

# ภาคผนวก ฉ

เอกสารรับรองการสอบเทียบเครื่องมือ

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### 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
<b>Ambient</b>									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP)	Andersen Instruments, Inc.	G25A 158M	Jiranatee Associates Co., Ltd.	COF-001-66	14 Jul 24	13 Jul 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1252	11 Apr 24	10 Apr 25	-
3	Aneroid Barometer	Total Suspended Particulate (TSP)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1369	22 Apr 24	21 Apr 25	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24H755	10 Apr 24	9 Apr 25	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778108	UAE Consultant Co.,Ltd.	04102024	4 Oct 24	3 Oct 25	
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778105	UAE Consultant Co.,Ltd.	26092024	26 Sep 24	25 Sep 25	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778106	UAE Consultant Co.,Ltd.	20092024	20 Oct 24	19 Sep 25	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778107	UAE Consultant Co.,Ltd.	26092024	26 Oct 24	25 Sep 25	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778111	UAE Consultant Co.,Ltd.	06092024	6 Sep 24	5 Sep 25	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778112	UAE Consultant Co.,Ltd.	04092024	4 Sep 24	3 Sep 25	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778113	UAE Consultant Co.,Ltd.	04092024	4 Sep 24	3 Sep 25	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1201778116	UAE Consultant Co.,Ltd.	19062024	19 Jun 24	3 Sep 25	-
14	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-

### 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
<b>Ambient</b>									
15	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497732	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636467	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200906880	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497730	UAE Consultant Co.,Ltd.	09092024	9 Sep 24	8 Sep 25	-
19	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0162121 2016PSIG	Airgas an Air Liquide company	E05NI91E15A0014	6 Jun 23	6 Jun 31	-
20	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DR0116	Thai Meteorological Department	100/24	22 Feb 24	21 Feb 25	-
21	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2112DR0065	Thai Meteorological Department	097/24	22 Feb 24	21 Feb 25	-
22	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2112DR0052	Thai Meteorological Department	098/24	22 Feb 24	21 Feb 25	-
23	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0114	Thai Meteorological Department	099/24	22 Feb 24	21 Feb 25	-
24	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6855	Innovative Instrument Co.,Ltd.	24-ACT-121	10 Sep 24	9 Sep 25	-
25	Sound Level Meter	$L_{Aeq} 1 \text{ hours}^*$ $L_{Aeq} 24 \text{ hrs}^*$ $L_{Amax}^*$ $L_{A90}$	Larson Davis	LxT2 0006691	Innovative Instrument Co.,Ltd.	24-SLM-236	10 Jul 24	9 Jul 25	-
26	Sound Level Meter	$L_{Aeq} 1 \text{ hours}^*$ $L_{Aeq} 24 \text{ hrs}^*$ $L_{Amax}^*$ $L_{A90}$	Larson Davis	LxT2 0006698	Innovative Instrument Co.,Ltd.	24-SLM-233	10 Jul 24	9 Jul 25	-
27	Sound Level Meter	$L_{Aeq} 1 \text{ hours}^*$ $L_{Aeq} 24 \text{ hrs}^*$ $L_{Amax}^*$ $L_{A90}$	Larson Davis	LxT2 0005286	Innovative Instrument Co.,Ltd.	24-SLM-234	10 Jul 24	9 Jul 25	-
28	Sound Level Meter	$L_{Aeq} 1 \text{ hours}^*$ $L_{Aeq} 24 \text{ hrs}^*$ $L_{Amax}^*$ $L_{A90}$	Larson Davis	LxT2 0005346	Innovative Instrument Co.,Ltd.	24-SLM-235	10 Jul 24	9 Jul 25	-

### List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Water</b>									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0C0025	Technology Promotion Association (Thailand-Japan)	24CH319	14 Mar 24	13 Mar 25	-
2	DO Meter	DO	Horiba	LAQUA-DO210 HE2L0031	Technology Promotion Association (Thailand-Japan)	24TW56	13 Mar 24	12 Mar 25	-





## Certificate of Calibration

Certificate No.: 24P1369  
Page: 1 of 2

Equipment : Aneroid Barometer  
Manufacturer: Barigo  
Model : -  
Serial No.: -  
ID No.: UAE.ANV.013/2547  
Condition As-Received: Used Item  
Received Date: 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,  
Phrakhanong, Bangkok 10260  
Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	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.Scale and conversion factor is 1 kPa = 7.50062 mmHg				
5.This result of calibration instrument was in absolute pressure.				
6.This instrument was used clean air as pressure media.				
7.The certificate is valid only to the item calibrated on date and place of calibration.				
8.This 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 :

[ ] Phalinee Pratspaipal  
[ ] Sura Suwannasri  
[✓] Attapol Panurach

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Cert.No.: 24P1369  
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 720 mmHg to 780 mmHg  
Scale Interval: 1 mmHg ( The Fifth Estimate )

### Increasing Pressure

Applied Pressure (mmHg)	718.40	729.71	740.61	751.07	761.97	773.05	786.91
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	1.60	0.29	-0.61	-1.07	-1.97	-3.05	-6.91

### Decreasing Pressure

Applied Pressure (mmHg)	786.91	772.99	761.71	750.69	740.13	729.35	718.44
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-6.91	-2.99	-1.71	-0.69	-0.13	0.65	1.56

The uncertainty of measurement was ± 0.24 mmHg

\* UUC = Unit Under Calibration

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

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## Certificate of Calibration

Certificate No.: 24H755  
Page: 1 of 2

Equipment : Dial Thermo-Hygrometer  
Manufacturer: Barigo  
Model : -  
Serial No.: -  
ID No.: UAE.ANV.130/2550  
Condition As-Received: Used Item  
Received Date: 05 April 2024  
Calibration Date: 10 April 2024  
Reference: 2404-0247WSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %  
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	A5A339	2311238	16 Oct 2024
2.The certificate is valid only to the item calibrated on date and place of calibration.				
3.This Certification is traceable to the International System of Unit maintained through:-				
-Thunder Scientific Corporation, NVLAB Accreditation No. Calibration 200582-0				
-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008				

Calibrated by : Chakrit Waewwanjua  
Issue Date : 18 April 2024

Approved Signatory :

[ ] Chakrit Waewwanjua  
[✓] Vipom Tantiyawutti  
[ ] Unnopphol Harachai

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Cert. No.: 24H755  
Page: 2 of 2

Result of Calibration:- Without Adjustment  
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	44	3.9	1.6
25.0	60.0	61	1.0	1.7
25.0	80.0	76	-4.0	1.8

Result of Calibration:- Without Adjustment  
Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.007	20.5	0.493	0.72
25.032	25.0	-0.032	0.72
29.997	30.0	0.003	0.72
35.010	35.0	-0.010	0.72
40.019	39.5	-0.519	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%.

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### MULTI-POINT GAS TEST REPORT

Test Date : Oct 4, 2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778108

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB0159156  
Expiration Date : Nov 6, 2026

#### Dilutor Detail

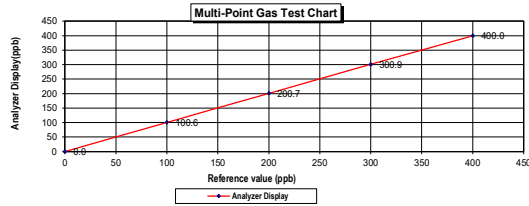
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.6	0.60	0.60
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00

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

Average Difference (%) 0.25



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Approve by  
Pattam K  
4 Oct 2024

### MULTI-POINT GAS TEST REPORT

Test Date : Sep 26, 2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778105

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB0159156  
Expiration Date : Nov 6, 2026

#### Dilutor Detail

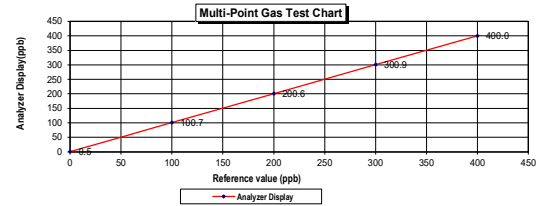
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.50	0.50	0.50
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.6	0.60	0.30
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00

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

Average Difference (%) 0.36



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Pattam K  
26 Sep 2024

### MULTI-POINT GAS TEST REPORT

Test Date : Sep 20, 2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778106

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB0159156  
Expiration Date : Nov 6, 2026

#### Dilutor Detail

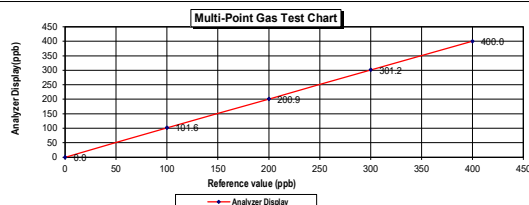
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.6	1.60	1.57
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	301.2	1.20	0.40
Level 5	80.00%	400.0	400.0	0.00	0.00

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

Average Difference (%) 0.48



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20 Sep 2024

### MULTI-POINT GAS TEST REPORT

Test Date : Sep 26, 2024

Equipment : Gas Analyzer (NO<sub>2</sub>) Model : 42i  
Manufacturer : Thermo Scientific Serial Number : 1201778107

#### Standard Gas Concentration

Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB0159156  
Expiration Date : Nov 6, 2026

#### Dilutor Detail

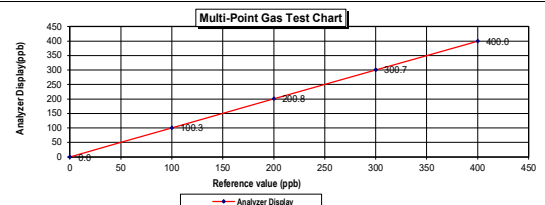
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.3	0.30	0.30
Level 3	40.00%	200.0	200.8	0.80	0.40
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00

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

Average Difference (%) 0.19



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26 Sep 2024



## CERTIFICATE OF ANALYSIS

## Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)

LTD.

Part Number: EDSN191E15A0014

Cylinder Number: EB0162121

Laboratory: 124 - Plumsteadville - PA

PGVP Number: A12023

Gas Code: CO,CO2,NO,NOX,SO2,BALN

Reference Number: 160-402772205-1

Cylinder Volume: 144.0 CF

Cylinder Pressure: 2015 PSIG

Valve Outlet: 860

Certification Date: Jul 06, 2023

Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA-600/5-12-037, using the assay procedures listed. Analytical Metrology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do not use this cylinder below 100 psig, i.e. 8.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.9% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/25/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	+/- 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	154202308	CCT54364	95.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jun 04, 2031
PRM	C2219101	APC1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 29, 2025
GMIS	2023042525	CCT54361	95.52 PPM NITRIC OXIDE/NITROGEN	+/-0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMIS	15340020202	EB0130037	9.993 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.8%	Sep 25, 2025
NTRM	160102-22	KAL063520	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230001	CCT45862	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 09, 2028
NTRM	130005-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.8%	May 14, 2025

ANALYTICAL EQUIPMENT			
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration	
Nicolet 650 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023	
SIEMENS ULTRAMATE M1-CO-180	NDIR	Jun 14, 2023	
Nicolet 650 FTIR AUP2010245 NO	FTIR	Jun 29, 2023	
Nicolet 650 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023	
Nicolet 650 FTIR AUP2010245 SO2	FTIR	Jun 05, 2023	

Approved for Release

Page 1 of 1

## MULTI-POINT GAS TEST REPORT

Test Date : Sep 6, 2024

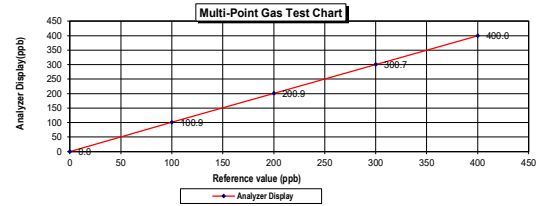
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778111

Standard Gas Concentration		Dilution Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB0159156		
Expiration Date :	Nov 06, 2026		

## Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.90	0.89	0.89
Level 3	40.00%	200.0	0.90	0.45	0.45
Level 4	60.00%	300.0	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  $\pm 5\%$



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Page 1 of 1

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## MULTI-POINT GAS TEST REPORT

Test Date : Sep 4, 2024

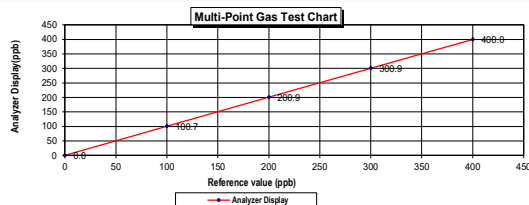
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778112

Standard Gas Concentration		Dilution Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB0159156		
Expiration Date :	Nov 06, 2026		

## Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.70	0.70	0.70
Level 3	40.00%	200.0	0.90	0.45	0.45
Level 4	60.00%	300.0	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  $\pm 5\%$



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Page 1 of 1

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## MULTI-POINT GAS TEST REPORT

Test Date : Sep 4, 2024

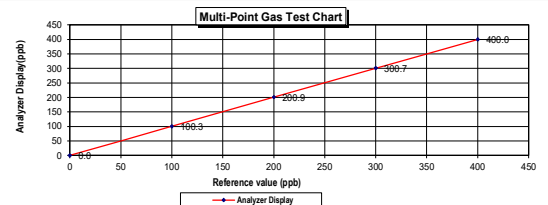
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778113

Standard Gas Concentration		Dilution Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9		
Cylinder No. :	EB0159156		
Expiration Date :	Nov 06, 2026		

## Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.30	0.30	0.30
Level 3	40.00%	200.0	0.90	0.45	0.45
Level 4	60.00%	300.0	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  
4 9 2567

Approve by  
4 Sep 2024

Page 1 of 1

เอกสารไม่ควบคุม

### MULTI-POINT GAS TEST REPORT

Test Date : June 19, 2024

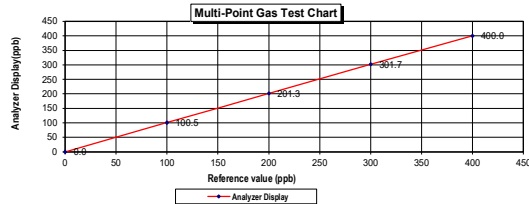
Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778116

