

ภาคผนวก ฉ

เอกสารสอบเทียบเครื่องมือตรวจวัดและวิเคราะห์



List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Jiranatee Associates Co., Ltd.	COF-002-66	14 Jul 23	13 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1402	9 May 23	8 May 24	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCat DC1 158850	Innovative Instrument Co.,Ltd.	23-AFM-187	30 Aug 23	29 Aug 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1860	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920005	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920006	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920007	UAE Consultant Co.,Ltd.	03052023	3 May 23	2 May 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-76412-383	UAE Consultant Co.,Ltd.	03052023	3 May 23	2 May 24	-
10	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-0607415779	UAE Consultant Co.,Ltd.	03052023	3 May 23	2 May 24	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-0611116459	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-62236-334	UAE Consultant Co.,Ltd.	03052023	3 May 23	2 May 24	-
14	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-76465-383	UAE Consultant Co.,Ltd.	25042023	25 Apr 23	24 Apr 24	-
15	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 24	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48CTL-65506-348	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 24	-
18	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
19	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920019	UAE Consultant Co.,Ltd.	03042023	3 Apr 23	2 Apr 24	-
20	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
21	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0041	Thai Meteorological Department	119/24	13 Mar 24	12 Mar 25	-
22	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	098/24	22 Feb 24	21 Feb 25	-
23	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0058	Thai Meteorological Department	121/24	13 Mar 24	12 Mar 25	-
24	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2301DR0024	Thai Meteorological Department	096/24	22 Feb 24	21 Feb 25	-
25	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6307	Innovative Instrument Co.,Ltd.	23-ACT-067	12 May 23	11 May 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
26	Sound Level Meter	$L_{Aeq} 1 hr$ $L_{Aeq} 24 hr$ L_{Amax} L_{A90} L_{A10} เสียงรบกวน	Rion, Japan	NL-62 00511776	Sithiporn Associates Co., Ltd.	ACL23183	8 Jun 23	7 Jun 24	-
27	Sound Level Meter	$L_{Aeq} 1 hr$ $L_{Aeq} 24 hr$ L_{Amax} L_{A90} L_{A10} เสียงรบกวน	Rion, Japan	NL-62 00901739	Sithiporn Associates Co., Ltd.	ACL23151	9 May 23	8 May 24	-
28	Sound Level Meter	$L_{Aeq} 1 hr$ $L_{Aeq} 24 hr$ L_{Amax} L_{A90} L_{A10} เสียงรบกวน	Rion, Japan	NL-62 00511775	Sithiporn Associates Co., Ltd.	ACL23150	9 May 23	8 May 24	-

CERTIFICATE OF CALIBRATION

Certificate No. : CCF-002-66

Page 1 of 2 Pages

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

: Top Load Office
: Anderson Instruments
: Q25A
: 1301
: UAEANV551/2547
: Used Item
: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomruek 41, Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Rocks Meter) Model G65/84C/8249. The W-100-004 was used as a calibration gas.

Traceability:
This certificate provides a traceability of the measurement to recognized the national standard (unit) to realization of the International System of Units (SI) through the VSL (National Metrology) Division of Netherlands via Certificate number: 52221901

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

RECEIVED DATE : 07.04.2023
MEASUREMENT DATE : 14.04.2023
ISSUE DATE : 18.04.2023

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:
Temperature : 23.0 ± 0.1 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning : 14 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.9 °C and 54.5 kPa.

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

TABULATION OF RESULTS:

The table on next page give the measured values.



Approved signatory : Mr. Pariny Booncharoen
Calibration Department Manager

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

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Electron Corporation Serial Number : 43C-0607415779

Standard Gas Concentration

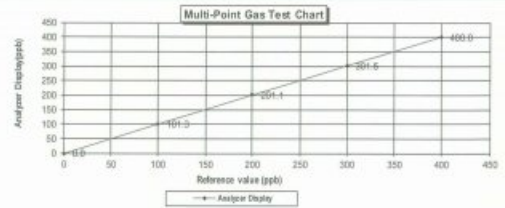
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Diluter Detail

Manufacturer : Thermo SCIENTIFIC
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.3	1.30	1.28
Level 3	40.00%	200.0	201.5	1.10	0.55
Level 4	60.00%	300.0	301.5	1.50	0.50
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		
Acceptable Limit $\pm 5\%$			0.47		



Calculate by
Aphiwat K.
3, 5, 66

Approve by
Pichan
3 May, 2023

Page 1 of 1

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Continuation of Certificate of Calibration Number CCF-002-66

Page 2 of 2 Pages

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Rocks Meter). The humid air was used as a medium in the system. The standard conditions are 25 °C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _g] °C	Temperature [T _{ref}] °C	Q _g meter mmHg	Q _g Orifice mmHg	F	Standard Flow [Q _s] m ³ /min
1	0.701	754.115	23.87	23.10	55.600	1.626	1.273	0.648
2	0.997	754.083	23.80	23.13	61.350	3.236	1.795	0.924
3	1.121	754.005	23.81	23.20	41.803	4.878	3.075	1.007
4	1.172	754.004	23.72	23.16	30.933	4.891	3.308	1.122
5	1.410	753.994	23.76	23.18	29.415	7.159	2.671	1.352

Slope (m) : 1.66462
Intercept (b) : -0.02636
Correlation coefficient (r) : 0.99972
Uncertainty (u=2) : 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _g] °C	Temperature [T _{ref}] °C	Q _g meter mmHg	Q _g Orifice mmHg	F	Standard Flow [Q _s] m ³ /min
1	0.701	754.115	23.87	23.10	55.600	1.626	0.800	0.651
2	0.997	754.083	23.80	23.13	61.350	3.236	1.129	0.917
3	1.121	754.005	23.81	23.20	41.803	4.878	1.307	1.061
4	1.172	754.004	23.72	23.16	30.933	4.891	1.388	1.126
5	1.410	753.994	23.76	23.18	29.415	7.159	1.679	1.357

Slope (m) : 1.24306
Intercept (b) : -0.01029
Correlation coefficient (r) : 0.99972
Uncertainty (u=2) : 0.015 m³/min

End of Certificate of Calibration



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MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Electron Corporation Serial Number : 43C-061116459

Standard Gas Concentration

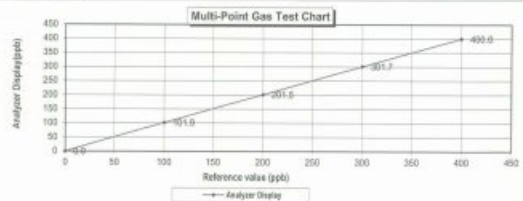
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Diluter Detail

Manufacturer : Thermo SCIENTIFIC
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.9	1.90	1.86
Level 3	40.00%	200.0	201.5	1.50	0.74
Level 4	60.00%	300.0	301.7	1.70	0.56
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		
Acceptable Limit $\pm 5\%$			0.63		



Calculate by
Aphiwat K.
2, 4, 66

Approve by
Pichan
7 Apr, 2023

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

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Environmental Instruments Serial Number : 43C-62236-334

Standard Gas Concentration

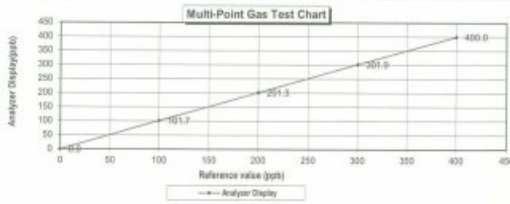
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail

Manufacturer : Thermo SCIENTIFIC
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

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	101.7	1.70	1.67
Level 3	40.00%	200.0	201.3	1.30	0.65
Level 4	60.00%	300.0	301.9	1.90	0.63
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%) 0.59		
Acceptable Limit $\pm 5\%$					



Calculate by
Aphivat K.
9 May 2023

Approve by
Pichan W.
3 May 2023

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Airgas Specialty Gases
Airgas USA, LLC
600 United Drive
Durham, NC 27713
Airgas.com

