 Sep 25	-
		TPH (Diesel Range Hydrocarbon C15-C28)							
		TPH (Heavy Oil Range Hydrocarbon C29-C36)							
12	Fluorescence Spectrophotometer		Perkin Elmer	LS 8500 / FL85K2062801	Perkin Elmer Ltd.	FL_3002/2024	8 Sep 24	7 Sep 25	-
13	Incubator	Total Coliform Bacteria	Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	24TM588	1 Apr 24	31 Mar 25	-
14	Incubator		Arco	UR-1320 / (UAE.WAO.006/2553)	Technology Promotion Association (Thailand-Japan)	24TM587	1 Apr 24	31 Mar 25	-
15	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	24TM429	10 Feb 24	8 Feb 25	-
16	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	24TM430	10 Feb 24	8 Feb 25	-
17	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2403982-001-01	7 Aug 24	6 Aug 25	-
18	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2402281-001-01	2 Apr 24	1 Apr 25	-
19	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	2402419-001-01	19 Apr 24	18 Apr 25	-

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

Calibration Certificate

Certificate No.: 2401718-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udumak 41, Sukhumvit Road,
Bangcheek, Prakhong, 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. Manas Somsak Specialist
Approved by (Mr. Phersaph Tuenjit)
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 capability to recognize national standards and to the units of measurement related at the corresponding national standards laboratory. This certificate may not be reproduced (other than in full) except with the prior written approval of the National Food Institute.

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

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 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (51 ± 3) %
Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method: W-CO-PH-2: In-house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM).

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date	
2.1 DC Voltage Calibrator	2709K7	Fiske	2352003	14 June 2024	
2.2 Digital Thermometer	2709C7	Fiske	CC 66670-01	19 Octabr 2024	
2.3 Thermo-Hygro Meter	NFLBTH 014723	Isaro	CC 66635-01	3 April 2024	
Certified Reference Material		Lot No.	Manufacturer	Rel No	Expiry Date
2.4 pH buffer 4.003 (Primary pH buffer Solution)		888842	CPAchem	PH215.L5	13 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)		888843	CPAchem	PH217.L5	13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)		888844	CPAchem	PH220.L5	13 April 2025
2.7 pH buffer 7.00 (Standard pH buffer Solution)		C03109	HACH LANGE GmbH	B11M004	16 October 2025

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

- 3.1 Instruments Ng.2.1 through NSG-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
- 3.2 Instruments Ng.2.2 and 2.3 through NSG-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0361
- 3.3 Certified Reference Material Ng.2.4 to 2.6 traceable to Primary measurement method: Hanna cal using calibrated thermometer, barometer, and spectrometer. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
- 3.4 Certified Reference Material Ng.2.7 traceable to PTB Certificate No. PTB-PH04-603/0504/23 and Certificate No. PTB-PH06-655/0626/23 (PTB Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)

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

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

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

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)
		mV	pH		
0	414.121	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.168	-59	8.00	0.58	2.00
10	-177.491	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.116	-414	14.00	0.58	2.00

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

Equipment: pH Electrode Type: Combined Electrode
Manufacturer: METTLER TOLEDO Model: InLab Solids
Serial No.: 3065701 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		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.006	4.01	188	-	0.0071	2.00
7.001	7.00	15	98.9	0.0086	2.00
10.010	10.01	-169	97.2	0.0083	2.00
6.865	6.87	21	-	0.0074	2.00

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

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: 51 % ± 2 %

Condition of this results of Calibration:

- 1. Calibration Method: In-house method, W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1522	2148154	PSL-T 0877/3	08-Jun-24	TISR
Platinum Resistance Thermometer (PRT)	687A	877332			

Support Equipment: Low Temperature Bath (SODAL-6), Model: Europe-6 Plus Basic, S.N. 3415622

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

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

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

6. Condition of Calibrated Item: Good

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

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

Certificate of Calibration

Calibration Report

Certificate No.: 24517-06-001-01
Equipment: Digital Thermometer: KLIN RTD (pH Meter)
Resolution: 0.1 °C Model: SevenEasy pH
Serial No: 1231155210 ID No.: UAE.WAT.91C2563
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 SN: N/A
Dimension of probe: Diameter: 3 mm, Length: 120 mm
Sheath material: Stainless Steel

UUC Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.985	0.1	0.050
25.1	24.998	0.1	0.050
35.1	34.997	0.1	0.050

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 -----

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


Equipment: pH METER
Model: SevenEasy
Serial No. (or ID.): 1230525212 (UAE.WAS.003/2653)
Manufacturer: METTLER TOLEDO
Electrode Serial No.: 1156883
Condition: In Condition
Certificate No.: C07240167
Issued Date: 9 April 2024
Job No.: WO-00024208
Page: 1 of 3
Model: InLab Solids **Brand:** METTLER TOLEDO


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

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

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

Calibration By: Miss.Orawan Khlaiphloi
Calibration Date: 9 April 2024
The Method used: In house method, CAL-WI-58, base on ASTM E 70-07
Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 938377, 931965, 931984 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20230350EA


(Miss Orawan Khlaiphloi)
Person in charge


(Mr. Nitinun Sthawan)
Authorized signatory

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

บริษัท ดีเคเอส อี. จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C07-14: 9 Apr 2024

Certificate No.: C07240167 Page 2 of 3

Calibration Results:

pH Scale

Input (mV)	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	Error (mV)	(pH)		
414.12	414	-0.12	0.00	0.58	2.00
354.96	355	0.04	1.00	0.58	2.00
295.8	296	0.20	2.00	0.58	2.00
236.64	237	0.36	3.00	0.58	2.00
177.48	178	0.52	4.00	0.58	2.00
118.32	118	-0.32	5.00	0.58	2.00
59.16	59	-0.16	6.00	0.58	2.00
0	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-118	0.32	9.00	0.58	2.00
-177.48	-177	0.48	10.00	0.58	2.00
-236.64	-236	0.64	11.00	0.58	2.00
-295.8	-295	-0.20	12.00	0.58	2.00
-354.96	-355	-0.04	13.00	0.58	2.00
-414.12	-414	0.12	14.00	0.58	2.00

Practical slope and zero point*

The three-point calibration using three standard buffer solutions: pH 4.008, pH 6.985 and pH 9.997
-During calibration, display of pH meter reading: pH 4.00, pH 7.00 and pH 10.01
The practical slope of the pH electrode: 57.01 (mV/pH), 95.37%
The zero point of the pH electrode: 6.88 (pH)