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB0159156		
Expiration Date :	Nov 06, 2026		

#### Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.5	0.50	0.50
Level 3	40.00%	200.0	201.3	1.30	0.65
Level 4	60.00%	300.0	301.7	1.70	0.56
Level 5	80.00%	400.0	400.0	0.00	0.00

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



Calculate by  
Ginchan C.  
19/06/2567

Approve by  
Rakham B.  
19/June/2024

### CERTIFICATE OF ANALYSIS

#### Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)  
LTD.  
Part Number: EDSN191E15A0014  
Cylinder Number: EB0162121  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12023  
Gas Code: CO, CO<sub>2</sub>, NO, NO<sub>2</sub>, SO<sub>2</sub>, BALN

Reference Number: 160-402772205-1  
Cylinder Volume: 144.0 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: Jul 06, 2023

Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 8200-1-0231, using the assay procedures listed. Analytical Metrology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	$\pm 0.9\%$ NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	$\pm 0.8\%$ NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	$\pm 0.3\%$ NIST Traceable	06/25/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	$\pm 1.2\%$ NIST Traceable	06/27/2023
NITROGEN	Balance				

#### CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	154222208	CG754364	95.36 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Jun 04, 2031
PRM	02219101	APC1514048	100.19 PPM NITRIC OXIDE/NITROGEN	$\pm 0.3\%$	Feb 29, 2025
GMIS	0223042525	CG754381	96.52 PPM NITRIC OXIDE/NITROGEN	$\pm 0.4\%$	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	$\pm 1.5\%$	Feb 17, 2023
GMIS	15340020202	EB0150037	9.993 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 1.5\%$	Sep 29, 2025
NTRM	160102-22	KAL053826	97.69 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Nov 01, 2027
CO	230001	CC745862	249.47 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.3\%$	Dec 09, 2028
NTRM	130606-02	DC411730	13.359 % CARBON DIOXIDE/NITROGEN	$\pm 0.6\%$	May 14, 2025

The GMIS, NTRM, PRM, or NDM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

#### ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 550 FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMATEE N1-C8-160	NDIR	Jun 14, 2023
Nicolet 550 FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet 550 FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet 550 FTIR AUP2010245 SO2	FTIR	Jun 08, 2023

Approved for Release

### MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

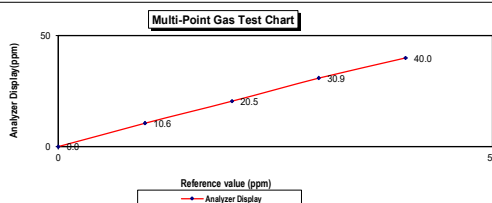
Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1201497732

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

#### Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.6	0.6	5.7
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.9	0.9	2.9
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm  
Acceptable Limit  $\pm 5\%$



Calculate by  
Ginchan C.  
9/9/2567

Approve by  
Rakham B.  
9 Sep 2024

### MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

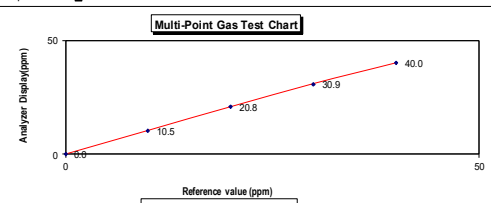
Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1200636467

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO <sub>2</sub> )	42.89 PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	46.77 PPM	Model :	146i
Methane (CH <sub>4</sub> )	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	965.9 PPM		
Cylinder No. :	EB01159156		
Expiration Date :	Nov 06, 2026		

#### Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.5	0.5	4.8
Level 3	40.00%	20.0	20.8	0.8	3.8
Level 4	60.00%	30.0	30.9	0.9	2.9
Level 5	80.00%	40.0	40.0	0.0	0.0

Remark : Measuring Range 50.0 ppm  
Acceptable Limit  $\pm 5\%$



Calculate by  
Ginchan C.  
9/9/2567

Approve by  
Rakham B.  
9 Sep 2024



### MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

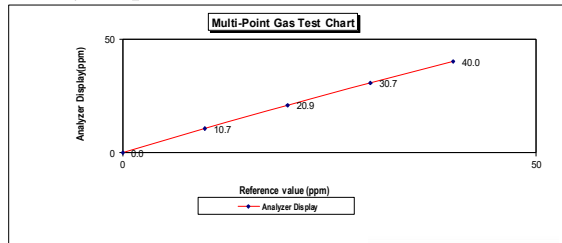
Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1200906880

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB01159156  
Expiration Date : Nov 06, 2026

**Dilutor Detail**  
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.9	0.9	4.3	4.3
Level 4	60.00%	30.0	30.7	0.7	2.3	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range			50.0 ppm	Average Difference (%)		2.63



Calculate by  
Gachan C  
9/9/2567

Approve by  
Rachan C  
9/Sep/2024

Page 1 of 1

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### MULTI-POINT GAS TEST REPORT

Test Date : Sep 9, 2024

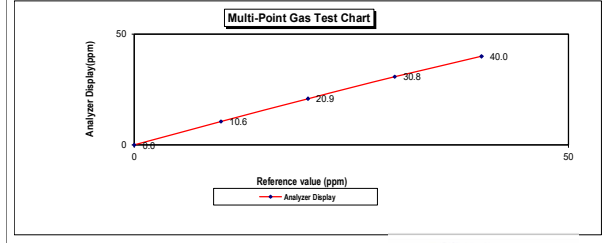
Equipment : Gas Analyzer (CO) Model : 48i  
Manufacturer : Thermo Scientific Serial Number : 1201497730

**Standard Gas Concentration**  
Sulphur Dioxide (SO<sub>2</sub>) 42.89 PPM  
Nitric Oxide (NO) 46.77 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 965.9 PPM  
Cylinder No. : EB01159156  
Expiration Date : Nov 06, 2026

**Dilutor Detail**  
Manufacturer : Thermo Scientific  
Model : 146i  
Serial Number : 1180540071

#### Multi-point gas test data

Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.0	0.0	0.0
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	30.8	0.8	2.6
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)		2.51



Calculate by  
Gachan C  
9/9/2567

Approve by  
Rachan C  
9/Sep/2024

Page 1 of 1

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### CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Customer: AIR LIQUIDE (THAILAND)  
LTD-  
Part Number: E05N191E15A0014  
Cylinder Number: EB0162121  
Laboratory: 124 - Plumsteadville - PA  
PGVP Number: A12023  
Gas Code: CO, CO<sub>2</sub>, NO, NO<sub>2</sub>, SO<sub>2</sub>, BALN  
Reference Number: 160-402772205-1  
Cylinder Volume: 144.0 CF  
Cylinder Pressure: 2018 PSIG  
Valve Outlet: 660  
Certification Date: Jul 06, 2023  
Expiration Date: Jul 06, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/5-02-001, using the assay procedures listed. Analytical Metrology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mass/volume basis unless otherwise noted. The results noted only for the items listed. The report shall not be reproduced except in full without approval of the laboratory. Do not use this cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	100.0 PPM	100.4 PPM	G1	+/- 0.3% NIST Traceable	06/27/2023, 07/06/2023
NITRIC OXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.3% NIST Traceable	06/27/2023, 07/06/2023
SULFUR DIOXIDE	100.0 PPM	100.0 PPM	G1	+/- 1.4% NIST Traceable	06/27/2023, 07/06/2023
CARBON MONOXIDE	200.0 PPM	199.2 PPM	G1	+/- 0.3% NIST Traceable	06/25/2023
CARBON DIOXIDE	8.000 %	7.982 %	G1	+/- 1.2% NIST Traceable	06/27/2023
NITROGEN	Balance				

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
GMS	124232308	CD154054	95.36 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Jun 04, 2031
PRM	C2216101	APE1514048	100.19 PPM NITRIC OXIDE/NITROGEN	+/- 0.3%	Feb 28, 2025
GMS	2023042525	CD154381	96.52 PPM NITRIC OXIDE/NITROGEN	+/- 0.4%	Apr 25, 2031
PRM	12409	D913660	15.01 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Feb 17, 2023
GMS	15340020202	EB0130037	9.993 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.8%	Sep 26, 2025
NTRM	N67102-22	KAL03826	97.69 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 01, 2027
CO	230001	CD145962	249.47 PPM CARBON MONOXIDE/NITROGEN	+/- 0.3%	Dec 06, 2028
NTRM	130005-02	CC411730	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.8%	May 14, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet ISS FTIR AUP2010245 CO2	FTIR	Jun 15, 2023
SIEMENS ULTRAMATE N1-CS-190	NDR	Jun 14, 2023
Nicolet ISS FTIR AUP2010245 NO	FTIR	Jun 29, 2023
Nicolet ISS FTIR AUP2010245 NO2	FTIR	Jun 15, 2023
Nicolet ISS FTIR AUP2010245 SO2	FTIR	Jun 08, 2023

Approved for Release  
[Signature]

Page 1 of 1

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### THAI METEOROLOGICAL DEPARTMENT

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

### Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau  
Date of Issue : 22 February, 2024 Certification No. : 109/24  
Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0116  
Wind Sensor 2205DT0116

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Airt Plotting Board

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

N.I.S.T. Test Reference Number 731/241480 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

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

STANDARD THERMOMETER : Theodor Friedrich : Dry No. 8390/94 Wet No. 8399/94

: testo testo 645 Serial No. 02848057 : Thermoschneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. V14380001

Calibrated by : [Signature]

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Prapong Pannasat

Authorized Signatory

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



## THAI METEOROLOGICAL DEPARTMENT

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

### The Result of Calibration

Certification No. 100/24

22 February, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
mmHg	inches H <sub>2</sub> O	inches H <sub>2</sub> O	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	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	12.9	0.11
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by:   
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

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## THAI METEOROLOGICAL DEPARTMENT

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

### The Result of Calibration

Certification No. 100/24

Page : 3 of 5

22 February, 2024

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.84	1011	-0.16
1010.60	1011	-0.40
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1013	-0.05
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1016	-0.14
1015.69	1016	-0.31
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.45	1014	-0.51
Average		-0.12

Calibrated by:   
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

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## THAI METEOROLOGICAL DEPARTMENT

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

### The Result of Calibration

Certification No. 100/24

22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	761	-0.32
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
758.89	758	0.89
758.91	759	-0.09
759.11	759	0.11
759.67	759	0.67
759.98	760	-0.02
760.18	760	0.18
Average		0.07

Calibrated by:   
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



## THAI METEOROLOGICAL DEPARTMENT

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

### The Result of Calibration

Certification No. 100/24

Page : 5 of 5

22 February, 2024

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

Calibrated by:   
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 097/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2112OR0065

Wind Sensor 2112DT0065

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs FO14 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 7311/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-850-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)


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

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

: Iusto, Iusto 845 Serial No. 02846057 : Thermoschneider No.918902

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Digital Barometer Vaisala Type PFC301 No. KFC30101

Calibrated by : 

Signed :

Mr. Pibod Promut

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 2 of 5

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

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.84	1011	-0.16
1010.60	1011	-0.40
1011.71	1011	0.71
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1012	0.05
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1014	-0.51

Average

0.03

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	758	0.84
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	759	0.65
759.77	760	-0.23
760.20	760	0.20
760.69	760	0.69
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
758.69	759	-0.31
758.91	759	-0.09
759.11	759	0.11
759.67	760	-0.33
759.98	760	-0.02
760.15	760	0.15

Average

0.12

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 5 of 5

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

Calibrated by :

Notaraporn

Mr. Watcharapol Subwat  
Mechanical Engineer



เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 098/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0052

Wind Sensor 2111DT0052

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer Theodor Friedrichs F0014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460

: Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER

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

: Testo, testo 645 Serial No. 02948057

: Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB351 No. V1220001

Calibrated by :

Notaraporn

Signed :

Mr. Watcharapol Subwat

Mechanical Engineer

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

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# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 2 of 5

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

Wind Aloft Plotting Board.

U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU

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

Calibrated by :

Notaraporn

Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



# THAI METEOROLOGICAL DEPARTMENT

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

## The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1010.04	1011	-0.16
1010.60	1010	0.60
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1012	0.95
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.96	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.60	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1013	0.49

Average

0.08

Calibrated by :

Notaraporn

Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.85	760	-0.36
759.77	760	-0.23
760.20	760	0.20
760.66	760	0.66
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
758.89	759	-0.31
758.91	759	-0.08
759.11	759	0.11
759.67	760	-0.33
759.98	760	-0.02
760.18	760	0.18

Average

0.02

Calibrated by:

Mr. Watcharapol Subwat  
Mechanical EngineerCalibration & Test Section  
Meteorological Instruments Bureau

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## The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	46	0.2
30.3	30	0.3
15.8	15	0.8

Calibrated by:

Mr. Watcharapol Subwat  
Mechanical EngineerCalibration & Test Section  
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



## Calibration Certificate

Issued by : Calibration &amp; Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. : 099/24

Page : 1 of 5

Object : Wind Speed &amp; Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0114  
Wind Sensor 2205DT0114Customer : United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Axiot Plotting Board

: Micromanometer Theodor Friedrichs FG014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241480 : Standard Velocity at 20 - 30 m/sec

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

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

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

: Iseto, Iseto 045 Serial No. 02848057 : Thermoschneider No.818802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. V4320001

Calibrated by:

Mr. Watcharapol Subwat  
Mechanical Engineer

Signed:

Mr. Theodor Promut

(Authorized Signature)

for the Chief

Sub-Standard Instruments

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## The Result of Calibration

Certification No. 099/24

22 February, 2024

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure m/sec	Vacuum m/sec	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by:

Mr. Watcharapol Subwat  
Mechanical EngineerCalibration & Test Section  
Meteorological Instruments Bureau

เอกสารไม่ควบคุม





## The Result of Calibration

Certification No. 099/24


22 February, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.84	1011	-0.16
1010.60	1011	-0.40
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.75	1013	-0.21
1012.95	1013	-0.05
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1018	-0.14
1015.69	1016	-0.31
1011.51	1011	0.51
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1013	0.49

Average

-0.02

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau



เอกสารไม่ควบคุม



## The Result of Calibration

Certification No. 099/24


22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.84	758	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	761	-0.32
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
758.69	758	0.69
758.91	759	-0.09
759.11	759	0.11
759.87	760	-0.33
759.98	760	-0.02
760.16	760	0.16