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04N99E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 860
Gas Code: CO,NO,NOX,SO₂,BALN Certification Date: Jun 21, 2023
Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA-600/R-13/031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration module. All concentrations are on a mole/mole basis unless otherwise noted.
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	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 05/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 05/21/2021
SULFUR DIOXIDE	45.00 PPM	44.58 PPM	G1	$\pm 1.6\%$ NIST Traceable	05/14/2021, 05/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	05/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20051120	CC708068	45.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12386	0889326	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 02, 2025
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 18, 2025
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14050118	CC434277	996.5 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.8\%$	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR001333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR001333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR001333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR001333 SO2	FTIR	Jun 03, 2021

Tried Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



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

Approved for Release



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

MULTI-POINT GAS TEST REPORT

Test Date : Apr 25, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Environmental Instruments Serial Number : 43C-76465-383

Standard Gas Concentration

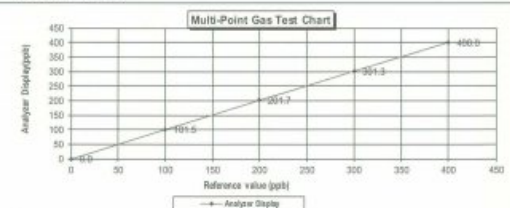
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail

Manufacturer : Thermo SCIENTIFIC
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.5	1.50	1.48	1.48
Level 3	40.00%	200.0	201.7	1.70	0.84	0.84
Level 4	60.00%	300.0	301.3	1.30	0.43	0.43
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%) 0.55		
Acceptable Limit $\pm 5\%$						



Calculate by
Aphivat K.
25 Apr 2023

Approve by
Pichan W.
25 Apr 2023

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

MULTI-POINT GAS TEST REPORT

Test Date : Dec 8, 2023

Equipment : Gas Analyzer (CO) Model : APMA-370
Manufacturer : HORIBA Serial Number : YRLHTB7G

Standard Gas Concentration

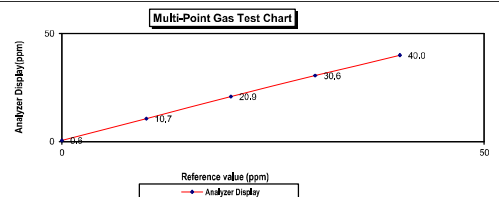
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.6	0.6
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.9	0.9	4.3
Level 4	60.00%	30.0	30.6	0.6	2.0
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range		50.0 ppm	Average Difference (%)		2.68
: Acceptable Limit $\pm 5\%$					



Calculate by
Aphivat K.
8 Dec 2023

Approve by
Pichan W.
8 Dec 2023

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MULTI-POINT GAS TEST REPORT

Test Date : Dec 8, 2023

Equipment : Gas Analyzer (CO) Model : 48C
Manufacturer : Thermo Environmental Instruments Serial Number : 48C-65506-348

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	984.8	PPM
Cylinder No. :	EB0143262	
Expiration Date :	Jun 20, 2024	

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	1461
Serial Number :	1180540071

Multi-point gas test data

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

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

Multi-Point Gas Test Chart

Calculate by : *[Signature]*
.....8...../.....12...../.....2023

Approve by : *[Signature]*
.....8...../.....Dec...../.....2023

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MULTI-POINT GAS TEST REPORT

Test Date : Apr 3, 2023

Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : 1182920019

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	984.8	PPM
Cylinder No. :	EB0143262	
Expiration Date :	Jun 20, 2024	

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	1461
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	5.7	5.5
Level 3	40.00%	20.0	20.2	0.2	1.0
Level 4	60.00%	30.0	30.5	0.5	1.6
Level 5	80.00%	40.0	40.0	0.0	0.0

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

Multi-Point Gas Test Chart

Calculate by : *[Signature]*
.....3...../.....04...../.....2023

Approve by : *[Signature]*
.....4...../.....Apr...../.....2023

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MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

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

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	984.8	PPM
Cylinder No. :	EB0143262	
Expiration Date :	Jun 20, 2024	

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	1461
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.8	0.8
Level 2	20.00%	10.0	10.7	6.5	6.5
Level 3	40.00%	20.0	20.9	4.3	4.3
Level 4	60.00%	30.0	30.7	2.3	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0

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

Multi-Point Gas Test Chart

Calculate by : *[Signature]*
.....13...../.....11...../.....2023

Approve by : *[Signature]*
.....13...../.....Nov...../.....2023

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-462135167-1
Cylinder Number: EB0143262
Laboratory: 124 - Durham (SAP) - NC Cylinder Volume: 144.4 CF
PGVP Number: B22021 Valve Outlet: 2015 PSIG
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, 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 the calibration module. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psi, i.e. 6.7 barg/psia.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.94 PPM	G1	±1.4% NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	±1.4% NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	±1.0% NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	±0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20051120	CC708068	46.82 PPM NITRIC OXIDE/NITROGEN	±1.0%	Feb 02, 2025
PRM	12336	D686035	9.91 PPM NITROGEN DIOXIDE/AIR	±2.0%	Feb 29, 2020
GMIS	40142358102	CC050581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	±2.1	Jun 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	±1.0%	Jun 17, 2022
NTRM	14052118	CC434277	992.9 PPM CARBON MONOXIDE/NITROGEN	±0.8%	Nov 15, 2025

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021

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



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

Approved for Release



CERT 3082.01

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THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024 Certification No. : 119/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver : 2111DR0041

Wind Sensor : 2111DT0041

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

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1010.6 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aft Plotting Board

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

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

: Ultrasonic Anemometer : Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629566)

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

STANDARD THERMOMETER : Theodor Friedrichs : Dry No.8360/94 Wet No. 8369/94

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220-No. V1220015

Digital Barometer Vaisala Type PTB350-No. 94230001

Calibrated by : *Natthapong* Signed : *[Signature]* (Authorized Signatory)

Mr. Watcharapol Subwat

Mr. Pisoot Promsue

Mechanical Engineer

Sub-Standard Instruments

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1009.99	1009	0.99
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1014	-0.56
1013.81	1014	-0.19
1014.19	1014	0.19
1015.96	1016	-0.04
1016.23	1016	0.23
1015.64	1016	-0.36
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37

Average : 0.04

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 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	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.12
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aft Plotting Board.

U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU

WIND DIRECTION

TESTED WIND DIRECTION

0

0

90

90

180

180

270

270

Calibrated by :

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. 119/24

13 March, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
757.25	757	0.25
757.15	757	0.15
757.64	758	-0.36
758.27	758	0.27
758.06	758	0.06
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	761	0.48
760.71	760	-0.29
760.28	760	0.28

Average : 0.00

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. 081-454-2804,0-2399-0449

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 5 of 5

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

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0449

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 :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0449

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 098/24

Page : 1 of 3

Object : Wind Speed & Wind Direction : DBts 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 Friedrich FC014 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

: Iserlo, testo 645 Serial No. 02840067 : ThermoSchneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB335 No. 35350001

Calibrated by : *Watchapol*

Signed :

Mr. Watchapol Subwat

Mr. Pissod Promsat

Mechanical Engineer

(Authorised Signatory)

For the Chief

Sub-Standard Instrument

THAI METEOROLOGICAL DEPARTMENT

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0449

The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1010.84	1011	-0.16
1010.80	1010	0.80
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	0.95
1013.50	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.85	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.18
1013.22	1013	0.22
1013.49	1013	0.49

Average

0.08

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
758.19	758	0.19
758.01	758	0.01
758.84	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.65	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	760	0.68
761.90	762	-0.10
762.08	762	0.08
761.96	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
760.18	760	0.18

Average 0.02

Calibrated by :

Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024

Certification No. 121/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0058

Wind Sensor 2111DT0058

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1011.9 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Airt Plotting Board

: Micromanometer Theodor Friedrichs FC014 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 120629593)

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

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8388/94

: Iseto, Iseto 645 Serial No. C2848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220.No. V1220015

: Digital Barometer Vaisala Type PTB330.No. V4330001

Calibrated by :