Sample Test Results

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

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

The End of Certificate



Certificate of Calibration

Certificate No.: C15240373

Page: 2 of 2

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

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

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

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

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

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

(Mr. Nateekam Mitjit)
Person in charge

(Mr. Pramote Ramrong)
Authorized signatory

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

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C15-14: 08 Dec 2022

Reference standard equipment:

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

Calibration Results:

Without Adjustment

Sensor Type: RTD		Channel: -		
Diameter (mm) 4		Length (mm): 135		Immersion (mm): 110
Calibrate Point (°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
15.0	15.010	15.1	-0.090	0.076
25.0	25.006	25.1	-0.094	0.076
35.0	35.004	35.0	0.004	0.076

The End of Certificate

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C15-14: 08 Dec 2022



Certificate of Calibration

Certificate No.: C24240057

Page: 2 of 2

Equipment: CONDUCTIVITY METER
Model: Lab 955
Serial No. (or ID): 16300356
Manufacturer: SI Analytic
Electrode Serial No. 16070067
Condition: In Condition

Certificate No.: C24240057
Issued Date: 11 March 2024
Job No.: WO-00020309
Page: 1 of 2
Model: LF413T Brand: SI Analytic

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

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

Calibration Place: Environment Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Pongpisut Suebchantha
Calibration Date: 11 March 2024
The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14
Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 960753, 890591, 890593

(Mr. Pongpisut Suebchantha)
Person in charge

(Mr. Nitinun Srihawan)
Authorized signatory

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

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C24-09: 12 Sep 2022

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	26.7 µS/cm	-1.700 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1428 µS/cm	-16.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.4 mS/cm	2.9 mS/cm	2.00	0.67 mS/cm

After Adjustment ; at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	25.9 µS/cm	-0.900 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	107.5 mS/cm	3.8 mS/cm	2.00	0.67 mS/cm

The End of Certificate

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม
CAL-FM-C24-09: 12 Sep 2022



Certificate of Calibration

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

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR204
Serial No. : C117635043
ID No. : UAE.WAS.012/2564
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room (108)
Received order : 11 May 2024
Calibration Date : 11 May 2024
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Khit Ruttanaprapachai
Approved by :
() Ponpan Paipim
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced either in full or in part without the prior written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



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

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

Calibration were conducted using in-house calibration procedure CP-0801 based on UKAS LAB 14 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0019-24	25 Jan 2026

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

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

After Adjustment :

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

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

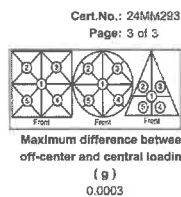


Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-2
Result of calibration

2. Effect of off center loading

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

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



3. Departure from nominal value

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

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

-o0o-

เอกสารไม่ควบคุม



มูลนิธิส่งเสริมพัฒนาอาหาร
ศูนย์บริการข้อมูลอาหาร
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,
Bangchak, Phrakhanong, 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 Prapawattipong Scientist
Approved by
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Date of Issue: 9 April 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 traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance
Model: XSR205DU
Serial No.: C710685394
Capacity: 220 g

Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Page 2 of 4

Environment Condition: Ambient Temperature: 24.5 °C Relative Humidity: 47.3 % 2.5 %

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TTS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 019/23	Quality Reborn	QR24-0343	9 February 2025

3. This certificate is traceable to SI UNIT

4. This certificate is 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	0.0005942
80	0.0006052
100	0.000548
200	0.000548

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.
The balance reading obtained is given in the table.

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

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

2008 ถนนสุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร เอกสารไม่ควบคุม
2008 Soi 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2-222 8588 Fax: +66(0) 2-222 8545 nfi.or.th

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g

Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Page 3 of 4

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	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
(g)	(g)	(g)	(g)	(g)	k
Unloaded	0.000000	0.00000	0.00000	0.0000385	2.00
0.001	0.001003	0.00101	-0.00001	0.0000089	2.00
0.005	0.005003	0.00500	0.00000	0.0000092	2.00
0.01	0.010003	0.01000	0.00000	0.0000089	2.00
0.05	0.049996	0.05000	0.00000	0.0000096	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000073	2.00001	0.00006	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00000	0.00003	0.000037	2.00
30	30.000040	30.00001	0.00003	0.000050	2.00
50	50.000028	50.00002	0.00001	0.000068	2.00
80	80.000068	80.00002	0.00005	0.00011	2.00

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

2008 ถนนสุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร เอกสารไม่ควบคุม
2008 Soi 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2-222 8588 Fax: +66(0) 2-222 8545 nfi.or.th

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g

Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Page 4 of 4

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	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
(g)	(g)	(g)	(g)	(g)	k
90	90.00010	90.00001	0.00009	0.000015	2.00
100	100.00006	100.00001	0.00005	0.000015	2.00
110	110.00007	110.00001	0.00006	0.000016	2.00
120	120.00009	120.00000	0.00009	0.000017	2.00
130	130.00010	130.00000	0.00010	0.000019	2.00
140	140.00014	140.00000	0.00014	0.000020	2.00
150	150.00009	150.00001	0.00008	0.000020	2.00
160	160.00010	160.00001	0.00009	0.000022	2.00
170	170.00012	170.00001	0.00011	0.000023	2.00
200	200.00016	200.00002	0.00014	0.000028	2.00

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

----- End -----

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

2008 ถนนสุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร เอกสารไม่ควบคุม
2008 Soi 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2-222 8588 Fax: +66(0) 2-222 8545 nfi.or.th

Calibration Certificate

Certificate No.:

2500116-001-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address:

3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Equipment:

CHAMBER (Hot Air Oven)

Manufacturer:

MEMMERT

Model:

UF55

Serial No.:

B216.1666

ID No.:

UAE.WAO.027/2559

Order No.:

2500116

Operation No.:

2500116-001

Date of Receipt:

8 October 2024

Date of Calibration:

8 October 2024

Calibrated by

Mr.Yothin Charoensuk
Scientist

Approved by

(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue:

15 October 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 traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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

2008 ถนนสุขุมวิท 35 แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร เอกสารไม่ควบคุม
2008 Soi 35, Aun Amarn Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2-222 8588 Fax: +66(0) 2-222 8545 nfi.or.th