Average

0.02

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau



เอกสารไม่ควบคุม




## The Result of Calibration

Certification No. 099/24

22 February, 2024

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	46	0.2
30.3	31	-0.7
15.8	16	-0.2

Calibrated by :   
Mr. Watcharapol Subwat  
Mechanical Engineer

Calibration & Test Section  
Meteorological Instruments Bureau



เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7 UDOMAKI RD. SOI MUKDAGORN 11 TANGKOR BANGKOK  
AMPHUR BANG PHU SAMUT PRAKAN PROVINCE 10740 THAILAND  
TEL : 0669-2116-7600 / FAX : 0669-2116-7140



## Certificate of Calibration

## Customer

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

Certificate No : 24-ACT-121  
Request No : Req-2024-1897

## Unit Under Calibration Details

Measurement item : Acoustic Calibrator  
Manufacturer : LARSON DAVIS  
Model : CAL150  
Serial Number : 6855  
ID : UAE-EFM-046/2566  
Class : 2  
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 : 26 August 2024  
Calibration Date : 10 September 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	EEI	12 June 2025
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 : 10 September 2024

Certificate No : 24-ACT-121

Request No : Req-2024-1897

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty ( $\pm$ dB)	Acceptance limit Class 2 ( $\pm$ dB)	Result
	Measured	Deviated value	Measured	Deviated value			
94 dB / 1000 Hz	93.66	-0.34	-	-	0.16	0.40	Pass
114 dB / 1000 Hz	113.85	-0.15	-	-	0.13	0.40	Pass

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( $\pm$ %)	Acceptance limit Class 2 ( $\pm$ %)	Result
	Measured (Hz)	Deviated	Measured (Hz)	Deviated			
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	1.7	Pass
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	1.7	Pass

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty ( $\pm$ %)	Acceptance limit Class 2 ( $\pm$ %)	Result
	Measured (%)	Measured (%)	Measured (%)	Measured (%)			
94 dB / 1000 Hz	0.63	-	-	-	0.40	3.0	Pass
114 dB / 1000 Hz	0.24	-	-	-	0.40	3.0	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.35 dB
Frequency	0.20%
Total distortion+noise	1.00%

1. Acceptance limit was IEC60601:2017 Class 1

2. The calibration results exclude the calibrator pressure correction

3. The calibration results exclude the microphone volume correction

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.  
File-Top-ACT-03 Rev.03 Issue date 15/12/24

เอกสารไม่ควบคุม

Certificate No : 24-ACT-121

Request No : Req-2024-1897

Decision Rule for Statements of Conformity

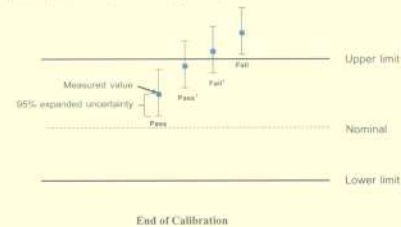
The standard decision rule employed for the statements of conformity to such calibration result will be applied using ILAC-G8:09/2019 Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit

Pass' - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit

Fail' - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit

Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.  
File-Top-ACT-03 Rev.03 Issue date 15/12/24

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-233  
Request No : Req-2024-1452

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : Lx12  
Serial Number : 0086698  
ID : UAEFPM1382565  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375A04  
Microphone S/N : 37398  
Preamplifier Model : PPM1x12C  
Preamplifier S/N : 071568  
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C  $\pm$  2 °C  
Humidity : 50 %RH  $\pm$  20 %RH  
Barometric Pressure : 1013 hPa  $\pm$  10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188271	20 August 2024	GRAS
Mid-frequency Calibrator	Quest	Quest-eil	EPA000234	26 July 2024	TSI
Audio Generator	Svante	Svan401	131	8 October 2024	WK Electric

Note

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

Calibrated By :   
Mr. Noppadol Luangtong  
Service Calibration Engineer

Approved By :   
Mr. Pasit Mathavorn  
Calibration Engineer Supervisor  
Issue Date : 10 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.  
File-Top-ACT-03 Rev.03 Issue date 15/12/24

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Certificate No : 24-SLM-233  
Request No : Req-2024-1452

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139 Level	Nominal (dB)	Before Adjust		After Adjust		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
Calibrator Setting								
1000 Hz 114 dB	113.76	114.6	0.84	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN. 59079

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured	UNCERTAINTY
UUC Weighting	(dB)	( $\pm$ dB)
A	29.3	0.10

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

UUC Setting FAST / 37-139	Measured	UNCERTAINTY
UUC Weighting	(dB)	( $\pm$ dB)
A	29.0	0.10
C	28.7	0.10
Z	33.1	0.10

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

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve				UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
	A	C	Z				
STD Setting	(dB)	(dB)	(dB)				
125 Hz	-0.1	0.1	0.0	0.60	1.5	Pass	
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass	
4000 Hz	0.7	0.7	0.7	0.60	3.0	Pass	
8000 Hz	0.9	0.9	1.0	0.70	5.0	Pass	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.  
File-Top-ACT-03 Rev.03 Issue date 15/12/24

เอกสารไม่ควบคุม

Certificate No : 24-SLM-233  
Request No : Req-2024-1452

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

UUC Setting	Deviation from various Frequency			UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
	A (dB)	C (dB)	Z (dB)			
FAST / 37-139						
STD Setting						
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.1	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.1	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.1	0.1		3.0	Pass
8000 Hz	0.0	0.0	0.1		5.0	Pass
16000 Hz	0.0	0.0	-0.1		+5, -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC	ERR			
FAST / 37-139						
UUC Weighting	(dB)	(dB)	(dB)			
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD REF	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC	ERR			
37-139 / A						
UUC Time Response	(dB)	(dB)	(dB)			
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Leq	114.00	114.0	0.0		0.10	Pass

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ISO 9001:2015 Rev.04 Issue date 04/24

Certificate No : 24-SLM-233  
Request No : Req-2024-1452

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated REF	Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC	ERR			
FAST / A / 37-139						
STD dB	(dB)	(dB)	(dB)			
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	98.9	-0.1		1.1	Pass
94.00	94	93.9	-0.1		1.1	Pass
89.00	89	88.9	-0.1		1.1	Pass
84.00	84	83.9	-0.1		1.1	Pass
79.00	79	78.9	-0.1		1.1	Pass
74.00	74	73.9	-0.1		1.1	Pass
69.00	69	68.9	-0.1		1.1	Pass
64.00	64	63.9	-0.1		1.1	Pass
59.00	59	58.9	-0.1		1.1	Pass
54.00	54	53.9	-0.1		1.1	Pass
49.00	49	49.0	0.0		1.1	Pass
44.00	44	44.0	0.0		1.1	Pass
39.00	39	39.3	0.3		1.1	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of เอกสารไม่ควบคุม  
ISO 9001:2015 Rev.04 Issue date 04/24

Certificate No : 24-SLM-233  
Request No : Req-2024-1452

9. Level linearity including the level range control

UUC Setting	STD REF	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC	ERR			
FAST / A						
UUC Range	(dB)	(dB)	(dB)			
44-110	-44.2	0.1		0.30	1.1	Pass
37-139	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD Toneburst	Anticipated Ref	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
			UUC	ERR			
A / 37-139							
UUC Time Response	(ms)	(dB)	(dB)	(dB)			
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.7	-0.3		+1.0, -2.5	Pass
	0.25	109.0	108.6	-0.4		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	108.9	-0.1		+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated REF	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC	ERR			
FAST / C / 93-142						
STD Setting	(dB)	(dB)	(dB)			
Complete cycle	137.4	136.8	-0.60	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of เอกสารไม่ควบคุม  
ISO 9001:2015 Rev.04 Issue date 04/24

Certificate No : 24-SLM-233  
Request No : Req-2024-1452

12. Overload indication

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Positive one-half cycle	143.1			
Negative one-half cycle	143.0			
Deviated	0.1			

13. High Level Stability

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

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

\* Acceptance limit and Maximum-permitted Uncertainty was IEC 60672-1:2011

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of เอกสารไม่ควบคุม  
ISO 9001:2015 Rev.04 Issue date 04/24



Certificate No : 24-SLM-233  
Request No : Req-2024-1452

#### Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity in each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the

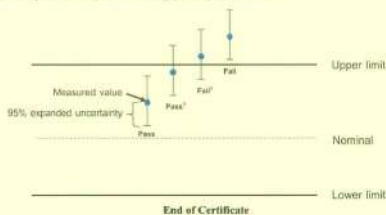
Reporting of Compliance with Specification as following Fig. and statement

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass<sup>+</sup> = The measurement result was within the limit, however, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>+</sup> = The measurement result was out of the limit, however, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

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

ISO 17025:2017 Rev.04 (date: 2024)

#### Certificate of Calibration

##### Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 91 Soi Udomak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok  
10260

Certificate No : 24-SLM-234

Request No : Req-2024-1453

##### Unit Under Calibration Details

Measurement Item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : Lx12  
Serial Number : 0005286  
ID : UAEJFM.002/2362  
Resolution : 0.1 dB  
Microphone Class : 2  
Microphone Model : 375B02  
Microphone S/N : 011740  
Preamplifier Model : P8MLX12B  
Preamplifier S/N : 050087  
Instrument Status : Used

##### Calibration Environment and Details

Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1:2013 Electroacoustics - Sound level meters - Part 1: Periodic tests  
Location of Calibration : Lab Acoustic

##### Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40BAN	188273	20 August 2024	GRAS
Multi-frequency Calibrator	Qson	Quantul	IFA000234	26 July 2024	TNI
Audio Generator	Svantek	Scan401	131	8 October 2024	WK Electric

##### Note

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

Calibrated By :   
Mr. Noppadon Luangrat  
Service Calibration Engineer

Approved By :   
Mr. Pacht Mathavorn  
Calibration Engineer Supervisor

Issue Date : 10 July 2024

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

ISO 17025:2017 Rev.04 (date: 2024)

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

#### 1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
Calibrator Setting								
1000 Hz 114 dB	113.76	114.4	0.64	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 33A, S/N: 58079

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	31.3	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY (± dB)
FAST / 37-139		
UUC Weighting		
A	31.1	0.10
C	30.6	0.10
Z	34.9	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A	C	Z			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.2	1.2	1.2	0.60	3.0	Pass
8000 Hz	2.7	2.8	2.9	0.70	5.0	Pass

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

ISO 17025:2017 Rev.04 (date: 2024)

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
FAST / 37-139						
STD Setting						
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.0		5.0	Pass
16000 Hz	0.0	-0.1	-0.1		+5, -INF	Pass

#### 6. Frequency and time weightings at 1kHz

UUC Setting	STD REF	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
FAST / 37-139						
UUC Weighting						
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD REF	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
		UUC (dB)	ERR (dB)			
37-139 / A						
UUC Time Response						
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Leq	114.00	114.0	0.0		0.10	Pass

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

ISO 17025:2017 Rev.04 (date: 2024)

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

## 7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	Pass
STD Setting	(dB)			
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

## 8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	REF	UUC	(± dB)	(± dB)	Pass
STD dB	(dB)	(dB)			
130.00	130	130.0			
134.00	134	134.0			
129.00	129	129.0	0.30	1.1	Pass
124.00	124	124.0			
119.00	119	119.0			
114.00	114	114.0			
109.00	109	109.0	0.30	1.1	Pass
104.00	104	104.0			
99.00	99	99.0			
94.00	94	94.0			
89.00	89	89.0	0.30	1.1	Pass
84.00	84	84.0			
79.00	79	79.0			
74.00	74	74.0			
69.00	69	69.0	0.30	1.1	Pass
64.00	64	64.0			
59.00	59	59.0			
54.00	54	54.0			
49.00	49	49.1	0.30	1.1	Pass
44.00	44	44.2			
43.00	43	43.3			
42.00	42	42.3			
41.00	41	41.4	0.30	1.1	Pass

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File: 708-01-M-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

## 9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A	REF	UUC	(± dB)	(± dB)	Pass
UUC Range	(dB)	(dB)			
37-139	46.30	46.4			
	114	114.0			

## 10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance Limit	Result
A / 37-139	Yenchoist	Ref	UUC	ERR	(± dB)	Pass
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	134.9	-0.1		
	2	118.0	117.6	-0.4		
	0.25	109.0	108.6	-0.4	0.20	Pass
Slow	200	128.6	128.5	-0.1		
	2	109.0	108.9	-0.1		
	200	129.0	129.0	0.0		
SEL	2	109.0	109.0	0.0	1.0	Pass
	0.25	100.0	99.8	-0.2		

## 11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / C / 95-142	REF	UUC	(± dB)	(± dB)	Pass
STD Setting	(dB)	(dB)			
Complete cycle	137.4	136.8			
Positive half cycle	136.4	136.2			
Negative half cycle	136.4	136.2	0.20	2.0	Pass

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

File: 708-01-M-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

## 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	Pass
STD Setting	(dB)			
Positive one-half cycle	145.5			
Negative one-half cycle	145.4			
Deviated	0.1	0.20	1.5	Pass

## 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	Pass
STD Setting	(dB)			
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1 kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

\* Acceptance limit and Maximum permitted Uncertainty was 10% 0.072-1.201

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

File: 708-01-M-01 Rev.04 Issue date: 5/6/24

Certificate No : 24-SLM-234  
Request No : Req-2024-1453

## Decision Rule for Statements of Conformity

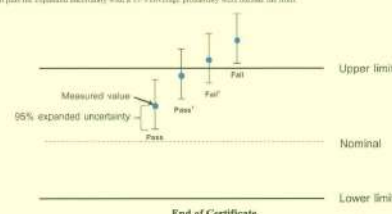
The standard decision rule employed for the statement of conformity to each calibration result will be applied using ILAC-G8:09-2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statement

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability, were within the limit.

Pass<sup>+</sup> - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail<sup>+</sup> - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.