Mr. Watchapol Subwat
Mechanical Engineer

Signed :

Mr. Pladon Promsat

(Authorized Signature)

for the Chief
Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

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	45	0.2
30.3	30	0.3
15.8	15	0.8

Calibrated by :

Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 2 of 5

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

Wind Airt 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. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
1009.09	1009	0.59
1009.45	1010	-0.55
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1013	0.44
1013.81	1014	-0.19
1014.19	1014	0.19
1015.96	1016	-0.04
1016.23	1016	0.23
1015.64	1015	0.64
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37

Average

0.00

Calibrated by :

Wathapong

Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.1	45	0.1
30.2	30	0.2
15.4	16	-0.6

Calibrated by :

Wathapong

Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mmHg
757.25	757	0.25
757.15	757	0.15
757.64	758	-0.36
758.27	758	0.27
758.66	758	0.66
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.85	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	762	-0.52
759.71	760	-0.29
760.28	760	0.28

Average

0.03

Calibrated by :

Wathapong

Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2884, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 096/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2301DR0024

Wind Sensor 2301DT0024

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

81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1010.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board
: Micromanometer Theodor Friedrich PC014 Serial No. 9310119 : HOOK GAUGE NO 1425

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

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

Serial Number 110730029 (sensor 120629596)

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

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

: 1660, Iwko-645 Serial No. C0848257 : ThermoSchneider No.918892

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB220 No. V1220001

Calibrated by : *Wathapong*

Signed : *Wathapong*

Mr. Watchapol Subwat
Mechanical Engineer

Mr. Pongsak Pongsa
Mechanical Engineer

(Authorized Signature)
for the Chief
Sub-Standard Laboratory

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 096/24

22 February, 2024

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Velocity	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	ft/min	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	-	-	-	10.9	0.12
13.01	-	-	-	12.9	0.11
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	19.9	0.12

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

Calibrated by :
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 096/24

22 February, 2024

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction 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
759.05	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	761	-0.32
761.90	762	-0.10
762.06	762	0.06
761.86	762	-0.04
761.83	762	-0.17
759.09	759	-0.31
759.91	759	-0.09
759.11	759	0.11
759.87	760	-0.33
759.98	760	-0.02
760.18	760	0.18
Average		-0.03

Calibrated by :
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 096/24

22 February, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1010.84	1011	-0.16
1010.80	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
1012.96	1013	-0.06
1013.62	1014	-0.48
1014.10	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1016	-0.14
1015.69	1016	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	1013	0.49

Average -0.02

Calibrated by :
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 096/24

22 February, 2024

Page : 5 of 5

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

Calibrated by :
Mr. Watchapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 23-ACT-067
Request No : Req-2023-0978

Unit Under Calibration Details
Measurement item : Acoustic Calibrator
Manufacturer : LARSON DAVIS
Model : CAL150
Serial Number : 6307
ID : UAE.EFM.049/2563

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 kPa)
Received Date : 9 May 2023
Calibration Date : 12 May 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 2023
THD Multimeter	2015	1047765	NIMT	31 January 2024

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

Note

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

Calibrated By : 
Mr. Noppadol Luangert
Service Calibration Engineer

Approved By : 
Mr. Pachi Muthavorn
Calibration Engineer Supervisor

Issue Date : 12 May 2023

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Issuing Calibration Laboratory.
FM-TS12-04-04-020664

เอกสารไม่ควบคุม

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62 / Microphone UC-59L / Pre-amplifier NH-26
Serial No. : 00511776 / 02267 / 11974
ID No. : UAE.EFM.092/2565

Condition As Found : GOOD

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

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

Received Date : 29 MAY 2023
Calibration Date : 07-08 JUNE 2023
Date of Issue : 09 JUNE 2023

Calibrated by : Natsakorn Pisutpaisan

Approved by : 
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Certificate No : 23-ACT-067
Request No : Req-2023-0978

Calibration Results: Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.98	-0.02	-	-	0.13	0.40
114 dB / 1000 Hz	114.12	0.12	-	-	0.13	0.40

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.11	0.09	-	-	0.01	1.7
114 dB / 1000 Hz	999.11	0.09	-	-	0.01	1.7

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.12		-	-	0.40	3.0
114 dB / 1000 Hz	0.22		-	-	0.40	3.0

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results include the calibration process correction
- The calibration results include the microphone volume correction

End of Calibration

The results related only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of the Issuing Calibration Laboratory.
FM-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23183
Job No. : VC66AC0062
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA1	34560495	AA-3002-23	14-FEB-24

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

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

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Cert. No. : ACL23183
Job No. : VC66AC0062
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.4	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.5	0.5
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

Cert. No. : ACL23183
Job No. : VC66AC0062
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	-0.1	±1.0
125	0.0	0.1	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.1	-1.2	-1.1	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

Cert. No. : ACL23183
Job No. : VC66AC0062
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	15.4
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.0
1000	0.3	0.3	0.3	± 0.7
8000	0.8	0.9	0.9	+ 1.5, - 2.5

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

Cert. No. : ACL23183
Job No. : VC66AC0062
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL23183
Job No. : VC66AC0062
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	117.0	0.0	1.0; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	135.5	-0.9	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

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



Cert. No. : ACL23151
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62 / Microphone UC-59L / Pre-amplifier NH-26
Serial No. : 00901739 / 02317 / 01844
ID No. : UAE.EFM.094/2565

Condition As Found : GOOD

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

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

Received Date : 05 MAY 2023
Calibration Date : 08-09 MAY 2023
Date of Issue : 10 MAY 2023

Calibrated by : Nathakim Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23183
Job No. : VC66AC0062
Pages : 8 of 8

11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23151
Job No. : VC66AC0053
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.4	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Rethu

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.1
C - weight	15.9
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.4	0.4	± 1.0
1000	0.3	0.3	0.3	± 0.7
8000	1.0	0.9	0.9	+ 1.5, - 2.5

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Rethu

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.1	-0.2	0.0	±1.0
125	0.0	-0.1	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	-0.1	0.0	±1.0
2000	0.0	0.0	0.1	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.1	0.0	0.1	+ 1.5, - 2.5
16000	0.1	-1.2	-1.1	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.1	0.1	± 0.2
Flat	94.0	94.1	0.1	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.1	0.1	± 0.1
Leq	94.0	94.1	0.1	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Rethu

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±0.8
136.0	136.1	0.1	±0.8
135.0	135.1	0.1	±0.8
134.0	134.1	0.1	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.1	0.1	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	25.9	-0.1	±0.8
25.0	24.9	-0.1	±0.8

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Rethu

Cert. No. : ACL23151
Job No. : VC66AC0053
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5; -5.0
	2	8	117.0	116.9	-0.1	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5; -5.0
	2	8	108.0	107.9	-0.1	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	135.6	-0.8	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

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

Cert. No. : ACL23150
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62 / Microphone UC-59L / Presamplifier NH-26
Serial No. : 00511775 / 02266 / 11973
ID No. : UAEFEM.091/2565

Condition As Found : GOOD

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

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

Received Date : 05 MAY 2023
Calibration Date : 08-09 MAY 2023
Date of Issue : 10 MAY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Cert. No. : ACL23151
Job No. : VC66AC0053
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	(dB)	(dB)
89.4	89.6	0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Cert. No. : ACL23150
Job No. : VC66AC0053
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petchur

Continuation of Calibration Certificate

Cert. No. : ACL23150
Job No. : VC66AC0053
Pages : 3 of 8

Summary of Measurement Result :

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

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL23150
Job No. : VC66AC0053
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

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

Frequency Weighting	Measured value (dB)
A-weight	10.8
C-weight	16.4
Flat	23.5

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.0
1000	0.3	0.3	0.3	± 0.7
8000	0.3	0.4	0.4	+ 1.5, - 2.5

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL23150
Job No. : VC66AC0053
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	-0.1	0.0	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.2
C-weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.7