Calibration Report

Certificate No.: 2500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55 Serial No.: 8216.1666
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
Manufacturer: MEMMERT
Date of Calibration: 8 October 2024

Location: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition: Ambient Temperature (30.3 ± 1) °C
Relative Humidity (55 ± 1) %
Line Voltage (230 ± 3) Volt

Condition of this results of Calibration:

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

Reference Standard Instrument:

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY57903188	TE 670486-01	8 June 2025	NATIONAL FOOD INSTITUTE
	RTD	CH701-209/RTD#201-209			

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

UUC Description:
Time of Record 1 Hour 9 Minute At 104.0, 140.0 and 180.0 °C
Fresh air Damper: ☒ Open Position ☒ Fan 49%
☒ Close Fan ☐ Not Available
7. Result of Calibration: ☒ Without adjustment ☐ After adjustment

F-CS-012 Rev/rev: 01 Date: 20-01-65

เอกสารไม่ควบคุม
nfi

Calibration Report

Certificate No.: 2500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55 Serial No.: 8216.1666
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
Manufacturer: MEMMERT
Date of Calibration: 8 October 2024

Calibration point: 104.0, 140.0 and 180.0 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	29.3	54	227.0
MAX	31.2	56	232.0

Table 1: Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No. 9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	103.89	103.66	103.88	103.89	104.40	103.98	103.70	104.10	104.15	0.53
140.0	139.85	139.53	139.87	139.88	140.67	140.00	139.60	140.25	140.23	0.73
180.0	179.63	179.22	179.71	179.76	181.03	180.06	179.41	180.87	180.39	0.90

Table 2: Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.15	0.49	0.58
140.0	140.0	140.0	140.0	0.13	0.71	1.2
180.0	180.0	180.0	180.0	0.13	1.2	1.9

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

UUC* = Unit Under Calibration

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

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

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

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

----- End -----

F-CS-012 Rev/rev: 01 Date: 20-01-65

เอกสารไม่ควบคุม
nfi

Agilent
CrossLab
From bench to business

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.

Agilent 7890 GC Preventive Maintenance Checklist

Agilent
CrossLab
From bench to business

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 Startup 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%20Guide.pdf

Revision: 2.00, Issued: December 30, 2020
Agile Document Number: D0007063
DE number: 44166.759722222
© Agilent Technologies, Inc. 2020

Page 2 of 9

Agilent

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
 © Agilent Technologies, Inc. 2020

Page 3 of 9



เอกสารไม่ควบคุม

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.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
 © Agilent Technologies, Inc. 2020

Page 4 of 9



เอกสารไม่ควบคุม

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.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
 © Agilent Technologies, Inc. 2020

Page 5 of 9



เอกสารไม่ควบคุม

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.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.7597222222
 © Agilent Technologies, Inc. 2020

Page 6 of 9



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.

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
 © Agilent Technologies, Inc. 2020

Page 7 of 9



เอกสารไม่ควบคุม

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 & VI)	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	G1531-67090	7890A/B	
Standard .011-inch FID Jet for capillary FID base	G1531-80550	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	

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
 © Agilent Technologies, Inc. 2020

Page 8 of 9



เอกสารไม่ควบคุม

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 Phuwarnai Yoktragul Customer signature

Total number of pages in this document 9

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
 © Agilent Technologies, Inc. 2020

Page 9 of 9



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)

Company Name:		United Analyst and Engineering Consultant Co., LTD.	
Address (Instrument Location):		41 Sukumvit Rd., Phra Khanong, Bangkok 10260	
Serial Number:	PFBS20031902	PM Number:	2 of 2
Customer Name (if applicable):	K. Yalinda	Telephone Number:	095-5580049
Customer Support Engineer Name:	K. Chayanan	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.

Copyright Information

This document contains proprietary information that is protected by copyright. All rights are reserved.

No part of this publication may be reproduced in any form whatsoever or translated into any language without the prior, written permission of PerkinElmer, Inc.

Copyright © 2013 PerkinElmer, Inc.

Trademarks

Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law. PerkinElmer is a registered trademark of PerkinElmer, Inc. All other trademarks and registered trademarks not owned by PerkinElmer, Inc. or its subsidiaries that are depicted herein are the property of their respective owners. Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no Warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

เอกสารไม่ควบคุม

Component List

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

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
80501696	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
N9301734	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

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	X Lumina HCL	1	030819-010130
N3050152	Ni Lumina HCL	1	052719-020020

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 slot 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

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

8.4 D₂ Background Compensation with Copper

Description: Verifies the instrument's 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 HS 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.

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 ☒ Falls ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	Date:
<i>Chayanon R.</i>	14-May-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	Date:
<i>อ.วิภากร</i>	14-May-2024 (DD-MMM-YYYY)

Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES
Preventive Maintenance

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 what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

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. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- 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.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.

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 "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system 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.
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Verification section including the customer's and your signature.

Important Customer Web Links

- 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.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/us/AgilentResources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- 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>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/Agilent>
- Need to place a service call?** [View the Repair Options | Agilent](#)

Instrument Maintenance

System Information

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

Instrument System Name and ID	5100 VDV ICP-OES
Instrument System Site and Location	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 50130	MY 15030001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray (OneNeb) Conical Other
Spray Chamber	Cyclonic Single Pass (Cyclonic Double Pass) Other
Torch	Radial (Dual View) Other
Torch Type	One Piece (Semi Dismountable) Fully Dismountable Other
Injector Diameter	2.4mm (1.8mm) 1.4mm 0.8mm Other
Injector Material	Quartz Ceramic Other

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 and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

Preventive Maintenance Procedures

Record Pre-PM instrument performance

- ☒ Run Instrument Performance test
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

- ☐ Service not applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

SPS 3 Auto Sampler

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

SPS 4 Auto sampler

- ☒ Service not applicable
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

- ☒ Service not applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following instrument tests
 - ☒ Subsystem Communications Test
 - ☒ Air Flow
 - ☒ Water Flow
 - ☒ Gas Flows
 - ☒ RF Generator
 - ☒ Camera Test
 - ☒ Optics Test
 - ☒ Nebulizer Test
- ☒ Record the result in the instrument Test Results Table

Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. N/A
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ 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. Systems in a compliant environment may need additional documentation.
- ☒ Complete the Signature Page with both Service Engineer and Customer signatures.