Certificate of Calibration

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

**Certificate No :** 24-SLM-235  
**Request No :** Req-2024-1454

**Unit Under Calibration Details**

Measurement Item : Sound Level Meter  
Manufacturer : Tascam Davis  
Model : LX72  
Serial Number : 0005346  
ID : UAEETM0432563  
Resolution : 0.1 dB

Microphone Class : 2  
Microphone Model : 375B602  
Microphone SN : 11798  
Preamplifier Model : PRMLx12B  
Preamplifier SN : 056138  
Instrument Status : Used

**Calibration Environment and Details**


Temperature :  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$   
Humidity :  $50\% \text{RH} \pm 20\% \text{RH}$   
Barometric Pressure :  $1013 \text{ hPa} \pm 10 \text{ hPa}$   
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

**Reference Standard**

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svante	Svan401	131	8 October 2024	WK Electric

**Note**

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

Calibrated By :   
Mr. Noppadon Luangart  
Service Calibration Engineer

Approved By :   
Mr. Paet Mahavorn  
Calibration Engineer Supervisor  
Issue Date : 10 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**  
IUT-708-SLM-01 Rev.01 Issue date: 5/6/24

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

**1. Indication at the calibration check frequency**

UUC Setting	Nominal Level	Before Adjust		After Adjust		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
FAST / A / 37-139								
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	113.3	1.54	113.8	-0.04	0.20	0.30	Pass

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

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

UUC Setting	Measured (dB)	UNCERTAINTY ( $\pm$ dB)
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	31.4	0.10

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

UUC Setting	Measured (dB)	UNCERTAINTY ( $\pm$ dB)
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	31.3	0.10
C	39.5	0.10
Z	35.0	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
	A	C	Z			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)	( $\pm$ dB)		
125 Hz	0.0	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	1.1	1.1	1.1	0.60	3.0	Pass
8000 Hz	2.6	2.5	2.6	0.70	5.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**  
IUT-708-SLM-01 Rev.01 Issue date: 5/6/24

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

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

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
	A (dB)	C (dB)	Z (dB)			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)	( $\pm$ dB)	( $\pm$ dB)	
63 Hz	-0.1	0.0	0.1	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	-0.1	0.0		3.0	Pass
8000 Hz	-0.1	-0.1	0.0		5.0	Pass
16000 Hz	-0.1	-0.1	-0.1		+3, -40	Pass

**6. Frequency and time weightings at 1kHz**

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
FAST / 37-139						
UUC Weighting	(dB)	(dB)	(dB)	( $\pm$ dB)	( $\pm$ dB)	
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD REF (dB)	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
37-139 / A						
UUC Time Response	(dB)	(dB)	(dB)	( $\pm$ dB)	( $\pm$ dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Leq	114.00	114.0	0.0		0.10	Pass

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IUT-708-SLM-01 Rev.01 Issue date: 5/6/24

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

**7. Long Term Stability**

UUC Setting	Measured UUC (dB)	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139				
STD Setting	(dB)	( $\pm$ dB)	( $\pm$ dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

**8. Level linearity on the reference level range**

UUC Setting	Anticipated REF (dB)	Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
FAST / A / 37-139						
STD dB	(dB)	(dB)	(dB)	( $\pm$ dB)	( $\pm$ dB)	
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	128	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.1	0.1		1.1	Pass
44.00	44	44.2	0.2		1.1	Pass
41.00	41	41.3	0.3		1.1	Pass
40.00	40	40.3	0.3		1.1	Pass

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IUT-708-SLM-01 Rev.01 Issue date: 5/6/24

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

9. Level linearity including the level range control

UUC Setting	STD	Measured			UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
		REF	UUC	ERR			
FAST / A	(dB)	(dB)	(dB)				
UUC Range	(dB)	(dB)	(dB)				
37-139	95-40	46.3	0.1		0.30	1.1	Pass
	114	114.0	0.0			1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
			Ref	UUC			
A / 37-139	Toneburst	(ms)	(dB)	(dB)			
UUC Time Response	(ms)	(dB)	(dB)	(dB)			
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	116.0	117.6	-0.4		+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	0.25	109.0	108.8	-0.2		+1.0, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured			UNCERTAINTY	Acceptance	Result
FAST / C / 95-142	REF	UUC	ERR	(± dB)	Limit	Pass	
STD Setting	(dB)	(dB)	(dB)		(± dB)		
Complete cycle	137.4	136.8	-0.60	0.20	3.0	Pass	
Positive half cycle	136.4	136.2	-0.20		2.0	Pass	
Negative half cycle	136.4	136.2	-0.20		2.0	Pass	

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1347506-01-0101 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

12. Overload indication

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Positive one-half cycle	145.4			
Negative one-half cycle	145.3			
Distorted	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	UUC			
STD Setting	(dB)			
Initial	138.0			
Final	138.0			
Distorted	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
5. Acoustic signal test of frequency weightings at 4 kHz to 10 kHz	0.70 dB
6. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
7. Frequency and time weightings at 1 kHz	0.20 dB
8. Long Term Stability	0.10 dB
9. Level linearity on the reference level range	0.30 dB
10. Level linearity including the level range control	0.30 dB
11. Tone burst response	0.30 dB
12. Peak C Sound level	0.35 dB
13. Overload indication	0.25 dB
14. High Level Stability	0.10 dB

Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-3:2013

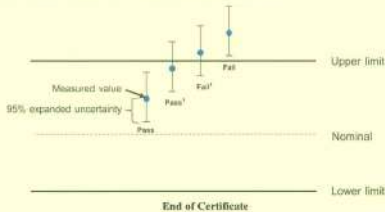
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1347506-01-0101 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-235  
Request No : Req-2024-1454

Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2010: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

- Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.  
Pass<sup>+</sup> = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.  
Fail<sup>+</sup> = The measurement result was out of the limit, however, a portion of the expanded uncertainty of measurement at 95% is within the limit.  
Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of เอกสารไม่ควบคุม  
1347506-01-0101 Rev.04 Issue date 5/6/24

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10250

Certificate No : 24-SLM-236  
Request No : Req-2024-1455

Unit Under Calibration Details

Measurement item : Sound Level Meter  
Manufacturer : Larson Davis  
Model : LxT2  
Serial Number : 0006691  
ID : UAE13M.131/2565  
Resolution : 0.1 dB

Microphone Class : 2  
Microphone Model : 375A04  
Microphone SN : 335080  
Preamplifier Model : PRM4xT2C  
Preamplifier SN : 071565  
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C  $\pm$  2 °C  
Humidity : 30 %RH  $\pm$  20 %RH  
Barometric Pressure : 1013 hPa  $\pm$  10 hPa  
Received Date : 1 July 2024  
Calibrated Date : 10 July 2024  
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests  
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	18K273	20 August 2024	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA00234	26 July 2024	TSI
Audio Generator	Scantek	Scap401	131	8 October 2024	WK Electric

Note

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

Calibrated By :   
Mr. Noppadol Lueangit  
Service Calibration Engineer

Approved By :   
Mr. Paet Pathavorn  
Calibration Engineer Supervisor

Issue Date : 10 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of เอกสารไม่ควบคุม  
1347506-01-0101 Rev.04 Issue date 5/6/24



Certificate No : 24-SLM-236  
Request No : Req-2024-1455

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	Level	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
Calibrator Setting								
1000 Hz 114.0	113.76	114.2	0.44	113.8	-0.04	0.20	0.30	Pass

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

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	39.9	0.10

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

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	( $\pm$ dB)
A	30.8	0.10
C	30.5	0.10
Z	35.0	0.10

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

UUC Setting	Deviation from various Frequency Weighting Response Curve			UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / 37-139	A	C	Z			
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.1	0.1	0.1	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	2.0	1.9	1.9	0.60	3.0	Pass
8000 Hz	1.7	1.6	1.7	0.70	5.0	Pass

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F:\37-50-SLM-01 Rev. 04\Rev. data 5/6/24

Certificate No : 24-SLM-236  
Request No : Req-2024-1455

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

UUC Setting	Deviation from various Frequency Weighting Response Curve			UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / 37-139	A	C	Z			
STD Setting	(dB)	(dB)	(dB)			
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.0	0.0		3.0	Pass
8000 Hz	0.0	0.0	0.1		5.0	Pass
16000 Hz	0.0	-0.1	-0.1		+5.0 -INF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / 37-139	REF	UUC	ERR			
UUC Weighting	(dB)	(dB)	(dB)			
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
37-139 / A	REF	UUC	ERR			
UUC Time Response	(dB)	(dB)	(dB)			
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Log	114.00	114.0	0.0		0.10	Pass

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F:\37-50-SLM-01 Rev. 04\Rev. data 5/6/24

Certificate No : 24-SLM-236  
Request No : Req-2024-1455

7. Long Term Stability

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

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A / 37-139	REF	UUC	ERR			
STD dB	(dB)	(dB)	(dB)			
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	94.0	0.0		1.1	Pass
89.00	89	89.0	0.0		1.1	Pass
84.00	84	84.0	0.0		1.1	Pass
79.00	79	79.0	0.0		1.1	Pass
74.00	74	74.0	0.0		1.1	Pass
69.00	69	69.0	0.0		1.1	Pass
64.00	64	64.0	0.0		1.1	Pass
59.00	59	59.0	0.0		1.1	Pass
54.00	54	54.0	0.0		1.1	Pass
49.00	49	49.1	0.1		1.1	Pass
44.00	44	44.2	0.2		1.1	Pass
40.00	40	40.5	0.5		1.1	Pass
36.00	36	36.3	0.3		1.1	Pass
32.00	32	32.3	0.3		1.1	Pass
28.00	28	28.4	0.4		1.1	Pass
24.00	24	24.5	0.5		1.1	Pass

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Certificate No : 24-SLM-236  
Request No : Req-2024-1455

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / A	REF	UUC	ERR			
UUC Range	(dB)	(dB)	(dB)			
37-139	-60.00	-60.1	0.1	0.30	1.1	Pass
	134	134.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
A / 37-139	Toneburst	Ref	UUC	ERR			
UUC Time Response	(ms)	(dB)	(dB)	(dB)			
Fast	200	135.0	135.0	0.0	0.20	1.0	Pass
	2	118.0	117.8	-0.2		+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	109.0	0.0		+1.0, -2.5	Pass
	0.25	100.0	99.7	-0.3		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY ( $\pm$ dB)	Acceptance Limit ( $\pm$ dB)	Result
FAST / C / 95-142	REF	UUC	ERR			
STD Setting	(dB)	(dB)	(dB)			
Complete cycle	137.4	136.6	-0.80	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		3.0	Pass
Negative half cycle	136.4	136.2	-0.20		3.0	Pass

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Certificate No : 24-SLM-236  
Request No : Req-2024-1455

### 12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 35-139	UUC	( $\pm$ dB)	( $\pm$ dB)	
STD Setting	(dB)	( $\pm$ dB)	( $\pm$ dB)	
Positive one-half cycle	144.9			
Negative one-half cycle	144.9			
Deviated	0.0	0.20	1.5	Pass

### 13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 35-139	UUC	( $\pm$ dB)	( $\pm$ dB)	
STD Setting	(dB)	( $\pm$ dB)	( $\pm$ dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

### Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.25 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

\* Acceptance limit and Maximum permitted Uncertainty was IEC 61672-1:2015

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File: 2024-03-01 Rev. 04-04-2024 3/424

Certificate No : 24-SLM-236  
Request No : Req-2024-1455

### Decision Rule for Statements of Conformity

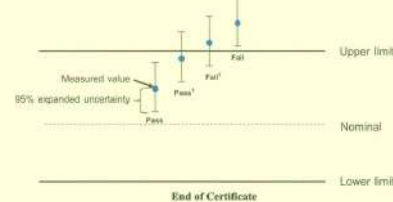
The standard decision rule employed for the statements of conformity to each calibration result will be applied using IAC-GB 09:2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statement:

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass\* = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail\* = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

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

File: 2024-03-01 Rev. 04-04-2024 3/424



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



Cert.No.: 24CH319  
Page.: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Horiba  
Model : LAQUA-PH210  
Serial No. : HAOC0025  
ID No. : UAE.EFM.117/2563(EFM.pH.07/63)  
Condition As-Received: Used Item  
Received Date : 12 March 2024  
Calibration Date : 14 March 2024  
Reference : 2403-0386WSC-1  
Submitted by : United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260

Ambient Temperature : (25  $\pm$  2.5) °C  
Relative Humidity : (50  $\pm$  15) %  
Calibration Procedure : In-house method ;  
- CP-QH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)  
- CP-QH8 by comparison with temperature standard

Calibrated by : Warakorn Lerngagrakul

Approved by :   
Approved Signatory

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

Issue Date : 15 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH319  
Page.: 2 of 3

### Content of this calibration result

#### 1. Reference Standard Instrument

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

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

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

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

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

### Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4.7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor k
			mV	pH		
pH Meter S/N: HAOC0025	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	7.00	0.00	0.0	7.02	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

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a 1206341



Cert.No.: 24CH319  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ( $\pm$ )	Coverage factor $k$
pH Electrode S/N : -	4.008	4.01	149.4	0.0091	2.07
	6.986	7.00	-25.1	0.0093	2.00
	6.986	7.02	-24.3	0.011	2.00
	9.997	10.01	-199.5	0.0095	2.00

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : -  
- Serial No. : -

Dimension of probe

- Length : 103 mm.  
- Diameter : 16 mm.  
- Immersion Depth : 90 mm.