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL23150
Job No. : VC66AC0053
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.1	0.1	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.1	0.1	±0.8
69.0	69.1	0.1	±0.8
64.0	64.0	0.0	±0.8
59.0	59.1	0.1	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

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เอกสารไม่ควบคุม

7. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL23150
Job No. : VC66AC0053
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	135.7	-0.7	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Rth



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-34 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 23P1402
Page : 1 of 2

Equipment : U Tube Manometer

Manufacturer : Dwyer

Model : 1221-36-WIM

Serial No. : -

ID No. : UAE.EFM.1802551

Condition As-Received: Used Item

Received Date: 26 April 2023

Calibration Date: 09 May 2023

Reference: 2304-0703WVC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

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

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

81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CPM-004, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guideline.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1108	MP-0137-22	24 Aug 2023

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

3. Scale and conversion factor is 1 kPa = 4.01463293 inH₂O

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

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

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

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

8. This Calibration is traceable to the International System of Unit maintained through:-
National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aueasamee
Issue Date : 11 May 2023

Approved Signatory : Attapol P.
[] Phalinee Prabpai
[] Sura Suwanmasri
[x] Attapol Panurach

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B 0314242

Continuation of Calibration Certificate

Cert. No. : ACL23150
Job No. : VC66AC0053
Pages : 8 of 8

11. Overload indication

Measured value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	
89.5	89.6	0.1

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

QF-TS12-04-04-020664

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7. Rth



Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

Range : 0 inH₂O to 36 inH₂O

Scale Interval : 0.1 inH₂O (The Fifth Estimate)

Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	ΔP (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	-1.00	0.00	0.00
2.00	1.00	-2.00	0.00	0.00
4.00	2.00	-3.00	0.00	0.00
6.00	3.00	-4.00	0.00	0.00
8.00	4.00	-5.00	0.00	0.00
10.00	5.00	-6.00	0.00	0.00
12.00	6.00	-7.02	0.00	0.02
14.00	7.00	-8.02	0.00	0.02
16.00	8.00	-9.02	0.00	0.06
18.00	9.02	-10.04	0.00	0.06
20.00	10.02	-11.04	0.00	0.06
22.00	11.00	-12.06	0.00	0.08
24.00	12.02	-13.06	0.00	0.08
26.00	13.02	-14.04	0.00	0.06
28.00	14.00	-15.02	0.00	0.04
30.00	15.02	-16.02	0.00	0.02
32.00	16.00	-17.00	0.00	0.00
34.00	17.00	-17.98	0.00	0.04
36.00	17.96	-18.96	0.00	0.14

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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

-00-

Attapol P.

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B 1160343

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 : 23-AFM-187
Request No : Req-2023-1655

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 158850
ID : UAE.EFM.038/2561

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 7 August 2023
Calibration Date : 30 August 2023
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19035011003	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501072012	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Quborn	27 February 2024
Pressure meter	CPC3400	410000DU/451802	TPA	7 November 2023

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 1943.01

Note :

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

Calibration By :
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :
Mr. Pachi Mathakorn
Calibration Engineer Supervisor
Issue Date : 30 August 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
FM-708-AFM-01 Rev.00 Issue date: 01/07/23

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 : 23-TPM-424
Request No : Req-2023-1655

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 158850
Resolution : 0.1 °C
ID Number : UAE.EFM.038/2561

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

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 August 2023
Calibration Date : 30 August 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

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

Traceability

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

Note

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

Approved By :
Mr. Noppadon Luangart
Technical Manager
Issue Date : 30 August 2023

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

เอกสารไม่ควบคุม

Certificate No : 23-AFM-187
Request No : Req-2023-1655

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (0/min)	UUC (0/min)	Error (0/min)	Uncertainty (0/min)
25.10	100.70	14.50	14.50	0.00	0.20
25.10	100.70	15.00	14.99	-0.01	0.21
25.00	100.70	15.80	15.79	-0.01	0.22
24.90	100.70	16.67	16.65	-0.02	0.23
24.80	100.70	18.30	18.26	-0.04	0.26

Note
STD : Standard
UUC : Unit Under Calibration
- UUC Reference Condition : At 25.0 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where : Q = Flow Rate, P = Absolute Pressure, T = Absolute Temperature
Meas = Measurement Condition
ref = Standard Condition

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
FM-708-AFM-01 Rev.00 Issue date: 01/07/23

เอกสารไม่ควบคุม

Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 23-TPM-424
Request No : Req-2023-1655
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
Ta	20.032	20.0	0.0	0.13
	25.034	25.0	0.0	0.13
	30.035	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.038	40.1	-0.1	0.13
	45.041	45.1	-0.1	0.13
	50.044	50.2	-0.2	0.13

End of Certificate

Calibrated By :
Mr. Sirichok Jengadornsil

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

เอกสารไม่ควบคุม



Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name :
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Page : 1/2

Certificate No : 23-TPM-458
Request No : Req-2023-1977

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delba Cal DC1
Serial Number : 158850
Resolution : 0.1 °C
ID Number : UAE.EFM.034/2561
Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details

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

Reference Standard : Digital Thermometer with Sensor, Manufacture: GINGO-GINGO, Model: GT11/RTD100, SN: 0800057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-0494
Traceability : This Certificate is traceable to SI Unit through Quality Robom Co., Ltd., NSC-ONSAC Accreditation No.: Calibration 0292

Note

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

Approved By :

Mr. Noppadon Luangrat

Technical Manager

Issue Date : 27 September 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head office.
PM-508-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม



Certificate of Calibration

Certificate No.: 23P1860
Page: 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model :
Serial No. :
ID No. : UAE.ANV.153/2550

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.

Condition As-Received: Used Item
Received Date: 26 May 2023
Calibration Date: 02 June 2023

Reference: 2305-0019WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1006 mbar

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

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using " DKD-R 8-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP142	1422505045	MP-0094-23	03 May 2024

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.
3.This result of calibration was made on requested at the point specified by customer.
4.This result of calibration instrument was in absolute pressure.
5.This instrument was used clean air as pressure media.
6.The certificate is valid only to the item calibrated on date and place of calibration.
7.This Certification is traceable to the International System of Unit maintained through:-
National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaw
Issue Date : 05 June 2023

Approved Signatory :

เอกสารไม่ควบคุม
B 0316960



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-458

Request No : Req-2023-1977

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	VTC Reading (°C)	Correction (°C)	Uncertainty (°C)
TF	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.0	0.0	0.13
	35.034	35.1	-0.1	0.13
	40.040	40.1	-0.1	0.13
	45.039	45.1	-0.1	0.13
	50.043	50.1	-0.1	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jongsakulnontak

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head office.
PM-508-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม



Cert.No.: 23P1860
Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa

Scale Interval : 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	963.65	975.02	984.39	993.78	1002.68	1011.75	1020.25	1030.28
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	-3.65	-5.02	-4.39	-3.78	-2.68	-1.75	-0.25	-0.28

Decreasing Pressure

Applied Pressure (hPa)	1030.28	1020.69	1012.07	1002.79	993.81	984.44	975.05	964.28
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-0.28	-0.69	-2.07	-2.79	-3.81	-4.44	-5.05	-4.28

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

-00-

เอกสารไม่ควบคุม
Attapol P.
B 1165503



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

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1182920007

Standard Gas Concentration

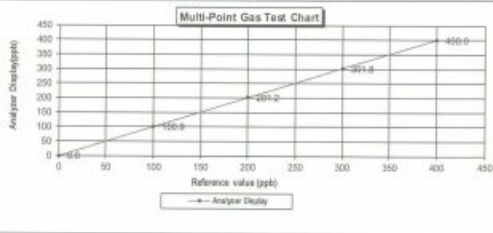
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : E80143262
Expiration Date : Jun 21, 2024

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.90	0.89	0.89
Level 3	40.00%	200.0	1.20	0.60	0.60
Level 4	60.00%	300.0	1.80	0.60	0.60
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		
Acceptable Limit $\pm 5\%$			0.42		