ICP-OES Status Results Table

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

Measurement	Standby Mode		Plasma On	
Mains Voltage	231.4 V	VAC	236.9 V	VAC
Mains Current	0.06 A	A	0.105 A	A
Instrument Temperature	22.1 °C	°C	23.5 °C	°C
RF Air Flow (sensor speed)	14.0 Hz	Hz	19.0 Hz	Hz
Plasma Exhaust Temperature	No measurement		63.4 °C	°C
Water Flow Oscillator	No measurement		1.34 L/min	L/min
Water Flow Detector	0.66 L/min	L/min	0.61 L/min	L/min
Water Inlet Temperature	19.3 °C	°C	19.9 °C	°C
Polychromator Temperature	35.0 °C	°C	35.0 °C	°C
CCD Temperature	-40.1 °C	°C	-39.8 °C	°C
Thermal Stabilizer	35.0 °C	°C	35.0 °C	°C
Argon Supply Pressure	249.1 kPa	kPa	291.85 kPa	kPa
Purge Gas Supply Pressure*1	245.55 kPa	kPa	212.41 kPa	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.30 L/min	L/min
Nebulizer Back Pressure	No measurement		158.43 kPa	kPa
Plasma Gas Flow	No measurement		11.91 L/min	L/min
Auxiliary Gas Flow	No measurement		1.00 L/min	L/min
RF Power	No measurement		1204.5 W	W
RF Supply Current	No measurement		7.1653 A	A
RF Supply Voltage	No measurement		204.41 V	V

*1 If option installed

Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial*	Radial	Axial*
Zn 213.857 nm SRBR	1500.3	247.4	1124.3	6965.9
Mn 267.510 nm SRBR	3915.0	7492.1	13017.9	31126.6
Al 396.152 nm SBR	9.3	10.3	9.3	21.1
K 766.491 nm SBR	5.3	26.1	4.6	45.3

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

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

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

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68016	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Reduculator	-
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Penstatic pump tubing, PVC Solvaflex, 3 bridged.	3710049000	SPS 4	-

Consumed Parts Reference

(Purchased by customer, not included as part of PM)

☒ Section Not Applicable.

Part Description	Part Number	Product or Model# where used	Quantity consumed
------------------	-------------	------------------------------	-------------------

Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:

6009197160

Date Service Completed:

04 Nov 2024

Service Engineer Name:

Kanyakorn S.

Customer Name:

Alpha Ink Co Ltd

Service Engineer Signature:

Kanyakorn S.

Customer Signature:

Alpha Ink Co Ltd

Total number of pages in this document:

14

Revision A.02, Issued: 21 January 2022
Document Number: 68014-90075
© Agilent Technologies, Inc. 2022

Page 13 of 14



เอกสารไม่ควบคุม

Report Summary

Instrument Model Agilent 5100/5110 VDV ICP-OES
Instrument ID G8011A/G8015A
Instrument Serial Number MY18030001
Software Version 7.3.1.8507
Firmware Version 3442
Tested By Pre Test_PM_Kanyakorn S.
Test Completed On 11/4/2024 9:19:10 AM

Result Summary

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

Page 1 of 4

เอกสารไม่ควบคุม

Resolution Test

Pass

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.98
As (188.980 nm)	≤ 8.20	6.17
C (193.027 nm)	≤ 11.50	8.30
Mo (202.032 nm)	≤ 8.20	6.38
Cr (206.158 nm)	≤ 13.40	8.98
Zn (213.857 nm)	≤ 8.70	6.80
Pb (220.353 nm)	≤ 9.50	7.09
Co (228.615 nm)	≤ 17.20	11.67
Ba (230.424 nm)	≤ 9.40	7.20
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	14.11
Cr (267.716 nm)	≤ 11.00	8.04
Cu (324.754 nm)	≤ 25.00	18.97
Cu (327.395 nm)	≤ 14.20	11.23
Sr (338.071 nm)	≤ 33.50	24.30
Ba (455.403 nm)	≤ 44.00	33.47
Sr (480.733 nm)	≤ 36.00	17.23
Ba (493.408 nm)	≤ 36.00	25.37
Ba (614.171 nm)	≤ 42.00	25.54
Ar (675.283 nm)	≤ 74.00	58.51
K (766.491 nm)	≤ 80.00	65.86

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test

Fail

Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8
Se (196.026 nm)	≥ 41.0	SRBR	87.8	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	746.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3516.0	SRBR	3916.0	264700.2	4420.0
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5563.2
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8
K (766.491 nm)	≥ 1.6	SBR	5.7	99038.2	14687.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8
Zn (213.857 nm)	≥ 234.0	SRBR	466.0	6784.2	198.7
Cd (214.439 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7829.5	489.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16811.7
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	128706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290748.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18006.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956460.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	28.1	1395180.2	47996.2

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			
			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.73	
Se (196.026 nm)	≤ 2.60	0.95	
Zn (213.857 nm)	≤ 1.50	0.31	
Pb (220.353 nm)	≤ 2.60	0.73	
Mn (257.610 nm)	≤ 1.50	0.39	
Al (396.152 nm)	≤ 1.50	0.39	
Ba (493.408 nm)	≤ 1.50	0.87	
K (766.491 nm)	≤ 1.50	0.32	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	1.21	
Se (196.026 nm)	≤ 1.50	0.84	
Zn (213.857 nm)	≤ 1.50	0.98	
Cd (214.439 nm)	≤ 1.50	0.26	
Pb (220.353 nm)	≤ 1.50	0.51	
Mn (257.610 nm)	≤ 1.50	0.97	
Cr (267.716 nm)	≤ 1.50	0.22	
Cu (324.754 nm)	≤ 1.50	0.24	
Al (396.152 nm)	≤ 1.50	0.33	
Ba (493.408 nm)	≤ 1.50	0.40	
K (766.491 nm)	≤ 1.50	0.65	

Page 4 of 4

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
File Name	3442
Tested By	Post Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 11:07:24 AM
Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass
Subsystem Communications Test	Pass
Optics Test	
	Pass
Intensity	Radial 3184054 Axial 3177175
Wavelength	Radial 737.212 Axial 737.212