Calibration Point ( $^{\circ}\text{C}$ )	Standard Temperature ( $^{\circ}\text{C}$ )	UUC* Reading ( $^{\circ}\text{C}$ )	Error ( $^{\circ}\text{C}$ )	Uncertainty of measurement ( $\pm$ $^{\circ}\text{C}$ )	Coverage factor $k$
25.0	25.001	25.0	-0.001	0.13	2.00
30.0	30.001	30.0	-0.001	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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

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a 1206342



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

Cert.No.: 24TW56  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE2L0031  
ID No. : UAE.EFM.020/2566(EFM.DO.05/66)  
Received Date : 12 March 2024  
Test Date : 13 March 2024  
Reference : 2403-0385WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

Laboratory Condition : Temperature (  $25 \pm 5$  )  $^{\circ}\text{C}$   
Humidity (  $50 \pm 20$  ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirinthean

Approved by :   
Approved Signatory

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

Issue Date : 15 March 2024

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Cert.No.: 24TW56  
Page.: 2 of 2

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

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

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

##### 2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: 9K2H0053

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.19	0.0055

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

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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24LM41  
Page.: 1 of 2

## Certificate of Calibration

Equipment : DO Meter With Sensor  
Manufacturer : Horiba  
Model : LAQUA-DO210  
Serial No. : HE2L0031  
ID No. : UAE.EFM.020/2566(EFM.DO.05/66)  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260

Location : TPA Chemistry Calibration Laboratory

Received Order : 12 March 2024  
Calibrated Date : 14 March 2024  
Ambient Temperature : (  $26 \pm 10$  )  $^{\circ}\text{C}$   
Relative Humidity : (  $50 \pm 30$  ) %  
AC Line Voltage : (  $220 \pm 22$  ) V

Calibrated by : Preecha Hiahib

Approved by :   
Approved Signatory

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

Issue Date : 29 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : DO Meter With Sensor  
Condition As-Received : Used Item  
Reference : 2403-0385WSC-2

Cert. No.: 24LM41  
Page.: 2 of 2

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	A52847	23I1222	TPA	10 Oct 2024

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

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

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

Result of Calibration :- ( \* ) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 9K2H0053

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
25.0	100	25.005	25.1	0.095	0.16	2.00
30.0	100	30.004	30.0	-0.004	0.16	2.00
35.0	100	35.002	35.0	-0.002	0.16	2.00

UUC\* : Unit Under Calibration

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

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*Seunt*

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 Air Quality Analysis									
1	Analytical Balance (Readability 0.1 mg)	TSP	Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19 Apr 24	18 Apr 25	-
Equipment for Water Quality Analysis									
2	pH Meter	pH	Mettler-Toledo	Seven Easy S20 / 1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
3	BOD Incubator	BOD	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	9 Feb 25	-
4	DO Meter	DO	YSI	5100 / 11B101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25	-
5	Analytical Balance (Readability 0.01 mg)	SS	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-
6	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2500116-001-01	8 Oct 24	7 Oct 25	-
7	Analytical Balance (Readability 0.1 mg)	Fat, Oil & Grease	Mettler-Toledo	XSR204 / C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
8	Gas Chromatography - Mass Spectrometer (GC-MS)	VOCs	Agilent Technologies	System ID: CN17100005 Intovu 9000 (G3950A) / CN17100005 5977B MSD (G7077B) / US1715M030	Agilent Technologies (Thailand) Co.,Ltd.	Certificate of System Qualification GSMS-OQ	1 Mar 24	1 Mar 25	-
9	Atomic Absorption Spectrophotometer (AAS)	Cd, Cr, Pb	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC.ACL.No 358/67	11 Mar 24	10 Mar 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
Equipment for Water Quality Analysis									
10	Atomic Absorption Spectrophotometer (AAS)	Hg	Perkin Elmer	PinAAcle 900F / PFBS20031902	Perkin Elmer Co.,Ltd.	PinAAcle 900F Preventive Maintenance Report	14 May 24	13 May 25	-
11	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	-
12	Incubator	Total Coliform	Binder	KB400 / 20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25	-
13	Incubator		Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	24TM650	2 Apr 24	1 Apr 25	-
14	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	24TM29	10 Feb 24	8 Feb 25	-
15	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	24TM30	10 Feb 24	8 Feb 25	-
16	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2403982-001-01	7 Aug 24	6 Aug 25	-
17	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2402281-001-01	2 Apr 24	1 Apr 25	-
18	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.: 2402420-003-01  
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: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: MS204TS/00  
Serial No.: C252436235  
ID No.: UAE.AIR.023/2566  
Order No.: 2402420  
Operation No.: 2402420-003  
Date of Receipt: 19 April 2024  
Date of Calibration: 19 April 2024

Calibrated by Mr. Pheraphat Tuanit  
Scientist  
Approved by P. Janyabandit  
(Miss Preeyaporn Jaengkarnkit)  
Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team  
Date of Issue: 23 April 2024

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

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

## Calibration Report

Certificate No.: 2402420-003-01  
Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: MS204TS/00  
Serial No.: C252436235  
Capacity: 220 g  
Resolution: 0.0001 g  
ID No.: UAE.AIR.023/2566

Page 2 of 3

Date of Calibration: 19 April 2024  
Environment Condition: Ambient Temperature: 21.7 ± 1.5 °C Relative Humidity: 65 ± 6.7 %  
Place of Calibration: Room 206 Balance Room 2, 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 14:1 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M23111815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M23111825	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NF1.BTH.015/23	Quality Reborn	Q024-0492	4 March 2025

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Normal Value (g)	Standard Deviation of Reading (g)
100	0.000074
200	0.000074

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)
100.0005	100.0006	100.0003	100.0006	100.0003	100.0005	0.0002

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

## Calibration Report

Certificate No.: 2402420-003-01  
Equipment: Electronic Balance  
Manufacturer: METTLER TOLEDO  
Model: MS204TS/00  
Serial No.: C252436235  
Capacity: 220 g  
Resolution: 0.0001 g  
ID No.: UAE.AIR.023/2566

Date of Calibration: 19 April 2024  
Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor #
Unload	0.00000	0.00000	0.00000	0.000094	2.00
0.1	0.10000	0.10000	0.00000	0.000094	2.00
1	0.99998	1.00000	0.00000	0.000097	2.00
5	4.99997	5.00000	0.00000	0.000096	2.00
10	10.00002	10.00000	-0.00000	0.00012	2.00
20	20.00003	20.00001	-0.00001	0.00014	2.00
50	49.99998	50.00003	0.00003	0.00012	2.00
70	70.00000	70.00005	0.00005	0.00017	2.00
100	99.99997	100.00006	0.00006	0.00017	2.00
150	149.99994	150.00012	0.00012	0.00022	2.00
200	200.00001	200.00015	0.00015	0.00028	2.00

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

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

## Certificate of Calibration

Equipment: pH METER  
Model: SevenEasy  
Serial No. (or ID.): 1230525212 (UAE.WAS.003/2553)  
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,  
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, 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, 931985, 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 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.

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2533 Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260  
Phone +66 2018 7000 Email info@dksh.co.th Website www.dksh.com/certificat-thailand

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CAL-FM-C07-14: 9 Apr 2024

## 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	-296	-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

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2533 Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C07-14: 9 Apr 2024

## 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), 96.37%

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

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DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
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CAL-FM-C07-14: 9 Apr 2024



## 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.: WVO-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,  
Phrakanong, Bangkok 10260 Thailand

Calibration By: Mr. Nateekarn 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. Nateekarn 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.

## 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	0.078	
25.0	25.006	25.1	-0.094	0.078	
35.0	35.004	35.0	0.004	0.078	

The End of Certificate

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DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260  
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CAL-FM-C15-14: 06 Dec 2022

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CAL-FM-C15-14: 06 Dec 2022





## Certificate of Calibration

Cert. No.: 24TM303  
Page : 1 of 3

Equipment : BOD Incubator  
Manufacturer : Arco  
Model : UC4-1320  
Serial No. : 13URC4S013201  
ID No. : UAE.WAO.015/2561  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Lab Floor 2  
Received Order : 10 February 2024  
Calibration Date : 10 February 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$   
Calibrated by : Tawatchai Pama  
Approved by :   
( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
( ) Suwit Imjai  
Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2402-0234OC-1  
Result of Calibration : ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM303  
Page : 3 of 3

Calibration Point ( $^\circ\text{C}$ )	UUC* Setting ( $^\circ\text{C}$ )	UUC* Reading ( $^\circ\text{C}$ )	Temperature stability ( $\pm$ $^\circ\text{C}$ )	Temperature uniformity ( $^\circ\text{C}$ )	Overall Variation ( $^\circ\text{C}$ )	Coverage Factor k
20.0	20.1	19.9	0.37	0.72	1.4	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.873	19.803	20.322	19.690	19.615	19.585	19.612	19.558	19.645	0.58

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2402-0234OC-1  
Procedure Used :-

Cert. No.: 24TM303  
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	MY59003411	23LM208	TPA	27 Dec 2024

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

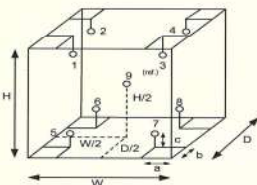
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

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

Dimension of Chamber :

D = 0.62 m  
W = 1.2 m  
H = 1.2 m  
Capacity = 0.89 m<sup>3</sup>

Environment during calibration		
	Beginning	Finished
Temp. ( $^\circ\text{C}$ )	28	31
REL.Humid. ( % )	70	65
AC Supply ( Volt )	233	234

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

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Cert.No.: 24TW39  
Page.: 1 of 2

## Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : 5100  
Serial No. : 11B 101863  
ID No. : UAE.WAO.004/2554  
Received Date : 20 February 2024  
Test Date : 21 February 2024  
Reference : 2402-0629DSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260  
Laboratory Condition : Temperature (  $25 \pm 5$  )  $^\circ\text{C}$   
Humidity (  $50 \pm 20$  ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
Tested by : Walalak Sirithuan  
Approved by :   
( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
( ) Saithip Meangmai  
Issue Date : 22 February 2024

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

#### Condition of this result of calibration

##### 1. Reference Standard Instruments :

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

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

##### 2. Standard Material :-

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

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %  
Dissolved Oxygen Probe No.: Z2B100125

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

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

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



## Calibration Certificate

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

Page 1 of 4

**Equipment:** Electronic Balance

**Manufacturer:** METTLER TOLEDO

**Model:** XSR205DU

**Serial No.:** C210685394

**ID No.:** UAE.WAO.010/2565

**Order No.:** 2402283

**Operation No.:** 2402283-002

**Date of Receipt:** 2 April 2024

**Date of Calibration:** 2 April 2024

**Calibrated by** Mr.Jerawut Prapawuttipong  
Scientist

**Approved by**   
(Mr.Pheraphat Tuanjit)  
Manager, Division of Calibration Laboratory  
Responsible for the Technical Management Team

**Date of Issue:** 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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



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



## 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 2 of 4

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

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

**Condition of Equipment:** Good Condition

#### Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-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	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFL8TH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

#### Calibration Results:

##### 1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
100	0.000048
200	0.000048

##### 2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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



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



## 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 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 (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.000000	2.00
0.001	0.001003	0.001001	-0.000001	0.00000089	2.00
0.005	0.005003	0.005000	-0.000003	0.00000092	2.00
0.01	0.010003	0.010000	-0.000003	0.00000089	2.00
0.05	0.049996	0.050000	0.000004	0.00000096	2.00
0.1	0.100011	0.100000	-0.000011	0.0000011	2.00
0.5	0.500016	0.500001	-0.000015	0.0000014	2.00
1	1.000003	1.000002	-0.000001	0.0000016	2.00
2	2.000023	2.000001	-0.000022	0.0000017	2.00
5	5.000017	5.000002	-0.000015	0.0000020	2.00
10	10.000009	10.000000	-0.000009	0.0000026	2.00
20	20.000031	20.000000	-0.000031	0.0000037	2.00
30	30.000040	30.000001	-0.000039	0.0000050	2.00
50	50.000028	50.000002	-0.000026	0.0000068	2.00
80	80.000068	80.000002	-0.000066	0.000011	2.00

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







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

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

## 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 Palpim  
( ) Suwit Imjai  
(✓) Kunchit Promprat  
Issue Date : 15 May 2024

Calibration were conducted using in-house calibration procedure CP-OB01 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-0013-24      | 25 Jan 2026 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
100	100.0000	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 ( g )	Standard Deviation of Reading ( g )
100	0.00007
200	0.00007

The Uncertainties are for a confidence probability of approximately 95%

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

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

### Result of calibration

#### 2. Effect of off center loading

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

Position 1 ( g )	Position 2 ( g )	Position 3 ( g )	Position 4 ( g )	Position 5 ( g )	Maximum difference between off-center and central loading ( g )
+0.0002	-0.0001	0.0000	+0.0002	0.0000	0.0003

#### 3. Departure from nominal value

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
Unload	0.0000	0.0000	0.15	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 %.

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QC-098-04-114

Agilent  
CrossLab  
From insight to outcome

## Agilent CrossLab Start Up Services Agilent Intuvo 9000 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.





## 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>.

Revision: 2.03, Issued: February 27, 2023  
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Page \_\_\_\_ of \_\_\_\_



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## Service Engineer's Responsibilities

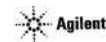
- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist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

### 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: 2.03, Issued: February 27, 2023  
Agile Document Number: D0013614  
DE number: 44166.759722222  
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Page \_\_\_\_ of \_\_\_\_



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## System Information

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

Instrument System Name and ID	CN17100005
Instrument System Site and Location	UAE

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3950A	CN17100005
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: 2.03, Issued: February 27, 2023  
Agile Document Number: D0013614  
DE number: 44166.759722222  
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Page \_\_\_\_ of \_\_\_\_



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## Preventive Maintenance Procedure

### Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify operation of all instrument fans.

### Inlet and detector consumable replacement

- ☒ For the inlet installed, perform inlet maintenance using the built-in procedures accessed from Agilent 9000 touch screen display or web interface.
- ☒ Replace column Compression Bolts.
- ☒ Replace the split vent trap for the Split/Splitless Capillary (SSL) or Multi-Mode Inlet (MMI) using the built-in procedure accessed from Agilent 9000 touch screen display or web interface.
- ☒ 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. Use the built-in procedures accessed from Agilent 9000 touch screen display or web interface.
- ☒ Replace the Guard Chip or Jumper Chip for the Split/Splitless Capillary (SSL) or Multi-Mode Inlet (MMI) using the built-in procedure accessed from Agilent 9000 touch screen display or web interface.

### Inlet and Detector Tests

- ☒ Zero all pressure sensors.
- ☒ Perform the inlet pressure leak test.
- ☒ Perform the inlet restriction test.
- ☒ Perform the FID jet restriction test if FID installed.
- ☒ Perform the FID leakage test if FID installed.
- ☒ Record if test passed or failed in the results table.