Calculate by

Aphimol K.
3, 5, 11

Approve by

3, May, 2023

เอกสารไม่ควบคุม



Airgas Specialty Gases
Airgas USA, LLC
600 United Drive
Durham, NC 27713
airgas.com

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04N99E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: E80143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 860
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2023
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA-600/R-13/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration module. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.95 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.88 PPM	G1	$\pm 1.0\%$ NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	06/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20051120	CC708068	45.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12386	0889326	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 02, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14050118	CC434277	990.5 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.8\%$	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0001333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0001333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0001333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR0001333 SO2	FTIR	Jun 03, 2021

Tried Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



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

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม



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

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-76412-383

Standard Gas Concentration

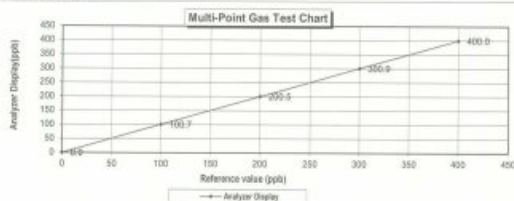
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : E80143262
Expiration Date : Jun 21, 2024

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.5	0.25	0.25
Level 4	60.00%	300.0	300.9	0.30	0.30
Level 5	80.00%	400.0	400.6	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		
Acceptable Limit $\pm 5\%$			0.25		



Calculate by

Aphimol K.
3, 5, 11

Approve by

3, May, 2023

เอกสารไม่ควบคุม

List Certificate of Instrument for Water Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Instrument for Water, Wastewater, Sea, Soil, Sediment Quality Analysis.									
1	pH Meter	ค่าความเป็นกรด-ด่าง (pH) อุณหภูมิ	Mettler-Toledo	Seven Easy S20 / 1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
2	pH Meter		Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
3	Conductivity Meter	ความเค็ม	SI Analytics	Lab955 / 16300356	DKSH (Thailand) Ltd.	C24240057	11 Mar 24	10 Mar 25	-
4	Analytical Balance (Readability 0.01 mg)	ของแข็งแขวนลอย ของแข็งละลายน้ำทั้งหมด	Mettler-Toledo	XSR205DU / C009071872	National Food Institute, Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25	-
5	Analytical Balance (Readability 0.01 mg)		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	2400141-001-01	11 Oct 23	10 Oct 24	-
7	Hot Air Oven		Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25	-
8	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน ปิโตรเลียมไฮโดรคาร์บอน	Mettler-Toledo	XSR204 / C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
9	BOD Incubator	บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	9 Feb 25	-
10	BOD Incubator		Arco	UR-1320 / (UAE.WAO.018/2551)	Technology Promotion Association (Thailand-Japan)	24TM587	1 Apr 24	31 Mar 25	-
11	UV-VIS Spectrophotometer	ไนโตรเจน-ไนโตรเจน ฟอสเฟต-ฟอสฟอรัส	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	7 May 24	6 May 25	-
12	UV-VIS Spectrophotometer	แอมโมเนียรวม โครเมียมเฮกซะวาเลนท์	Hitachi	U-1900 / 2021-064	DQE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25	-

List Certificate of Instrument for Water Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Instrument for Water, Wastewater, Sea, Soil, Sediment Quality Analysis.									
13	UV-VIS Spectrophotometer	ซีโอดี	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25	-
14	Atomic Absorption Spectrophotometer (AAS)	แคดเมียม, โครเมียมเฮกซะวาเลนท์, ตะกั่ว, ทองแดง, แมงกานีส, สังกะสี, เหล็ก, ปรีท, สลารหนู, แคดเมียม	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25	-
15	Atomic Absorption Spectrophotometer (AAS)		Perkin Elmer	PinAAcle 900F / PFBS20031902	Perkin Elmer Co.,Ltd.	PM Service No. WO-02273773	26 Jun 23	25 Jun 24	-
16	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24	-
17	Cold Vapor Atomic Spectrometer (CVAFS)	ปรอท (น้ำทะเล)	Analytik Jena	mercur DUO plus / K170A0153	Analytik Jena FarEast Thailand Ltd.	Maintenance Protocol	12 Feb 24	10 Feb 25	-
18	Cold Vapor Atomic Absorption (CVAAS)	ปรอท (ดิน,ภาคตะกอน)	Milestone	DMA-80 / 11030982	Sithiporn Associates Co.,Ltd.	Service Protocol Report	17 Nov 23	16 Nov 24	-
19	Distillation Unit (Kjeldahl Method)	ทีเคเอ็น	FOSS TECATOR	DT2520 / 91794469	FOSS South East Asia	9809	8 Feb 24	7 Feb 25	-
20	Distillation Unit (Kjeldahl Method)		Velp	DKL 20 / 213517	National Food Institute, Ministry of Industry, Thailand	2304455-001-01	28 Aug 23	27 Aug 24	-
21	Incubator	แบคทีเรียกลุ่มฟิโคไซโบลีฟอร์มทั้งหมด โคลิฟอร์มแบคทีเรียทั้งหมด	Binder	KB400 / 20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25	-
22	Incubator		Memmert	IPP 260 / V516.0066	Technology Promotion Association (Thailand-Japan)	24TM650	2 Apr 24	1 Apr 25	-
23	Water Bath		Memmert	VNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	24TM30	10 Feb 24	8 Feb 25	-

List Certificate of Instrument for Water Quality Analysis.

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Instrument for Water, Wastewater, Sea, Soil, Sediment Quality Analysis.									
24	Water Bath		Memmert	WNE 14 / L414.1407	Technology Promotion Association (Thailand-Japan)	24TM614	1 Apr 24	31 Mar 25	-
25	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2304203-001-01	10 Aug 23	9 Aug 24	-
26	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2402281-001-01	2 Apr 24	1 Apr 25	-
27	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01234158	7 Dec 23	6 Dec 24	-

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



Certificate No.: C07240167 Page 3 of 3

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,
Bangkok, Prakanong, Bangkok 10260 Thailand

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

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

Calibration By: Miss.Orawan Khlaiphloi

Calibration Date: 9 April 2024

The Method used: In house method, CAL-WI-58, base on ASTM E 70-07

Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Hamed 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

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

(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.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com/certificate-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C07-14: 9 Apr 2024

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com/certificate-thailand

Delivering Growth - in Asia and Beyond.

เอกสารไม่ควบคุม

CAL-FM-C07-14: 9 Apr 2024



Certificate No.: C07240167 Page 2 of 3

Calibration Results:

pH Scale

Input	pH Meter Reading				Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	(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	



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00024208

ชนิดเครื่องวัด: pH METER

รุ่น: SevenEasy

หมายเลขเครื่อง: 1230525212

ตรวจสอบ (ปี)	รายการตรวจเช็ค		ตรวจสอบ (ดี)		หมายเหตุ
			ปกติ	ไม่ปกติ	
09 Apr 2024	General				
ปกติ	ไม่ปกติ				
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. สวิตช์ ปิด - เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Spectrophotometer			
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. แบตเตอรี่สำรอง (Battery Backup) >= 2.5 VDC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7. ตัวควบคุมความยาวคลื่น (Wavelength Control)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	pH Meter and Conductivity Meter			
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12. ขั้วไฟฟ้า (Electrode and Connection Cable)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	14. ฝาปิดกันน้ำ Electrode (Dust Protection Hood)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	15. ขาตั้งขั้วไฟฟ้า (Stand)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Turbidimeter			
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17. ระดับการกรองตัวอย่าง (>= 2.5 ไมครอน 3.0)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Automatic titrator			
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	18. สภาพ Piston Burettes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	19. Function Rinsing and Dosing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

เซ็นเซอร์อุณหภูมิ :

Miss.Orawan Khlaiphloi
Service Engineer

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com/certificate-thailand

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เอกสารไม่ควบคุม

CAL-FM-C07-14: 9 Apr 2024

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2039 7000 Email: info@dksh.com Website: www.dksh.com/certificate-thailand