Page 1 of 4

เอกสารไม่ควบคุม

Resolution Test		
Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.97
As (188.980 nm)	≤ 8.20	6.14
C (193.027 nm)	≤ 11.50	8.33
Mo (202.032 nm)	≤ 8.20	6.33
Cr (205.133 nm)	≤ 13.40	9.06
Zn (213.857 nm)	≤ 8.70	6.70
Pb (220.353 nm)	≤ 9.50	7.03
Co (228.615 nm)	≤ 17.20	11.72
Ba (230.424 nm)	≤ 9.40	7.32
Mn (257.610 nm)	≤ 13.30	9.44
Mn (260.568 nm)	≤ 20.30	14.21
Cr (267.716 nm)	≤ 11.00	7.94
Cu (324.754 nm)	≤ 25.00	18.99
Cu (327.395 nm)	≤ 14.20	11.27
Sr (338.071 nm)	≤ 33.50	24.40
Ba (455.403 nm)	≤ 44.00	33.50
Sr (460.793 nm)	≤ 36.00	17.31
Ba (493.408 nm)	≤ 36.00	25.44
Ba (614.171 nm)	≤ 42.00	25.16
Ar (676.283 nm)	≤ 74.00	56.16
K (766.491 nm)	≤ 80.00	65.56

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	174.9	1596.7	73.0
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1853.4	110.2
Zn (213.857 nm)	≥ 234.0	SRBR	740.9	6838.0	83.1
Cd (214.439 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.6	1006837.8	1044.0
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.81	
Se (196.026 nm)	≤ 2.60	0.98	
Zn (213.857 nm)	≤ 1.50	0.22	
Pb (220.353 nm)	≤ 2.60	0.37	
Mn (257.610 nm)	≤ 1.50	0.27	
Al (396.152 nm)	≤ 1.50	0.25	
Ba (493.408 nm)	≤ 1.50	0.53	
K (766.491 nm)	≤ 1.50	0.15	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.81	
Se (196.026 nm)	≤ 1.50	0.65	
Zn (213.857 nm)	≤ 1.50	0.79	
Zn (213.857 nm)	≤ 1.50	0.81	
Cd (214.439 nm)	≤ 1.50	0.35	
Pb (220.353 nm)	≤ 1.50	0.33	
Mn (257.610 nm)	≤ 1.50	1.02	
Cr (267.716 nm)	≤ 1.50	0.32	
Cu (324.754 nm)	≤ 1.50	0.51	
Al (396.152 nm)	≤ 1.50	0.37	
Ba (493.408 nm)	≤ 1.50	0.68	
K (766.491 nm)	≤ 1.50	0.74	

Page 4 of 4

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-QES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Post Test_PM_Kanyakorn S.	
Test Completed On	11/4/2024 11:30:15 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
15.00	19.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.30	0.61	20.55

Page 1 of 2

เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	154.65	2.00	2.00	110.92
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	115.38	18.00	17.97	21.48
RF Generator Test			Pass		
RF Power Supply Test	Passed				
RF Power Supply (V)	128.554				
RF Oscillator Test	Passed				
RF Oscillator Frequency (MHz)	25.834				
Work Coil Current (A)	44.660				
RF Power Supply Current (A)	1.999				
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.228	Passed		
Dark Current Test	6000	1.168	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

Page 2 of 2

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	change mirror
Test Completed On	11/8/2024 10:35:26 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

Page 1 of 4

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	8.79	
As (188.980 nm)	≤ 8.20	5.80	
C (193.027 nm)	≤ 11.50	8.15	
Mo (202.032 nm)	≤ 8.20	5.90	
Cr (206.158 nm)	≤ 13.40	8.85	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	6.61	
Co (228.615 nm)	≤ 17.20	11.79	
Ba (230.424 nm)	≤ 9.40	7.25	
Mn (257.610 nm)	≤ 13.30	9.47	
Mn (260.568 nm)	≤ 20.30	14.50	
Cr (267.716 nm)	≤ 11.00	7.91	
Cu (324.754 nm)	≤ 25.00	18.72	
Cu (327.395 nm)	≤ 14.20	11.09	
Sr (338.071 nm)	≤ 33.50	25.39	
Ba (455.403 nm)	≤ 44.00	33.09	
Sr (460.793 nm)	≤ 36.00	18.54	
Ba (493.408 nm)	≤ 36.00	25.74	
Ba (514.171 nm)	≤ 42.00	25.23	
Ar (675.283 nm)	≤ 74.00	58.92	
K (766.491 nm)	≤ 80.00	63.16	

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	110.5	888.9	54.3	
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3	
Zn (213.857 nm)	≥ 1421.0	SRBR	3536.4	44017.7	153.9	
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	158.8	
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.8	
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0	
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903164.1	15166.0	
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3	
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2	
Zn (213.857 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1	
Zn (213.857 nm)	≥ 1743.0	SRBR	6389.3	157551.5	601.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99673.7	385.2	
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.5	
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6	
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5	
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9	
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5	
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.6	60122.8	
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	62582.1	

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.56	
Se (196.026 nm)	≤ 2.60	1.16	
Zn (213.857 nm)	≤ 1.50	0.50	
Pb (220.353 nm)	≤ 2.60	0.74	
Mn (257.610 nm)	≤ 1.50	0.63	
Al (396.152 nm)	≤ 1.50	0.54	
Ba (493.408 nm)	≤ 1.50	0.78	
K (766.491 nm)	≤ 1.50	0.44	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.82	
Se (196.026 nm)	≤ 1.50	0.82	
Zn (213.857 nm)	≤ 1.50	0.35	
Zn (213.857 nm)	≤ 1.50	0.34	
Cd (214.439 nm)	≤ 1.50	0.44	
Pb (220.353 nm)	≤ 1.50	0.48	
Mn (257.610 nm)	≤ 1.50	0.83	
Cr (267.716 nm)	≤ 1.50	0.53	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.56	
Ba (493.408 nm)	≤ 1.50	1.29	
K (766.491 nm)	≤ 1.50	0.74	

Page 4 of 4

เอกสารไม่ควบคุม

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 M.*
(Pradit M.)

Approved by : *Kitichai S.*
(Kitichai S.)