Revision: 2.03, Issued: February 27, 2023  
Agile Document Number: D0013614  
DE number: 44166.759722222  
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Page \_\_\_\_ of \_\_\_\_



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## ALS Maintenance

- ✓ 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 rod – clean if necessary
- ✓ Check for correct operation of syringe volume stops

## Restore Instrument

- ✓ Restore the normal operating conditions using the Keyboard or Data System.
- ✓ 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.

## 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.

Revision: 2.03, Issued: February 27, 2023  
Agile Document Number: D0013614  
DE number: 44166.759722222  
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Page \_\_\_\_ of \_\_\_\_



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## 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.

## PM Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Detector output [D1]	25	18
Detector output [D2]	N/A	

Tests	Expected Result	Actual Result or N/A
Inlet Leak Test	Pass	Pass
Inlet Restriction Test	Pass	Pass
FID Jet restriction test if FID installed	Pass	Pass
FID leakage test if FID installed	Pass	Pass

Revision: 2.03, Issued: February 27, 2023  
Agile Document Number: D0013614  
DE number: 44166.759722222  
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Page \_\_\_\_ of \_\_\_\_



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## Intuvo Parts List Table

Note: The following kits are recommended for capillary and MultiMode 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/Model # where used	Quantity Consumed
FID Jet 0.11 inch ID	5200-0176	G3950A	
Inlet PM Kit	5188-6497	G3950A	
FID Ignitor Glow Plug	19231-60680	G3950A	
Bus Bolt with Washer	G4581-60260	G3950A	
Guard Chip for SS inlet	G4587-60565	G3950A	
Guard Chip for MMI	G4587-60665	G3950A	
Jumper Chip for SS inlet	G4587-60575	G3950A	
Jumper Chip for MMI	G4587-60675	G3950A	
Column Compression Bolts	G4581-60260	G3950A	
Split Vent Trap Filter (Zpk)	5188-6497	G3950A	

## 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 6006726358 Date service completed 1 Mar 2024

Agilent signature Customer signature

Total number of pages in this document

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Page \_\_\_\_ of \_\_\_\_



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7697A Headspace Sampler  
Preventive Maintenance Checklist - Enhanced

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.chem.agilent.com/en-us/products/services/pages/default.aspx>

## 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 additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional costs.

## Service Engineer's Responsibilities

- Only complete/printout 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 a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- It is important to consult with the customer prior to a PM to determine which parts are installed in the instrument to decide if individual components need to be purchased rather than the 7697A Standard PM Kit. The 7697A Standard PM Kit contents are based off of the contents of the original shipment. Different types of deactivated treatment for the sample probe and sample loop, different sample loop sizes, and transfer line sizes may require for individual parts to be ordered to perform the PM procedure. If different parts are required, reference the Agilent supplies catalog for part numbers.

Issued: 10-Feb-2017, Revision: 6

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Page 1 of 6

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## 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced



### System Information

#### Guidance

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

Instrument system name and ID	CN1710005
Instrument system site and location	UAE
List system component product numbers	List the serial numbers of each component
1. 64557 ~64000	1. CN17110041
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

### Preparation

- Discuss any specific issues with the customer prior to starting.
- Review the instrument logbook.
- Save instrument control settings before starting the procedure.
- Perform general inspection of system for cleanliness.
- Check for proper installation of safety-related parts, assemblies, sensors etc.
- Check for required firmware updates and verify with customers if they would like it installed.

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Page 2 of 6

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## 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced

### Inspect and Clean Sampler

- If a tray is part of the system, remove the tray and pneumatics to allow for access to the oven.
- If a tray is part of the system, check that the shutter sensor is not dusty. If it is, use air duster to remove the dust.
- Check for any debris in the carousel and clean if necessary.
- If a tray is part of the system, reinstall the tray and pneumatics unit.
- Remove the front panel of the instrument.
- Check the carousel belt for wear. If it is worn, consult with the customer to determine if it should be replaced.
- Use a dry, clean cloth to wipe the lifter rod(s) clean. Do not apply any lubricant.
- Vacuum the inside of the unit.
- Reinstall the front panel of the instrument.
- Using the Manual Operations function under the Service Mode Key on the instrument keypad, confirm that the following components work:
  - Tray Lifter - if present
  - Sample Lifter
  - Carousel Motor
  - Shutter Motor - if present

### Pneumatic Components

- Remove the sample probe and the sample loop.
- Replace the six port valve rotor. Do not begin until the valve is cool enough to handle. For complete instructions, refer to your service procedures.
- Unscrew the valve assembly. Do move the preset socket adjustment screw.
- Carefully loosen and remove the rotor from the valve assembly noting the orientation of the rotor tab.
- Clean and inspect the valve body. Note any scratches. Recommend repairs in the engineer notes.
- Install the new rotor in the valve assembly with the same orientation.
- Screw in the valve assembly into the valve body one turn beyond the point where it first touches the rotor.
- To seat the valve, cycle it 10 times.
- With the valve in the full clockwise or counterclockwise position, tighten the preload.
- Cycle the valve 3 times.
- Install the new sample loop and the new sample probe.
- Remove the fused silica transfer line.
- Special Note: If OQ will be performed after the PM, remove the fused silica transfer line and do not reinstall it until the transfer line measurement is taken for the OQ procedure.
- Reinstall the fused silica transfer line.
- Use Service Reminders under the Service Mode Key to reset the counter (press the OFF key) of the

Issued: 10-Feb-2017, Revision: 6

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Page 3 of 6

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## 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced



sample probe, sample loop and transfer line.

- Use the Leak Test under the Service Mode Key on the instrument keypad to run the instrument restriction and leak test. Verify that it passes (make a note below in the tests results table). If it fails, consult the customer for repair options.

### Tray Components

- Section NOT applicable.
- Check for any debris in the sample trays and clean if necessary.
- Check that the tray gantry rod is clean. If it is dirty or dusty, wipe it clean with a dry cloth. Do not apply any kind of lubrication.
- Check that the sensors are not dusty. If they are, use air duster to remove the dust.
- Check the tray belts for any wear. If they are worn, consult with the customer to determine if they should be replaced.
- Verify that the three LED's for the tray racks light up when the trays are installed.
- Run the tray calibration.
- Reset the counter (pressing the OFF key) of the tray calibration.

### Restore Instrument

- Reconnect the headspace transfer line if it has not been already reconnected.
- Return instrument to initial conditions.
- Perform system checkout procedure or test.

#### 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.

Issued: 10-Feb-2017, Revision: 6 Copyright © 2016  
Page 4 of 6

เอกสารไม่ควบคุม



## 7697A Headspace Sampler Preventive Maintenance Checklist - Enhanced

### Service Review

- Attach available reports/printouts of all tests to this documentation.
- Record the PM service activity in the customer's instrument 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 Review Comments section below if there are additional comments.
- Review the service and any test results with the customer.
- If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

### 7697A Headspace Sampler Test Results Table

Test Description	Expected Test Result	Actual Test Result
Tray Calibration	Pass	Pass
Leak Test	Pass	Pass
Chemical Checkout Test		

### 7697A Headspace Sampler Parts List Table

Part Description	Part Number	Product or Model where used	Quantity Consumed
7697A Enhanced PM Kit	G4556-67012	7697A HS Sampler	1
Ferrule Flexi Inert 0.53mm Col 10/PK NFS	G3188-27503	7697A HS Sampler AND G3520A module	1 (Optional, not included in PM kit)

#### Part numbers and descriptions for the kit contents.

Part Description	Part Number	Quantity
Sample Probe	G4556-60125	1
Sample Loop (1mL)	G4556-80106	1
Six Port Valve Rotor	1535-4952	1
7697A Fused Silica and ProSteel Kit	G3903-61001	1
Polyimide, Valcon Ferrule, 5 pack	0100-2505	1
Nut and reducing union for 6 port valve transfer line connection	0100-2504	1
Thermal Gap Insulation Foam	G3530-00610	1
Liner, direct, 2mm ID, deactivated	5181-8818	1

Issued: 10-Feb-2017, Revision: 6

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Page 5 of 6

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7697A Headspace Sampler  
Preventive Maintenance Checklist - Enhanced



**Service Engineer Comments (optional)**

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 in this box.

**Other Important Customer Web Links**

- ☐ How to get information on your product: Literature Library - <http://www.agilent.com/chem/library>
- ☐ Need to know more? - [www.agilent.com/chem/education](http://www.agilent.com/chem/education)
- ☐ Need technical support, FAQs? - [www.agilent.com/chem/techsupp](http://www.agilent.com/chem/techsupp)
- ☐ Need supplies? - [www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)

**Service Completion**

Service request number 6906726358 Date service completed 11 May 2022

Agilent signature C. Tamm Customer signature \_\_\_\_\_

Document part number: G4556-90023

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Page 6 of 6

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Agilent Preventive Maintenance Services

**Agilent GCMS  
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.



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Agilent GCMS Preventive Maintenance Checklist



**Introduction**

This checklist covers the following model(s):

Type	Model
SQ	5973 Series MSD
SQ	5975 Series MSD
SQ	5977 Series MSD
TQ	7000 Series MS/MS
TQ	7010 Series MS/MS
QTOF	7200 Series QTOF
QTOF	7250 Series QTOF

**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.

**Customer Responsibilities**

Customers should ensure that all necessary operating supplies, consumables, and usage-dependent items such as gases, vials, syringes, calibrant solution and solvents required for successful preventive maintenance are available. A customer representative should be available while the preventive maintenance is being performed.

Agilent GCMS Preventive Maintenance Checklist



**Important notice for customers**

The customer should complete the following before the Support Provider arrives on site:

- ☒ Perform an autotune and retain the printed tune report just prior to the start of the PM to verify performance of the equipment.

**Note:** It is recommended to have the customer run the autotune and tune evaluation prior to the PM and then start the vent cycle so that the instrument will be ready for the service representative.

**Important Customer Web Links**

- To access Agilent training and education, visit <http://www.agilent.com/chem/training> 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/en-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?** Flexible Repair Options | Agilent

**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.

Revision: A.05, Issued: July 2023  
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Page \_\_\_\_ of \_\_\_\_



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- 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 order by sections: Review, System Checks, Pump maintenance, Cleaning System and Filters, then System Post Check.
  - The tasks in each section may be completed in the most logical order relevant to the system. 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 Verification section.
- Complete Signature Page and attach Signature Page to Service Order.

#### Additional Instruction Notes

- Preventive maintenance is a factory recommended procedure designed to reduce the likelihood of electromechanical failures. Failure to perform preventive maintenance may reduce the long-term reliability of certain instruments and systems. Two preventative maintenances (PMs) per year are recommended, the Major PM Service will be performed annually with an Interim PM performed 6 months after the Major PM.

#### Definition of the Task/Recommended items within the document

Task		Recommended			
Yes	No	Interim	Major	As Needed	
✓					Yes selected means that the task was done or the part was required
	✓				No selected means that the task was not done or the part was not required.
		✓			Interim selected means that this task is recommended to be done at 6-month intervals
			✓		Major selected means that this task is recommended to be done yearly; if the customer would like a service to be done at the 6-month interval then the service could be purchased
				✓	As needed selected means that the task was done, or the part was used as needed. For example, there could be two types of filters that could be used, and this was the one selected.

Revision: A.05, Issued: July 2023  
DE Number DE48526731  
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Page \_\_\_\_ of \_\_\_\_



## Instrument Maintenance

Select the appropriate service to be performed.

- ☐ Interim Preventive Maintenance (when available, is typically 6 months or at the request of the customer)
- ☐ Major Preventive Maintenance (Yearly)
- ☐ Enhanced Preventive Maintenance (when available, is provided "As needed")

#### System Information

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

Instrument System Name and ID	CN17100005
Instrument System Site and Location	UAE

List System Component Product Numbers	List the Serial Numbers of each Component
1. 67077B	U517150000
2.	
3.	
4.	
5.	
6.	

#### 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 firmware version(s). Updating to the most current versions is strongly recommended. Verify with the customer before updating.

Revision: A.05, Issued: July 2023  
DE Number DE48526731  
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Page \_\_\_\_ of \_\_\_\_



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## Preventive Maintenance Procedures

☐ Service Not Applicable

#### Interim / Major Preventive Maintenance – GCMS

Yes/No	Interim/Major	Description
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform general inspection of system for cleanliness
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss any problems the customer is having with the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Review customer maintenance records and exclude maintenance on recently serviced items
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Review the most recent autotune report. This will give a starting point for evaluating spectral peaks, baseline noise, peak shape, mass assignments and resolution.

#### Interim / Major Preventive Maintenance – System Checks

☐ Service Not Applicable

Yes/No	Interim/Major	System Checks
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify that calibration peaks were seen prior to starting the PM
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Vent the instrument
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inspect vacuum hoses, pump, exhaust tubing, and power cords for excessive wear.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Visually inspect calibrant levels – PFTBA/PFDTB (if appl.), IRM (if appl.). Refill if available.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Look for any obvious external damage or problems.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clean air intake(s). Cosmetic cover(s) may need to be removed.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Verify system line voltage meets instrument specifications: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	For Hydromert systems, verify customer is running hydrogen: Yes <input type="checkbox"/> No <input type="checkbox"/>

#### Interim / Major Preventive Maintenance – Wet Mechanical vacuum pumps

☐ Service Not Applicable

Yes/No	Interim/Major	Wet Mechanical vacuum pumps
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of oil leakage. Check pump gasket for leakage.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	GC/MS SQ with diffusion pump; drain and replace diffusion pump oil.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Drain and replace mechanical pump oil.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace Oil Mist Filter if applicable.

Revision: A.05, Issued: July 2023  
DE Number DE48526731  
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Page \_\_\_\_ of \_\_\_\_



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Yes/No	Interim/Major	Wet Mechanical vacuum pumps
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent oil changes if the oil is dirty
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Don't use mist filters with Chemical Ionization.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed. Visually confirm that no oil returns up vacuum hose.

#### Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Diaphragm

☒ Service Not Applicable

Yes/No	Interim/Major	Dry Mechanical vacuum pumps - Diaphragm
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Clear air flow paths of dust.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	If vacuum is poor, then replace the diaphragm pump.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

#### Interim / Major Preventive Maintenance – Dry Mechanical vacuum pumps - Scroll

☒ Service Not Applicable

Yes/No	Interim/Major	Dry Mechanical vacuum pumps - Scroll
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace the tips seal on the IDP pump.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Check for evidence of poor vacuum – Rough vac pressure, turbo power demand, poor manifold vacuum, etc.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Replace the Exhaust Filter if required.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Discuss with customer the need for more frequent changes, if needed.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Inform customer that pump gas ballast should be installed all the time.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Perform anti-suckback valve test. Power on until side plate is held closed, power off and check that side plate holds closed.

Revision: A.05, Issued: July 2023  
DE Number DE48526731  
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Page \_\_\_\_ of \_\_\_\_



## Interim / Major Preventive Maintenance – Cleaning System and Filters

☐ Service Not Applicable

Cleaning System and Filters	
Yes/No	Interim/Major
Description	
Fans	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Remove dust from fans and vent covers.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Verify fans are functional and that there is enough space around the instrument for proper cooling.	
Source cleaning (all sources except HydroInert)	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Open analyzer and remove the source.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Disassemble, Clean, Re-assemble source. (7200, also, remove and clean entrance lens)	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Re-install source and close analyzer.	
HydroInert Source	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Source NOT to be abrasively cleaned. No cleaning required at PM. If a decrease in performance is observed, recommend to the customer that filaments, insulators (repeller and extractor), extractor lens, and repeller lens may need to be replaced to restore performance. HydroInert source should not be run with helium carrier.	
Filters	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Replace RMSH-2 Helium gas filter (collision cell gas) – if applicable.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Replace RMSN-2 Nitrogen gas filter (collision cell gas) – if applicable.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Replace RMSHY-2 Hydrogen gas filter (HydroInert and JetClean) – if applicable.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CP17973 – Gas Clean GS/MS Filter (for He, N <sub>2</sub> or H <sub>2</sub> carrier) – if required	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5190-9071 – Methane Gas Filter (CI systems) – if applicable	

Guidance: Gas filters need to be changed only if required (ie indicating traps show color change, or if Big Universal Trap are approaching saturation based on time installed or number of gas cylinders changed for that trap)

Revision: A.05, Issued: July 2023  
DE Number DE48526731  
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Page \_\_\_\_ of \_\_\_\_



## Signature Page

## Service Engineer Comments (optional)

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

## Service Verification

Service Request Number:

600672 6358

Date of Service Completion:

1 Mar 2024

Service Engineer Name:

Sarnut Chongman

Customer Name:

Pobkietan J.

Service Engineer Signature:

C. Tan

Total number of pages in this document:

Revision: A.05, Issued: July 2023  
DE Number DE48526731  
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Page \_\_\_\_ of \_\_\_\_



## Interim / Major Preventive Maintenance – System Post Check

☐ Service Not Applicable

System post-check	
Yes/No	Interim/Major
Description	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Pump system back down. Wait until system stability has been achieved.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Verify system vacuum reading(s) via the gauge controller.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Leak Check	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Verify system in manual tune	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Compare against previous tune file report(s)	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Change to Tune and verify that all temperatures, pressures, and gas flows reach method set points	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Check manually that you have calibration peaks.	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
EJ Autotune Performed	

Guidance: if the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument setup 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 Signature Page and attach Signature Page to Service Order.

## Test Results

Test Description	Expected Test Result	Actual Test Result
ATUNE	Pass	Pass

Revision: A.05, Issued: July 2023  
DE Number DE48526731  
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Page \_\_\_\_ of \_\_\_\_



Request No. 25-67 / 0275

MTC. ACL.No. 358 / 67

## CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. S2-MEB675610

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

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

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

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

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

CALIBRATION DATE : 2 February 2024

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "CARLO ERBA"

Cadmium Lot No. 0006589926, Chromium Lot No. 0112384886, Copper Batch No. T117098A, Iron Batch No. T126087A,

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

AMBIENT CONDITIONS : Temperature 25 ± 5 °C Relative humidity 50 ± 20 %

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

Calibrated by Atipat

( Mr. Atipat Ratana )

Approved by Sulda

(Miss Sulda Chawong)

Director of Analytical Chemistry Laboratory

Ref. 2015267020100454001

Issued Date : 11 March 2024

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

FIABL.MTC.002 Rev.4

## Head Office

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Request No. 25-67 / 0275

1 / 5

MTC. ACL. No. 358 / 67

## CALIBRATION DATA

## 1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0006	0.0004	-0.0003	0.0001	-0.0011	-0.0005	0.0008	0.0004
	0.001	0.0017	-0.0009	0.0008	0.0001	0.0002	-0.0003	0.0007
	0.0006	0.0017	-0.0020	0.0005	0.0005	0.0004	0.0013	0.0014
	0.0001	0.0018	-0.0007	0.0005	0.0004	-0.0003	-0.0001	0.0010
	-0.0001	0.0019	-0.0014	0.0003	0.0010	0.0000	0.0002	-0.0001
	0.0011	0.0014	-0.0017	0.0009	-0.0008	0.0004	0.0006	0.0010
	-0.0002	0.0015	-0.0015	0.0003	0.0002	-0.0008	0.0009	0.0013
	0.0006	0.0012	-0.0001	0.0006	0.0008	0.0001	-0.0002	-0.0013
	0.0008	0.0009	-0.0003	0.0003	0.0005	0.0002	0.0001	0.0007
	0.0012	0.0011	-0.0012	0.0008	0.0003	0.0004	0.0004	0.0013
	0.0003	0.0015	-0.0019	0.0001	-0.0002	0.0000	-0.0003	0.0003
	0.0005	0.0017	-0.0019	-0.0007	0.0000	-0.0007	0.0005	0.0005
	-0.0006	0.0016	0.0000	0.0006	-0.0001	0.0013	0.0006	0.0010
	0.0003	0.0011	-0.0002	0.0001	-0.0007	0.0009	0.0009	0.0002
	0.0003	0.0012	-0.0011	0.0007	-0.0003	-0.0003	0.0010	0.0009
	0.0004	0.0018	-0.0016	-0.0004	-0.0006	0.0008	0.0007	0.0007
	-0.0001	0.0018	-0.0018	0.0013	-0.0006	-0.0001	0.0014	0.0006
	0.0003	0.0017	-0.0001	-0.0012	-0.0004	0.0001	0.0002	
	0.0010	0.0018	-0.0007	0.0003	-0.0005	-0.0002	0.001	0.0003
	0.0004	0.0019	-0.0008	-0.0001	-0.0004	0.0003	0.0002	0.0008
Average Absorbance	0.000	0.001	-0.001	0.000	0.000	0.000	0.000	0.001

Continue 2 / 5

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Request No. 25-67 / 0275

2 / 5

MTC. ACL. No. 358 / 67

## 2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0078	0.0076	0.0069	0.0075	0.0071	0.0070	0.0076	0.0074	0.0077	0.0067	0.007	0.0004	5.15
	0.30	0.1008	0.1007	0.0999	0.0997	0.1000	0.0996	0.1008	0.1002	0.1005	0.0999	0.100	0.0005	0.46
	0.70	0.2301	0.2306	0.2277	0.2305	0.2310	0.2295	0.2290	0.2293	0.2305	0.2296	0.230	0.0010	0.42
Cr	0.10	0.0094	0.0093	0.0093	0.0098	0.0094	0.0095	0.0090	0.0090	0.0094	0.0090	0.009	0.0003	2.75
	0.30	0.0241	0.0236	0.0221	0.0238	0.0231	0.0226	0.0231	0.0223	0.0230	0.0231	0.023	0.0006	2.75
	0.70	0.0500	0.0500	0.0500	0.0524	0.0499	0.0511	0.0509	0.0512	0.0513	0.0504	0.051	0.0008	1.63
Cu	0.05	0.0061	0.0062	0.0064	0.0061	0.0069	0.0069	0.0061	0.0062	0.0064	0.0061	0.006	0.0003	5.00
	0.30	0.0419	0.0411	0.0402	0.0407	0.0405	0.0404	0.0399	0.0400	0.0399	0.0400	0.040	0.0006	1.58
	0.70	0.0960	0.0960	0.0960	0.0959	0.0947	0.0955	0.0952	0.0952	0.0951	0.0955	0.096	0.0005	0.48
Fe	0.10	0.0096	0.0101	0.0103	0.0100	0.0099	0.0099	0.0106	0.0099	0.0105	0.0102	0.010	0.0003	3.38
	0.50	0.0424	0.0415	0.0428	0.0427	0.0421	0.0426	0.0413	0.0430	0.0421	0.0419	0.042	0.0006	1.33
	1.00	0.0830	0.0839	0.0847	0.0834	0.0832	0.0820	0.0839	0.0838	0.0837	0.0845	0.084	0.0008	0.92
Pb	0.20	0.0078	0.0074	0.0078	0.0078	0.0076	0.0078	0.0077	0.0078	0.0078	0.0077	0.008	0.0001	1.71
	0.70	0.0278	0.0273	0.0271	0.0267	0.0270	0.0264	0.0274	0.0273	0.0269	0.0269	0.027	0.0004	1.45
	1.50	0.0551	0.0548	0.0552	0.0555	0.0547	0.0546	0.0544	0.0544	0.0549	0.0547	0.055	0.0004	0.64
Mn	0.05	0.0116	0.0107	0.0110	0.0103	0.0108	0.0108	0.0112	0.0107	0.0109	0.0108	0.011	0.0003	3.15
	0.30	0.0650	0.0649	0.0649	0.0651	0.0646	0.0646	0.0649	0.0646	0.0640	0.0648	0.065	0.0003	0.48
	0.70	0.1463	0.1465	0.1459	0.1471	0.1475	0.1474	0.1487	0.1473	0.1462	0.1468	0.147	0.0008	0.56
Ni	0.10	0.0095	0.0100	0.0096	0.0103	0.0102	0.0096	0.0100	0.0095	0.0097	0.0096	0.010	0.0003	3.04
	0.50	0.0443	0.0433	0.0438	0.0444	0.0430	0.0437	0.0444	0.0437	0.0438	0.0434	0.044	0.0005	1.09
	1.00	0.0812	0.0820	0.0834	0.0829	0.0818	0.0829	0.0831	0.0835	0.0816	0.0819	0.082	0.0008	0.99
Zn	0.05	0.0374	0.0377	0.0373	0.0377	0.0374	0.0377	0.0373	0.0371	0.0371	0.0374	0.037	0.0002	0.61
	0.30	0.1985	0.1993	0.1975	0.1992	0.1979	0.1988	0.1995	0.1985	0.1974	0.2004	0.199	0.0009	0.47
	0.70	0.4027	0.4031	0.4019	0.4021	0.4023	0.3981	0.4042	0.4025	0.3993	0.3997	0.402	0.0019	0.48

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Request No. 25-67 / 0275

3 / 5

MTC. ACL. No. 358 / 67

## 3.1. Trueness

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.020	0.020	0.000	1.10	± 0.005
	0.301	0.301	0.000	0.11	± 0.005
	0.707	0.693	-0.013	1.85	± 0.008

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1007	0.104	0.004	3.49	± 0.009
	0.3035	0.297	-0.006	2.11	± 0.012
	0.7071	0.685	-0.023	3.19	± 0.023

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.051	0.047	-0.004	7.58	± 0.003
	0.303	0.296	-0.007	2.19	± 0.009
	0.704	0.698	-0.006	0.74	± 0.020

Continue 4 / 5

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4 / 5

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.104	0.005	4.60	± 0.014
	0.500	0.482	-0.018	3.55	± 0.016
	1.006	0.968	-0.038	3.75	± 0.029

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.201	0.202	0.001	0.34	± 0.014
	0.706	0.719	0.012	1.73	± 0.030
	1.513	1.459	-0.054	3.57	± 0.061

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.0505	0.050	0.000	0.83	± 0.005
	0.3031	0.306	0.003	1.12	± 0.007
	0.7023	0.698	-0.004	0.62	± 0.014

Continue 5 / 5

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5 / 5

MTC. ACL. No. 358 / 67

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

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Ni	0.101	0.098	-0.003	2.90	± 0.013
	0.508	0.502	-0.006	1.16	± 0.018
	1.012	0.962	-0.051	5.02	± 0.032

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

Element	Standard Value of RM (mg/L)	Reading (mg/L)	Error of Measurement (mg/L)	Error of Measurement (%)	Uncertainty (mg/L)
Zn	0.050	0.045	-0.005	9.39	± 0.013
	0.303	0.324	0.021	7.04	± 0.013
	0.707	0.675	-0.032	4.52	± 0.019

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

Calibrated by Atipat (Mr. Atipat Ratana)  
Approved by Suladda (Miss Suladda Deawtong)  
Director of Analytical Chemistry Laboratory  
Issued Date : 11 March 2024

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End of Certificate

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# PinAAcle 900F Preventive Maintenance Report

Company Name: VgF 3 3 สรณ  
Instrument Location: S1 N I ส  
( 5 nr 1u4hu  
Instrument Serial No.: ( er N4uuR1mu4  
Date: 14-May-2024

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## PinAAcle 900F Preventive Maintenance (PM)

Company Name:	V g F 3 3 สรณ
Address (Instrument Location):	S1 N I ส ( 5 nr 1u4hu
Serial Number:	( er N4uuR1mu4 PM Number: 4 4
Customer Name (if applicable):	5s Telephone Number: untadkku5m
Customer Support Engineer Name:	5s3 Service Order Number: / Wa4i ki dnu
Date PM Performed: (DD-MMM-YYYY)	14-May-2024 Next PM Due Date: (DD-MMM-YYYY) 14-Nov-2024
Standard Labor Hours to Complete PM :	5 hours

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

## Scope

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

The customer should save their method before the PM begins.

## General Instructions:

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

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

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

Update the PM sticker and instrument logbook as required.