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เอกสารไม่ควบคุม

CAL-FM-R31-03: 20 Jul 2022



Certificate of Calibration

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

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

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

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

(Mr. Nateekam Mitjit)
Person in charge

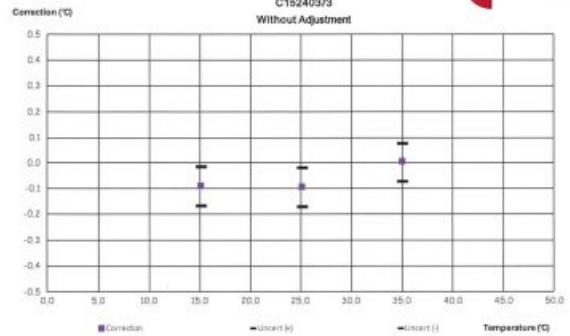
(Mr. Pramote Ramrong)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled.
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บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ซอยสุขุมวิท 41 ถนนสุขุมวิท กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certification-thailand

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CAL-FM-C15-14: 06 Dec 2022



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เอกสารไม่ควบคุม



Certificate No.: C15240373
Page: 2 of 2

Reference standard equipment:

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

Calibration Results:

Without Adjustment

Sensor Type: RTD

Channel: -

Diameter (mm): 4

Length (mm): 135

Immersion (mm): 110

Calibrate Point (°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
15.0	15.010	15.1	-0.090	0.076
25.0	25.006	25.1	-0.094	0.076
35.0	35.004	35.0	0.004	0.076

The End of Certificate

ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

Equipment: Digital Thermometer with Probe

Serial No.: 1230525212

Certificate No C15240373

Model: SevenEasy pH

ตรวจสอบ (รับ)	ตรวจสอบ (ส่ง)	หมายเหตุ
9-Apr-2024	9-Apr-2024	
ปกติ	ปกติ	
ไม่ปกติ	ไม่ปกติ	
General		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1. สายไฟ
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2. Adapter / Power supply 220 / 110 VAC
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3. การทำงาน Main Switch
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4. การทำงาน Selector Key
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	5. การแสดงผล Display
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	6. Battery
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	7. สภาพตัวเครื่อง
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	8. สภาพ Sensor (In / Ex)

ข้อแนะนำ :

Mr. Nateekam Mitjit
Service Engineer

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ซอยสุขุมวิท 41 ถนนสุขุมวิท กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certification-thailand

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CAL-FM-C15-14: 06 Dec 2022

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 ซอยสุขุมวิท 41 ถนนสุขุมวิท กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certification-thailand

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Calibration Certificate

Certificate No.: 2401718-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsak 41, Sukhumvit Road,
Bangsachok, Prakhong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.D102553
Order No.: 2401718
Operation No.: 2401718-001
Date of Receipt: 27 February 2024
Date of Calibration: 11 March 2024

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

The uncertainty 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, issued with the prior written approval of the National Food Institute.

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

24008 โรงงานอุตสาหกรรม 36 หมู่บ้านสวนรังสิต อำเภอลำลูกกา จังหวัดปทุมธานี เลขที่ 10001
24008 Soi 36, Ban Anan Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10170, Thailand
Tel: +66(0) 2-422 8558 Fax: +66(0) 2-422 8554



Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Serial No.: 1231155210
ID No.: UAE.WAT.D102553
Resolution: 0.01 pH
Model: SevenEasy pH
Type: Bench top
Date of Calibration: 11 March 2024

Page 3 of 5

Calibration Results: (Manual Temperature Compensation at 25 °C)

1. Calibration of pH Meter

(offset value before adjust: -0.8 mV)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (± mV)	Coverage Factor (K)
		mV	pH		
0	414.121	414	8.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	69.160	69	6.00	0.58	2.00
7	0.061	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.118	-414	14.00	0.58	2.00

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

Equipment: pH Electrode Type: Combined Electrode

Manufacturer: METTLER TOLEDO Model: InLab Solid

Serial No.: 3065701 ID No.: N/A

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

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (K)
	pH	mV			
4.008	4.01	188	-	0.0071	2.00
7.001	7.00	13	99.9	0.0086	2.00
10.010	10.01	-180	97.2	0.0089	2.00
8.985	8.97	21	-	0.0074	2.00

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

24008 โรงงานอุตสาหกรรม 36 หมู่บ้านสวนรังสิต อำเภอลำลูกกา จังหวัดปทุมธานี เลขที่ 10001
24008 Soi 36, Ban Anan Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10170, Thailand
Tel: +66(0) 2-422 8558 Fax: +66(0) 2-422 8554



Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Serial No.: 1231155210
ID No.: UAE.WAT.D102553
Resolution: 0.01 pH
Model: SevenEasy pH
Type: Bench top
Date of Calibration: 11 March 2024

Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (51 ± 3) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method: IN-CC-002 - In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standard / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 pH Voltage Calibrator	7700007	Fuke	7700000	14 June 2024
2.2 Digital Thermometer	2700697	Fuke	CC 900570-01	30 October 2024
2.3 Thermo-Hygro Meter	NFLBTH 01422	Watec	CC 900303-01	3 April 2024
Certified Reference Material				
	Lot No.	Manufacturer	Ref. N	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	88843	CPAchem	PH216L5	13 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	88843	CPAchem	PH217L5	13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	88844	CPAchem	PH205L5	13 April 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	033109	HACH LANGE GmbH	S11M004	16 October 2025

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

3.1 Instruments Np.2.1	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0098
3.2 Instruments Np.2.2 and 2.3	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0081
3.3 Certified Reference Material Np.2.4 to 2.6	traceable to	Primary measurement method: Homed off using calibrated thermometer, densimeter, and reproducible The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.4 Certified Reference Material Np.3.7	traceable to	PTB Certificate No. PTB-PHCA.63.10.03473 and Certificate No. PTB-PHCB.555/06623/02 (PTB: Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)

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.

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

24008 โรงงานอุตสาหกรรม 36 หมู่บ้านสวนรังสิต อำเภอลำลูกกา จังหวัดปทุมธานี เลขที่ 10001
24008 Soi 36, Ban Anan Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10170, Thailand
Tel: +66(0) 2-422 8558 Fax: +66(0) 2-422 8554



Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Manufacturer: METTLER TOLEDO
Serial No.: 1231155210
ID No.: UAE.WAT.D102553
Resolution: 0.1 °C
Model: SevenEasy pH
Type: Bench top
Date of Calibration: 11 March 2024

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature: 23 °C ± 1 °C

Relative Humidity: 51 % ± 2 %

Condition of this results of Calibration:

1. Calibration Method: - In house method: IN-TE-025 by comparison with standard thermometer.

- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.

- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2116154	PSL-T087798	09-Jun-24	TSTR
Platinum Resistance Thermometer (PRT)	5627A	877332			

Support Equipment: - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 3419902

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

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

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

6. Condition of Calibrated Item: ☒ Good

7. Result of Calibration: ☒ Without adjustment

☐ After adjustment

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

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24008 Soi 36, Ban Anan Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10170, Thailand
Tel: +66(0) 2-422 8558 Fax: +66(0) 2-422 8554





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



Certificate No.: C24240057

Page: 2 of 2

Calibration Report

Certificate No.: 2401718-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1251155219 ID No.: UAE.WAT.0102053

Manufacturer: METTLER TOLEDO

Date of Calibration: 11 March 2024

Page 2 of 2

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model: N/A S/N: N/A
- Dimension of probe: Diameter: 4 mm, Length: 125 mm.
- Sheath material: Stainless Steel

UUC Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.998	0.1	0.099
25.1	24.999	0.1	0.099
35.1	34.997	0.1	0.099

Note

- UUC: Unit Under Calibration

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

End

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

Calibration Results:

Before Adjustment

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty (±)
Conductivity Solution	Reading		(k)	
25.000 µS/cm	26.7 µS/cm	-1.700 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1428 µS/cm	-15.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	108.4 mS/cm	2.9 mS/cm	2.00	0.67 mS/cm

After Adjustment ; at 1413 µS/cm

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

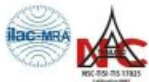
The End of Certificate

บริษัท เทคโนโลยี จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนน, กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260
Phone: +66 2059 7000 Email: info@dksh.co.th Website: www.dksh.com/thailand