Coax Group Corporation Ltd.
1131/62,64,325-331 Nakornchaisri road,
Kwang ThanonNakornchaisri, Dusit, Bangkok 10300 Thailand
Tel. 02-2435263, 02-6682436 Fax. 02-2437386

เอกสารไม่ควบคุม

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	0.9999	OK
		(r) ≥ 0.9990		
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

เอกสารไม่ควบคุม

Counter

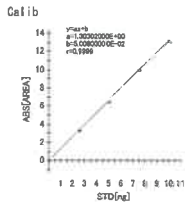
Measurement

MAIN | JO | Counter | Parameter |

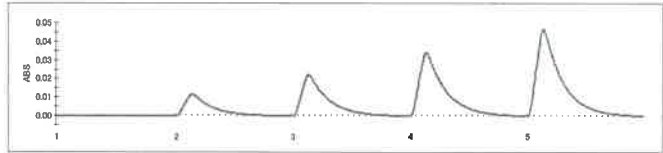
Measurement Column	2023/12/06-06	Clear	P1 Run(g/2000h)	0h00m24-07-00	Clear
Mercury Exhaust Filter Amount(g/1500mg)	012-06-08	Clear	P2 Run(g/2000h)	0h01m34-04-00	Clear
Lamp Active Time(5000h)	1/1/24-07-00	Clear	P3 Run(g/2000h)	0h02m34-04-00	Clear
Membrane Filter Usage Time(200h)	0h02m24-07-00	Clear	P4 Run(g/2000h)	0h03m24-07-00	Clear
Main Pump Lub(750h)	0h03m24-07-00	Clear	P5 Run(g/2000h)	0h04m24-07-00	Clear
Heating Lamp Time	1/05/23m21-08-00	Clear	P6 Run(g/2000h)	0h05m24-07-00	Clear
			P7 Run(g/2000h)	0h06m24-07-00	Clear

เอกสารไม่ควบคุม

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

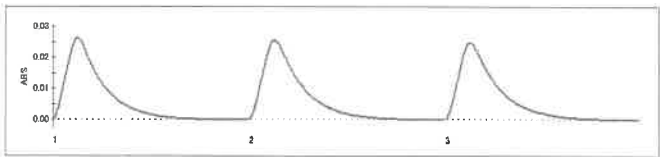


No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0846	0.0265	-	
2	100.000	0.025	5.000	5.000	2.500	3.3464	2.5298	1.2	
3	100.000	0.050	5.000	5.000	5.000	6.4170	4.8863	2.3	
4	100.000	0.075	5.000	5.000	7.500	9.8647	7.5322	0.4	
5	100.000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



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	

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

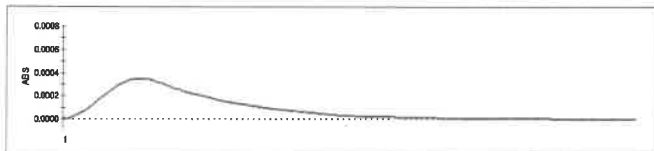


Self Check
Heat check:PASS!! (26.3degC[05:00] -> 30.3degC[02:29])
Sensor check:PASS!! (S3= 10= 43)
Leak check:PASS!! (0.19L/min)
Sig/Ref check:PASS!! (Sig:4.00V Ref:4.02V)
Drift check:PASS!! (0.0000061 - -0.0000179 = 0.0000240)

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

SMP

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



FL 8500 - Preventive Maintenance report

Company Name:	United Analyst and Engineering Consultant Co., Ltd.		
Address:	3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District, Phrakhanong District, Bangkok, THAILAND 10260		
User Name:	Mr. Kamphong	WO Number:	WO-02116940
Telephone Number:	094-623-3880	PM Number:	1 of 2 W
Customer Support Engineer:	Tanapakorn Tungmana	report Number:	FL_3017/2023
PM Performed: (DD-MMM-YYYY)	15-Sep-2023	Next PM Due Date: (DD-MM-YYYY)	15-Sep-2024

Scope

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

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the preventive maintenance. Always check with the customer before making any changes that may affect the customer's analysis. Should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the preventive maintenance sticker and instrument logbook as required.

Copyright Information

This document contains proprietary information that is protected by copyright. All rights are reserved. No part of this publication may be reproduced in any form whatsoever or translated into any language without the prior, written permission of PerkinElmer, Inc. Copyright © 2009 PerkinElmer, Inc.

Trademarks

Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law. PerkinElmer is a registered trademark of PerkinElmer, Inc. All other trademarks and registered trademarks not owned by PerkinElmer, Inc. or its subsidiaries that are depicted herein are the property of their respective owners. Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no Warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

-3-

เอกสารไม่ควบคุม

NIPON INSTRUMENTS CORPORATION

เอกสารไม่ควบคุม Page 1



Component List

Component Specific Model	Serial #	Software Version	Configuration Notes
FL8500	FL85K22062801	Spectrum FL 1.4.0	-
-	-	-	-
-	-	-	-

Parts Lists

Test standard Used				
Part Number (if applicable)	Description			
N4202000	LAMP HG/AR			
L2251365	Scaled Water Cell			
N4202027	Scaled Rhodamine Cell			
Additional Tools Required for preventive maintenance				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (mm/yy)
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
Additional Reagents and Standards Required for preventive maintenance				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (mm/yy)
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

เอกสารไม่ควบคุม Page 2



Procedure Checklist

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

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Perform general inspection of system for cleanliness.

2. Optical checks:

- ☒ Lamp Alignment/Intensity
- ☒ Sample Compartment Windows
- ☒ Mirror and Grating Alignment
- ☒ Cell Holder Alignment

3. Mechanical:

- ☒ Physical inspection - Please write any comments in the additional comments section.
- ☒ Grating Drive Mechanism.
- ☒ Slit Drive Mechanism.

4. Test:

Refer to Appendix A for the specifications of the instrument being tested.

- ☒ Water Raman Spectrum

	Actual Value	Validation Criteria
Raman Peak Wavelength	397.93	392.0 - 402.0 (nm)

- ☒ Water Raman Sensitivity

	Actual Value	Validation Criteria
Signal to Noise	318360.34	>= 4000
Drift	2.45	<= 10%

เอกสารไม่ควบคุม Page 3

☒ Emission Wavelength Accuracy.