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## Component List

Component / Specific Model	Serial #	Configuration Notes
( gg3 mue	( er N4uuR1mu4	N x สรณ สรณ
e 1uuTD f U	1uuN45u5udu1	

## Parts Lists

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

## 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	4i cRnSV 1	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 <sub>3</sub>	250 ml.	AR	AR

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Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	1u1Ouukmu1d
N1013002	1.0A Neutral density filter	1	1u1Ouukmu1d
03030997	System 2 EDL Driver	1	uRuRunmi
N3050605	As System 2 EDL	1	1h15k
N3050121	Cu Lumina HCL	1	uHuS1nuRu1ku
N3050109	Ba Lumina HCL	1	uh141nu4uuS1
N3050139	K Lumina HCL	1	uRuK1nu1u1Ru
N3050152	Ni Lumina HCL	1	ud4i 1nu4uu4u

## Procedure Checklist

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

- 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.
- PC Instrument Software:**
  - ✓ Instrument Software user files/databases archived, packed, and/or deleted as needed.
- 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).
- 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.
- Optics:**
  - ✓ Inspect and clean the sample compartment windows, if needed.
  - ✓ Inspect optics. Clean or replace if necessary,
- Gasses:**
  - ✓ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900F Series Pre-installation Checklist SDB.
  - ✓ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

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### 7. Flame Interlock Check:

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

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

### 8. After PM Performance tests:

#### 8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	๖๘๓๓๓	1๖15R	Passed
0.2 A ND Filter	± 5% from Cert.	๖๘1๓1๓	๖๘1๓1๓	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	๖๘๖4	Passed

#### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	๖๘๖๖4	Passed

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

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	๖๘๖๖1	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	๖๘๖4	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	๖๘๖44	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.	Otg	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	๖๘๖๖๔	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.

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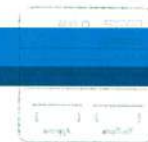
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## Additional Comments

### Additional Comments Regarding the PM

## 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.

## Review

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

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

### Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Chayanon R.

Date:

14-May-2024  
(DD-MMM-YYYY)

Authorized Customer Representative:

สุวิทย์ หงษ์

Date:

14-May-2024  
(DD-MMM-YYYY)

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## 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.

### 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/en-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?** Flexible Repair Options | Agilent

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### 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.

### Instrument Maintenance

#### System Information

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

Instrument System Name and ID	5110 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 6015A	WY 16030001
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 Demountable) Fully Demountable   Other
Injector Diameter	2.4mm (1.0mm) 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. ๖1๖
- ☒ 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. ๖1๖
- ☒ 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.

## 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	1500.5	2219.4	4124.5	6965.9
Mn 257.610 nm SRBR	3915.0	7492.1	13017.5	31127.6
Al 396.152 nm SRBR	9.9	10.7	9.7	21.1
K 766.491 nm SRBR	5.7	23.1	4.5	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



## 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	226.8 V
Mains Current	0.061 A	0.105 A
Instrument Temperature	22.1 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	63.6 °C
Water Flow Oscillator	No measurement	1.34 L/min
Water Flow Detector	0.96 L/min	0.91 L/min
Water Inlet Temperature	19.7 °C	19.7 °C
Polychromator Temperature	39.0 °C	35.0 °C
CCD Temperature	-40.1 °C	-39.6 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	646.92 kPa	541.55 kPa
Purge Gas Supply Pressure*1	646.66 kPa	612.41 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	105.43 kPa
Plasma Gas Flow	No measurement	11.91 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1204.7 W
RF Supply Current	No measurement	7.655 A
RF Supply Voltage	No measurement	204.417 V

\*1 If option installed

Revision: A.02, Issued: 21 January 2022  
Document Number: G8014-90075  
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Page 12 of 14



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### 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	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	—
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-58002	All	1
High Capacity Air Filter	G8010-60189	Optional	—
Rotor seal for 6-7 port valve for AVS5/7	G8494-50002	G8494A/G8495	—
Rotor seal for 4 port valve for AVS4	G8493-50002	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 3mm od x 5mm id, 2m	G8410-80122	SPS 4	—
<b>Additional Parts may be required from engineer's stock:</b>			
X axis drive belt	5410047500	SPS 3	—
Z axis drive belt	5410047400	SPS 3	—
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	—

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

☐ Section Not Applicable[illegible]

Revision: A.02, Issued: 21 January 2022  
Document Number: G8014-90075  
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Page 13 of 14



## เอกสารไม่ควบคุม

## 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:  
6007197100

Service Engineer Name:

Service Engineer Name: Kanyakorn S.

Service Engineer Signature:

Service Engineer's Signature \_\_\_\_\_

Total number of pages in this document:

Date Service Completed:

Date Service Completed:  
04 Nov 2024

Customer Name:

Customer Name: Bohary Ankang

Customer Signature:

Customer Signature: Behnam Akhond

Revision: A 02, Issued: 21 January 2022  
Document Number: G8014-90075  
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Page 14 of 14



## เอกสารไม่ควบคุม

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	6.60	
Pb (220.353 nm)	≤ 9.60	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 (460.733 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	50.51	
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	87.6	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	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)	≥ 1.8	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 (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7
Zn (213.857 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	7929.5	499.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16911.7
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956480.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	28.1	1395190.2	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 (206.200 nm)	≤ 1.50	0.56	
Zn (213.857 nm)	≤ 1.50	0.96	
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	
Intensity	Radial 3184054 Axial 3177175
Wavelength	737.212 737.212

Page 1 of 4

เอกสารไม่ควบคุม

Resolution Test			Pass
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 (206.138 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 (327.396 nm)	≤ 14.20	11.27	
Sr (338.071 nm)	≤ 33.50	24.40	
Ba (455.403 nm)	≤ 44.00	33.50	
Sr (460.783 nm)	≤ 36.00	17.31	
Ba (493.408 nm)	≤ 36.00	25.44	
Ba (614.171 nm)	≤ 42.00	25.16	
Ar (675.283 nm)	≤ 74.00	66.15	
K (766.491 nm)	≤ 80.00	65.56	

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Fail
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	271040.0	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	1566.7	73.0	
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2	
Zn (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1	
Zn (213.857 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	1006637.8	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 (206.200 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-OES	
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	0.81	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	11/0/2024 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	6.79
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 (460.783 nm)	≤ 36.00	18.54
Ba (493.408 nm)	≤ 36.00	25.74
Ba (614.171 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	868.9	54.3
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	159.8
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6
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 (206.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6398.3	157551.5	601.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10541.1	658.6
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	6460421.5	60122.8
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1

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	0.62	
Se (196.026 nm)	≤ 1.50	0.82	
Zn (206.200 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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 16, SUANLIANG, SUANLIANG BANGKOK 10250  
TEL.0-2717-3006-29 FAX.0-2719-9484



## Certificate of Calibration

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

Equipment : Incubator  
Manufacturer : Binder  
Model : KB 400 E6  
Serial No. : 2020000015535  
ID No. : UAE.MIC.018/2564  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10200  
Location : Microbiology Laboratory (302)  
Received Order : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature : ( 20 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanapongsaiboon  
Approved by :   
( ) Ponpan Paipim  
(✓) Suwit Imjai  
( ) Kunchit Promprat  
Issue Date : 7 April 2024

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

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

เอกสารไม่ควบคุม



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

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

### Procedure Used :-

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	MY49023932	23LM122	TPA	26 Jul 2024

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

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

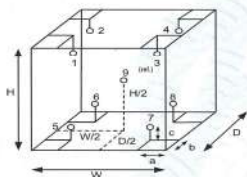
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

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



### Probe Installation Details :

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

### Dimension of Chamber :

D = 0.48 m  
W = 0.65 m  
H = 1.2 m  
Capacity = 0.37 m<sup>3</sup>

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



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

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

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
35.0	35.0	35.0	0.035	0.19	0.22	2

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

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม





## Certificate of Calibration

Cert. No.: 24TM650  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V616.0066  
ID No. : UAE.MIC.032/2559  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory (302)  
Received Order : 01 April 2024  
Calibration Date : 02 - 03 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Man Pattanasongpaiboon  
Approved by :   
( ) Ponpan Paipim  
(✓) Suwit Imjai  
( ) Kunchit Promprat  
Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-2  
Procedure Used :-

Cert. No.: 24TM650  
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	MY49023932	23LM122	TPA	26 Jul 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

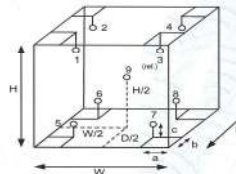
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL Humid. ( % )	57	54
AC Supply ( Volt )	221	222



### Probe Installation Details :

a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm

### Dimension of Chamber :

D = 0.50 m  
W = 0.64 m  
H = 0.80 m  
Capacity = 0.26 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	19-16RTD-04
5	19-16RTD-05
6	19-16RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Cert. No.: 24TM650  
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
25.0	25.0	25.0	0.053	0.78	1.3	2
36.0	36.0	36.0	0.14	0.57	0.93	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	9 (ref.)	
25.0	25.596	25.310	25.439	25.412	24.347	24.332	24.313	24.414	24.875	0.30
36.0	35.843	35.965	35.618	35.701	36.239	36.260	36.343	36.357	36.063	0.31

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



## Certificate of Calibration

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

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 14  
Serial No. : L416.0606  
ID No. : UAE.MIC.002/2560  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 10 February 2024  
Calibration Date : 10 February 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %  
Calibrated by : Krisda Malee  
Approved by :   
( ) Pornthippa Tameyakul  
(✓) Unnopphol Harachai  
( ) Suwit Imjai

Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม





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

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

#### Procedure Used :-

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.

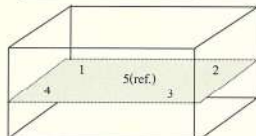
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

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	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

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

#### Result of Calibration :-

( \* ) Without Adjustment

Function of UUC\* : Temperature Source

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 %.

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เอกสารไม่ควบคุม



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



Cert. No.: 24TM30  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 14  
Serial No. : L416.0612  
ID No. : UAE.MIC.003/2560  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraekhanong,  
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 : Krisda Malee  
Approved by :  
( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
( ) Suwit Injai

Issue Date : 19 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



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

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

#### Procedure Used :-

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.

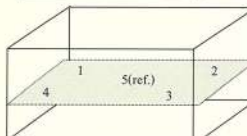
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

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 )
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.6	44.6	44.491	44.463	44.496	44.518	44.528	0.15

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor k
44.5	0.12	0.009	2

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

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

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

**UUC\*** : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



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



## Calibration Certificate

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

Page 1 of 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 Preeyaporn Jaengkarnit )  
 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 with the prior written approval of the National Food Institute.

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



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



## 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 (361), 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.

### 2. 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
	OM-CP-HITEMP-140	R55951	TE 670231-01	25-Feb-25	NATIONAL FOOD INSTITUTE
	OM-CP-HITEMP-140	R56916	TE 670232-01	25-Feb-25	NATIONAL FOOD INSTITUTE

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. This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.

7. Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 15 Minute At 121 °C

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

P. Jaengkarnit  
 14 Aug. 2024

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

มูลนิธิสถาบันพัฒนาบุคลากร  
 ฐานบริการห้องปฏิบัติการอุตสาหกรรมอาหาร  
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 Food Industrial Laboratory Service Center

เอกสารไม่ควบคุม



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



## 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

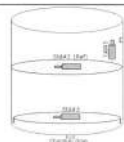
Date of Calibration: 7 August 2024

Page 3 of 3

Calibration point: 121 °C

### Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	28.0	55	224
Max	30.0	65	226



Standard at 121°C  
 121°C ± 0.1°C  
 121°C ± 0.1°C  
 121°C ± 0.1°C

### Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
121	122.43	122.44	122.44	0.65

### Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)			
122	122	122	122	0.11	0.065	0.031

### Note

The quoted uncertainty include " Stability " and " Loading effect ( 20% of 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.

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 \*\*\*\*\*

P. Jaengkarnit  
 14 Aug. 2024

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

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

เอกสารไม่ควบคุม



## Calibration Certificate

Certificate No.: 2402281-001-01  
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.: 808763  
ID No.: UAE.MIC.026/2563  
Order No.: 2402281  
Operation No.: 2402281-001  
Date of Receipt: 2 April 2024  
Date of Calibration: 2 April 2024

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

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

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

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

## Calibration Report

Certificate No.: 2402281-001-01  
Equipment: Autoclave  
Model: CL-40L Serial No.: 808763  
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563  
Manufacturer: ALP  
Date of Calibration: 2 April 2024

Page 2 of 3

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
Environment Condition: Ambient Temperature ( 25 ± 1 ) °C  
Relative Humidity ( 55 ± 7 ) %  
Line Voltage ( 225 ± 5 ) Volt

### Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories 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.

### 2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HTemp140-2	854918	TE 660383-01	8 April 2024	NATIONAL FOOD INSTITUTE
	HTemp140-2	525601	TE 670033-01	9 November 2024	MAGTECH INC.
	HTemp140-2	525602	TE 670034-01	9 November 2024	MAGTECH INC.

- 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 115.0 and 121.0 °C
- Result of Calibration : ☒ Without adjustment  
☐ After adjustment

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

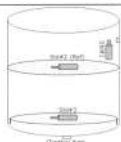
## Calibration Report

Certificate No.: 2402281-001-01  
Equipment: Autoclave  
Model: CL-40L Serial No.: 808763  
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563  
Manufacturer: ALP  
Date of Calibration: 2 April 2024

Page 3 of 3

Calibration point: 115.0 and 121.0 °C  
Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	24.4	48.6	220
Max	25.5	62.1	230



Standard at 115.0°C  
Sdty = attached to the test temperature probe.  
within 20 mm.  
Sdty = in the upper part of the chamber  
Sdty = in the lower part of the chamber, within 100 mm.

Table 1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
115.0	115.28	115.35	115.38	0.64
121.0	121.28	121.36	121.37	0.64

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)			
115.0	115.0	115.1	115.0	0.08	0.13	0.48
121.0	121.0	121.1	121.0	0.12	0.10	0.38

### Note

The quoted uncertainty include " Stability " and " Loading effect ( 20% of 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.

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

----- End -----

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

## Calibration Certificate

Certificate No.: 2402419-001-01  
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: Electronic Balance  
Manufacturer: OHAUS  
Model: PX623  
Serial No.: C236754745  
ID No.: UAE.MIC.055/2565  
Order No.: 2402419  
Operation No.: 2402419-001  
Date of Receipt: 19 April 2024  
Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit  
Scientist  
Approved by ( Miss Preeyaporn Jaengkarnkit )  
Vice President, Department of Laboratory Services  
Responsible for the Technical Management Team  
Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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