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เอกสารไม่ควบคุม

CAL-FM-CS-09: 12 Sep 2022



Certificate of Calibration

Equipment: CONDUCTIVITY METER

Model: Lab 955

Serial No. (or ID.): 16300356

Manufacturer: SI Analytic

Electrode Serial No.: 16070067

Condition: In Condition

Certificate No.: C24240057

Issued Date: 11 March 2024

Job No.: WO-00020309

Page: 1 of 2

Model: LF413T

Brand: SI Analytic

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

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

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

Calibration By: Mr. Pongpisut Suebchantha

Calibration Date: 11 March 2024

The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 960753, 890591, 890593

(Mr. Pongpisut Suebchantha)

Person in charge

(Mr. Niran 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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DKSH Technology Limited
2533 สุขุมวิท ถนน, กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260
Phone: +66 2059 7000 Email: info@dksh.co.th Website: www.dksh.com/thailand

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เอกสารไม่ควบคุม

CAL-FM-CS-09: 12 Sep 2022



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



Calibration Certificate

Certificate No.: 2402283-001-01

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

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

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2402283

Operation No.: 2402283-001

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr. Jirawat Prapawattipong
Scientist

Approved by (Mr. Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory

Date of Issue: 9 April 2024

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

F-CS-005 Revision: 01 Date: 20-04-65

บริษัท เทคโนโลยี จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนน, กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prakhonong, Bangkok 10260
Phone: +66 2059 7000 Email: info@dksh.co.th Website: www.dksh.com/thailand

เอกสารไม่ควบคุม

CAL-FM-CS-09: 12 Sep 2022

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

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	HC3040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	638-HI	NFI.BTH 016/23	Quality Return	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
80	0.000063
100	0.000048
200	0.000053

2. Off-Center Error:

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

The balance reading obtained is given in the table:

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

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

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 **Page 4 of 4**

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (+/- g)	Coverage Factor k
90	90.00010	90.0000	0.0001	0.00015	2.00
100	100.00006	100.0000	0.0001	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0000	0.0001	0.00018	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0000	0.0002	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 %.

----- End -----

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

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

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: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (+/- g)	Coverage Factor k
Unused	0.00000	0.00000	0.00000	0.0000008	2.00
0.001	0.001001	0.001001	-0.00001	0.0000091	2.00
0.005	0.005002	0.004999	0.00001	0.0000094	2.00
0.01	0.010003	0.010000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000063	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000038	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00

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

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

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

Date of Issue: 9 April 2024

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Model: XSR255DU

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: NPL Method W-PA-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 Imp to 200g 8505567572 TCS M23545335 8 April 2024

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

Thermo Hygro Meter 508-H1 NPL BTH 010/23 Quality Roborn QR24-0343 9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
120	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(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

2008 ซอยสุขุมวิท 36 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110 เลขสารไม่ควบคุม
2008 Soi 36, Asoke Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel : +66(0) 2462 8558 Fax : +66(0) 2462 8555



Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Model: XSR255DU

Serial No.: C210685394

Capacity: 220 g

Manufacturer: METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor #
80	80.00010	80.0001	0.0000	0.00015	2.00
100	100.00005	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	0.0001	0.00017	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	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 %.

----- End -----

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

2008 ซอยสุขุมวิท 36 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110 เลขสารไม่ควบคุม
2008 Soi 36, Asoke Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel : +66(0) 2462 8558 Fax : +66(0) 2462 8555



Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Model: XSR255DU

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 #
Unloaded	0.000000	0.00000	0.00000	0.0000006	2.00
0.001	0.0010003	0.00101	-0.00001	0.0000009	2.00
0.005	0.0050003	0.00500	0.00000	0.0000007	2.00
0.01	0.0100003	0.01000	0.00000	0.0000009	2.00
0.05	0.0499996	0.05000	0.00000	0.0000006	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00000	0.00003	0.000037	2.00
30	30.000046	30.00001	0.00003	0.000050	2.00
50	50.000028	50.00002	0.00001	0.000048	2.00
80	80.000068	80.00002	0.00005	0.00011	2.00

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

2008 ซอยสุขุมวิท 36 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110 เลขสารไม่ควบคุม
2008 Soi 36, Asoke Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10110, Thailand
Tel : +66(0) 2462 8558 Fax : +66(0) 2462 8555



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK, 10280
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Certificate of Calibration

Cert. No.: 24TM569

Page : 1 of 3

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 55

Serial No. : B212.0411

ID No. : UAE.WAO.005/2556

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

Location : Lab Floor 2

Received Order : 01 April 2024

Calibration Date : 01 - 02 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by : 

() Ponpan Paipim

(✓) Suwit Imjai

() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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

เลขสารไม่ควบคุม
A 0065065



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

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

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

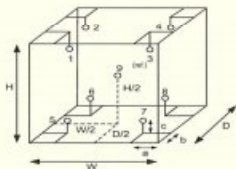
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details : Dimension of Chamber :

a = 5.0 cm	D = 0.50 m
b = 5.0 cm	W = 0.80 m
c = 5.0 cm	H = 0.75 m
	Capacity = 0.30 m ³

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

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

เอกสารไม่ควบคุม
a 1209739

Calibration Certificate

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

Page 1 of 4

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

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

The uncertainties are for a confidence probability of approximately 95%

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

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

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Date of Calibration: 10 May 2023

Environment Condition: Ambient Temperature: 21.4 ± 0.2 °C Relative Humidity: 43.4 ± 0.5 %

Place of Calibration: Balance room (Water Analysis Unit), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-M4-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standard:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8565567972	TCS	M2048535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Return	QR23-0489	21 February 2024

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

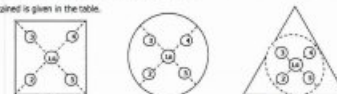
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000032
200	0.000032

2. Off-Center Error:

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

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0002	100.0002	100.0002	100.0002	100.0002	0.0001

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

เอกสารไม่ควบคุม
a 1209738

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635943
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Date of Calibration: 10 May 2023 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.00000	0.00000	0.00000	0.00000	2.99
0.01	0.01000	0.01000	0.00000	0.00000	2.99
0.02	0.02000	0.02000	0.00000	0.00000	2.99
0.05	0.05000	0.05000	0.00000	0.00000	2.99
0.1	0.10000	0.10000	0.00000	0.00000	2.99
0.2	0.20000	0.20000	0.00000	0.00000	2.99
0.5	0.50000	0.50000	0.00000	0.00000	2.99
1	1.00000	1.00000	0.00000	0.00000	2.99
2	2.00000	2.00000	0.00000	0.00000	2.99
3	3.00000	3.00000	0.00000	0.00000	2.99
5	5.00000	5.00000	0.00000	0.00000	2.99
10	10.00000	10.00000	0.00000	0.00000	2.99
20	20.00000	20.00000	0.00000	0.00000	2.99
30	30.00000	30.00000	0.00000	0.00000	2.99
40	40.00000	40.00000	0.00000	0.00000	2.99
45	45.00000	45.00000	0.00000	0.00000	2.99

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

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 10250
Location: Lab Floor 2
Received Order: 10 February 2024
Calibration Date: 10 February 2024
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Tawatchai Pama
Approved by: 
() Ponthipasa Tameyakul
(✓) Unnopphol Harachai
() Suwit Injai

Issue Date: 19 February 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

Calibration Report

Certificate No.: 2302827-001-01
Equipment: Electronic Balance
Model: XSR204
Serial No.: C117635943
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Date of Calibration: 10 May 2023 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
50	50.00000	50.00000	0.00000	0.00011	2.99
55	55.00000	55.00000	0.00000	0.00012	2.99
60	60.00000	60.00000	0.00000	0.00012	2.99
65	65.00000	65.00000	0.00000	0.00013	2.99
70	70.00000	70.00000	0.00000	0.00013	2.99
75	75.00000	75.00000	0.00000	0.00013	2.99
80	80.00000	80.00000	0.00000	0.00014	2.99
85	85.00000	85.00000	0.00000	0.00014	2.99
90	90.00000	90.00000	0.00000	0.00015	2.99
100	100.00000	100.00000	0.00000	0.00016	2.99
120	120.00000	120.00000	0.00000	0.00018	2.99
150	150.00000	150.00000	0.00000	0.00021	2.99
200	200.00016	200.00003	-0.00013	0.00028	2.99

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

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 (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°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)
	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	0.56

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



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.