Emission Wavelength Accuracy(Hg)		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	253.6	253.66	± 0.5 nm
Target Peak # 2	365.0	364.92	± 0.5 nm
Target Peak # 3	404.7	404.42	± 0.5 nm
Emission Wavelength Accuracy(Ar)		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	696.5	696.81	± 0.5 nm
Target Peak # 2	772.3	772.53	± 0.5 nm
Target Peak # 3	826.3	826.70	± 0.5 nm

☒ Emission Wavelength Repeatability.

Emission Wavelength Repeatability(Hg)		RSD	Validation Criteria
Target Peak (nm)		(nm)	Repeatability Limit +/- (nm)
Target Peak # 1	253.7	0.002	≤ 0.2 nm
Target Peak # 2	365.0	0.001	≤ 0.2 nm
Target Peak # 3	404.7	0.001	≤ 0.2 nm
Emission Wavelength Repeatability(Ar)		RSD	Validation Criteria
Target Peak (nm)		(nm)	Repeatability Limit +/- (nm)
Target Peak # 1	696.5	0.005	≤ 0.2 nm
Target Peak # 2	772.3	0.002	≤ 0.2 nm
Target Peak # 3	826.3	0.003	≤ 0.2 nm

เอกสารไม่ควบคุม Page 4

☒ Excitation Wavelength Accuracy.

Excitation Wavelength Accuracy		Actual Value	Validation Criteria
Target Peak (nm)		(nm)	Accuracy Limit +/- (nm)
Target Peak # 1	300.0	300.10	± 0.5 nm
Target Peak # 2	400.0	400.06	± 0.5 nm
Target Peak # 3	500.0	500.19	± 0.5 nm
Target Peak # 4	600.0	600.06	± 0.5 nm
Target Peak # 5	700.0	700.08	± 0.5 nm
Target Peak # 6	800.0	800.10	± 0.5 nm

☒ Excitation Wavelength Repeatability.

Excitation Wavelength Repeatability		RSD	Validation Criteria
Target Peak (nm)		(nm)	Repeatability Limit +/- (nm)
Target Peak # 1	300.0	0.00	≤ 0.2 nm
Target Peak # 2	400.0	0.00	≤ 0.2 nm
Target Peak # 3	500.0	0.00	≤ 0.2 nm
Target Peak # 4	600.0	0.00	≤ 0.2 nm
Target Peak # 5	700.0	0.00	≤ 0.2 nm
Target Peak # 6	800.0	0.00	≤ 0.2 nm

☒ Stray Light

	Actual Value	Validation Criteria
Stray Light at 240nm	0.52	< 3.0 %
Stray Light at 300nm	0.02	< 0.3 %

เอกสารไม่ควบคุม Page 5

5. Accessory (where applicable):

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

6. Review:

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

Additional Comments

Additional Comments Regarding the preventive maintenance

Review

The preventive maintenance checks and if applicable performance tests for FL 8500 have been completed.

This FL 8500 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 15-Sep-23 (DD-MM-YYYY)
Authorized Customer Representative:	Date: 15-Sep-23 (DD-MM-YYYY)

เอกสารไม่ควบคุม Page 6



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
554/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-31000-25 FAX: 0-2719-6484



Cert. No.: 24TMS87
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -


ID No. : UAE.WAO.D1B2551

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

Location : Lab Floor 2

Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by : 
Approved Signatory

() Ponpan Palpim
(✓) 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 Issuing of Calibration Services J : Equipment Calibration and Testing Service

เอกสารไม่ควบคุม
A 0065063



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-1
Procedure Used :-

Cert. No.: 24TM587
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

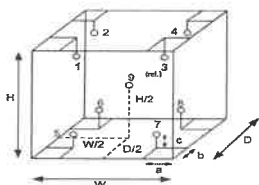
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL Humid. (%)	48	49
AC Supply (Volt)	221	220

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09

Probe Installation Details :

Dimension of Chamber :

a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.89 m ³

เอกสารไมควบคุม
a 1209743



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-1

Cert. No.: 24TM587
Page : 3 of 3

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.45	0.55	1.3	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.183	20.235	19.707	19.706	19.739	19.785	19.821	19.828	0.66

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสารไมควบคุม
a 1209742



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 16, SUANLUGANG, SUANLUGANG BANGKOK 10250
TEL. 0-2717-3499-2 FAX. 0-2715-9424



Cert. No.: 24TM588
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.006/2553

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

Location : Lab Floor 2

Received Order : 01 April 2024

Calibration Date : 01 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Kriada Malee

Approved by :

() Ponpan Palpim

(✓) Suwit Imjai

() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95 %

This certificate may not be re-used/used other than its full extent with the prior written

Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

เอกสารไมควบคุม

A 0065064



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-2

Cert. No.: 24TM588
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

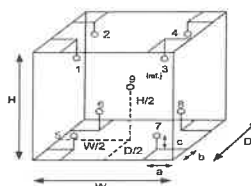
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	27
REL Humid. (%)	45	47
AC Supply (Volt)	220	221



Probe Installation Details :

Dimension of Chamber :

a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.89 m ³

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

เอกสารไมควบคุม

a 1209741



Equipment : BOD Incubator
 Condition As-Received : Used Item
 Reference : 2404-0004OC-2
 Result of Calibration : (*) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Not Available

Cert. No.: 24TM588
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	19.9	0.47	0.69	1.4	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.289	19.855	20.129	19.985	20.190	20.180	20.300	20.457	20.248	0.67

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 %.

-000-

กำหนดจุดห้ามใช้งาน

References Certificate Number. : 234TM588

Equipment : BOD Incubator

Model : UR-1320

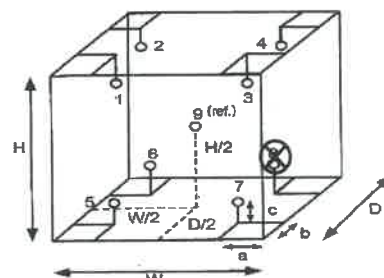
Serial No. : -

ID No. : UAE.WAO.006/2553

Manufacturer : ARCO

Calibration Point : 20.0 °C

Unit Under Calibration Setting : 20.0 °C



รูปภาพเครื่องมือ แสดงจุดที่ได้รับการสอบเทียบ และสัญลักษณ์ ⊗ แสดงจุดห้ามใช้งาน

กำหนดจุดห้ามใช้งานตำแหน่งที่.....8.....

เอกสารไม่ควบคุม
 a 1209740

หมายเหตุ เก็บใบแนบ.....

\\uae-netapp\Lab-BOD\INSTRUMENT\01-234TM588\Certificate\กำหนดจุดห้ามใช้งานเครื่องมือ\ใบกำหนดจุดห้ามใช้งานเครื่องมือ 234TM588\กำหนดจุดห้ามใช้งาน.doc เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
 5344 PATTANAKARN ROAD 501 16, SUANJANG, SUANLUANG RANGKON 10250
 TEL. 0-2719-8695-29 FAX. 0-2719-9484



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

Certificate of Calibration

Equipment : Water Bath
 Manufacturer : Memmert
 Model : WNE 14
 Serial No. : L416.0808
 ID No. : UAE.MIC.002/2560
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangkok, Phrakhanong,
 Bangkok 10260
 Location : Microbiology Laboratory
 Received Order : 10 February 2024
 Calibration Date : 10 February 2024
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %
 Calibrated by : Krida Malee

Approved by :

() Pornthippa Tameyakul
 () Unnopphol Harachai
 () Suwit Imjai

Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced without the prior written
 Approval of the head of Corporate Service 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



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

Cert. No.: 24TM29
 Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPR7).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	23LM27	TPA	25 Feb 2024

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

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

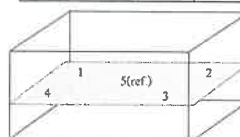
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

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



Front

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

เอกสารไม่ควบคุม



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

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

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
44.5	44.4	44.4	44.508	44.469	44.502	44.521	44.527	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.15	0.074	2

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

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

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

UUC* : Unit Under Calibration

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

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

-00-

เอกสารไม่ควบคุม



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

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

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	23LM27	TPA	25 Feb 2024

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

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

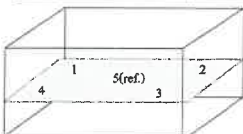
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

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



Front

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

เอกสารไม่ควบคุม



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

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

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

-00-

เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2403982-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Order No.: 2403982
Operation No.: 2403982-001
Date of Receipt: 7 August 2024
Date of Calibration: 7 August 2024

Calibrated by Mr. Manas Somsak Specialist
Approved by [Miss Praeyaporn Jaengkamit] Vice President, Department of Laboratory Services
Responsible for the Technical Management Team
Date of Issue: 14 August 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-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2403982-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP
Date of Calibration: 7 August 2024

Page 2 of 3

Location: MICROBIOLOGY LABORATORY (301), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (29 ± 1) °C
Relative Humidity (60 ± 5) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard Data loggers with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1:2021, Autoclaves for sterilization in laboratories
Part 1: Design, construction, safety and performance - Specification.
- The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	OM-CP-HITEMP-140	Q88555	TE 670230-01	25 Feb 25	NATIONAL FOOD INSTITUTE RATTHANA THANI INSTITUTE NATIONAL FOOD INSTITUTE
	OM-CP-HITEMP-140	R55951	TE 670231-01	25 Feb 25	
	OM-CP-HITEMP-140	R55916	TE 670232-01	25 Feb 25	

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL
Time of sterilization 15 Minute At 121 °C

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

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

Calibration Report

Certificate No.: 2402419-001-01
Equipment: Electronic Scale
Model: PM623
Serial No.: C236194745
Capacity: 600 g
Manufacturers: OHAUS
Resolution: 0.001 g
ID No.: UAE MIC.055/2465

Date of Calibration: 19 April 2024 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unload	0.0000	0.000	0.000	0.00093	2.90
1	1.0000	1.000	0.000	0.00093	2.00
5	5.0000	5.000	0.000	0.00093	2.90
10	10.0000	10.000	0.000	0.00093	2.90
20	20.0000	20.000	0.000	0.00093	2.90
50	50.0000	50.001	-0.001	0.00093	2.90
100	100.0000	100.001	-0.001	0.00094	2.00
200	200.0000	200.001	-0.001	0.0011	2.00
300	300.0000	300.003	-0.003	0.0011	2.00
400	399.9999	400.003	-0.003	0.0012	2.00
500	499.9999	500.003	-0.003	0.0013	2.00
600	599.9999	600.002	-0.002	0.0014	2.00

P. Jungsomjit
23 April 2024

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

----- End -----

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

อาคารศูนย์บริการ
2008 So. 25, Anur Avenue Road, Bang Mueang Subdistrict, Bang Pakong District, Bangkok 10700
Tel: +66(0) 2420 6568 Fax: +66(0) 2420 6545

เอกสารไม่ควบคุม
nfi orth

Equipment : Electronic Balance										
Model: PM623										
ID No.: UAE MIC.055/2465										
Nominal Value	Standard Value	Average Reading	Error		Correction	Uncertainty (U)	U + Error		Judgement	(Total Error < Judgement) Result (Pass / Fail)
			(g)	(g)			(g)	(g)		
0	0.0000	0.000	0.000	0.000	0.000	0.00093	0.001	0.001	0.005	Pass
1	1.0000	1.000	0.000	0.000	0.000	0.00093	0.001	0.001	0.005	Pass
5	5.0000	5.000	0.000	0.000	0.000	0.00093	0.001	0.001	0.005	Pass
10	10.0000	10.000	0.000	0.000	0.000	0.00093	0.001	0.001	0.005	Pass
20	20.0000	20.000	0.000	0.000	0.000	0.00093	0.001	0.001	0.005	Pass
50	50.0000	50.001	0.001	-0.001	-0.001	0.00093	0.002	0.002	0.005	Pass
100	100.0000	100.001	0.001	-0.001	-0.001	0.00094	0.002	0.002	0.005	Pass
200	200.0000	200.001	0.001	-0.001	-0.001	0.00110	0.002	0.002	0.005	Pass
300	300.0000	300.009	0.009	-0.009	-0.009	0.0011	0.004	0.004	0.010	Pass
400	399.9999	400.009	0.009	-0.009	-0.009	0.0012	0.004	0.004	0.010	Pass
500	499.9999	500.005	0.005	-0.005	-0.005	0.0013	0.004	0.004	0.010	Pass
600	599.9999	600.002	0.002	-0.002	-0.002	0.0014	0.003	0.003	0.010	Pass
U.C * : Unit Under Calibration										
Remarks:										

U.C. : Unit Under Calibration

Remarks:

เอกสารไม่ควบคุม