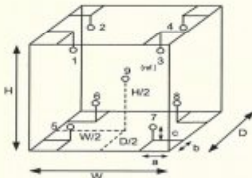
3. This certification is traceable to the International System of Unit.

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 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	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

เอกสารไม่ควบคุม



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

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

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

Condition of this result of calibration

1. Reference standard instrument:-

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

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

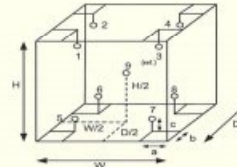
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



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 m³

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

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

เอกสารไม่ควบคุม
a 1209743



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES : 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.: 24TM587
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.018/2551

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

Location : Lab Floor 2

Received Order : 01 April 2024

Calibration Date : 01 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :
Approved Signatory

() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม
A 0065063



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

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

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

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.183	20.235	19.707	19.708	19.739	19.785	19.821	19.828	0.66

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

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

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

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

UUC* : Unit Under Calibration

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

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

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a 1209742

DQE Services

DQE Services Co.,Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : UAE.WAT.020/2558

Received Date : 7 May 2024

Calibration Date : 7 May 2024

Issue Date : 9 May 2024

Condition Instrument : Good

Calibrated by : 
(Mr.Tanasut Rimdach)
Technical Manager

Approved by : 
(Ms. Chonticha Sangngern)
Quality Manager


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

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

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REPORT OF CALIBRATION

Certificate No. : SP24-018Page 3 of 5

Calibration Results : Without adjustment


Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5780	0.5747	0.0033	0.0031	2.00
	1.0484	1.0438	0.0046	0.0029	2.00
	2.1876	2.1832	0.0044	0.0080	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5595	0.5581	0.0014	0.0034	2.00
	1.0239	1.0231	0.0008	0.0035	2.00
	2.1230	2.1219	0.0011	0.0080	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5230	0.5184	0.0046	0.0030	2.00
	0.9633	0.9614	0.0019	0.0029	2.00
	1.9753	1.9731	0.0022	0.0070	2.00
546.1	0.0000	0.0000	0.0000	0.0028	2.00
	0.5181	0.5150	0.0031	0.0031	2.00
	1.0002	0.9964	0.0038	0.0033	2.00
	1.9973	1.9914	0.0059	0.0088	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5517	0.5485	0.0032	0.0030	2.00
	1.0803	1.0772	0.0031	0.0030	2.00
	2.0373	2.0293	0.0080	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5591	0.5565	0.0026	0.0031	2.00
	1.0518	1.0482	0.0036	0.0030	2.00
	1.9274	1.9202	0.0072	0.0079	2.00

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REPORT OF CALIBRATION

Certificate No. : SP24-018Page 2 of 5

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

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 60 nm/min


Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.
Wavelength 0.1 nm.

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REPORT OF CALIBRATION



Certificate No. : SP24-018Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7435	0.0034	0.0057	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8639	0.0035	0.0060	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2907	0.0012	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6402	0.0028	0.0055	2.00

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REPORT OF CALIBRATION

Certificate No. : SP24-018Page 5 of 5

Wavelength Accuracy :



CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The overall expanded uncertainty of measurement is obtained on the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

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REPORT OF CALIBRATION

Certificate No. : SP24-008Page 2 of 5

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

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

Certified Reference Materials :

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

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

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min



Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

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CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021 064


ID No. : UAE.WAS.006/2552


Received Date : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

Condition Instrument : Good

Calibrated by : 
(Mr.Tanawat Rittidach)
Technical Manager

Approved by : 
(Ms. Chonhicha Sangneng)
Quality Manager



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

The measurement capability of an uncertainty 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 DQE Services Co., Ltd.

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REPORT OF CALIBRATION

Certificate No. : SP24-008Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

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

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

ISO 17025 FOR UUC

LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.748	-0.0011	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.865	0.0024	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.293	-0.0011	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

เอกสารไม่ควบคุม

PM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

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

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

ISO 17025 FOR UUC

LABORATORY DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-001

Page 1 of 5

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

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 4 January 2024

Calibration Date : 4 January 2024

Issue Date : 5 January 2024

Condition Instrument : Good

Calibrated by :

นายณัฐ

(Mr.Tanawat Rittidach)

Technical Manager

Approved by :

ชัชวาลย์

(Ms. Chonlicha Sangnorn)

Quality Manager

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

The measurement capability of this laboratory and its suitability 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 DQE Services Co., Ltd.

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PM-708-02 R01 1/11/2021

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ISO 17025 FOR UUC

LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.54	241.1	0.44	0.18	2.00
279.40	278.9	0.50	0.18	2.00
288.70	288.0	0.70	0.18	2.00
334.22	333.8	0.42	0.18	2.00
361.26	360.8	0.46	0.18	2.00
418.48	418.2	0.28	0.18	2.00
446.70	446.0	0.70	0.18	2.00
453.20	453.1	0.10	0.18	2.00
460.06	459.6	0.46	0.18	2.00
536.90	536.4	0.50	0.18	2.00
637.94	637.6	0.34	0.18	2.00
440.74	440.1	0.64	0.18	2.00
472.22	472.0	0.22	0.18	2.00
513.70	513.5	0.20	0.18	2.00
528.72	528.2	0.52	0.18	2.00
574.60	574.3	0.30	0.18	2.00
585.48	585.0	0.48	0.20	2.00
684.63	684.2	0.43	0.18	2.00
740.27	740.0	0.27	0.20	2.00
748.28	747.8	0.48	0.18	2.00
807.16	806.8	0.36	0.18	2.00
879.70	879.2	0.50	0.18	2.00

Remark : - UUC = User Under Calibration

- N/A = Not Available

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

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

- * Indicates not TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

PM-708-02 R01 1/11/2021

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DQE Services

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

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

ISO 17025 FOR UUC

LABORATORY DATA

REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

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

Certified Reference Materials :

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

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

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

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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PM-708-02 R01 1/11/2021

DQE Services Co., Ltd.
32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230
Phone : +66 (0)2 538 2054, Email : dgeservicesinfo@gmail.com

REPORT OF CALIBRATION

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Calibration Results : Without adjustment

Photometric Accuracy :

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

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REPORT OF CALIBRATION

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Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.2	0.52	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.4	0.19	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.4	0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.4	-0.23	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

Remark : - UUC = Unit Under Calibration
- N/A = Not Available
- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%
- * Indicates non TISI accredited

- End of Certificate -

FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP24-001 Page 4 of 5

Photometric Accuracy :

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

FM-708-02 R01 1/11/2021

Agilent Technologies

Agilent 5110 and 5100 ICP-OES Preventive Maintenance Checklist

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

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

Customer Information

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

Service Engineer's Responsibilities

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

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Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

System Information

Instrument system name and ID	ICP 5110 VDV
Instrument system site and location	UAE / 3rd Floor Laboratory
List system component product numbers	List the serial numbers of each component
1. G8015A	1. MY18030001
2. G8081A	2. 1801-01988
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

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

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Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

SPS 3 Auto Sampler

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

SPS 4 Auto Sampler

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

AVS 4, 6, 7

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

Instrument Adjustment

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

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Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

General Preparation

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

Inspect and clean the system

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

G8481A Cooling water system

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

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Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist

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

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	4100.6	8264.8	4375.0	8400.8
Mn 257.610 nm SRBR	11064.7	31849.1	12901.7	30846.2
Al 306.152 nm SBR	7.5	14.9	9.9	16.8
K 766.491 nm SBR	5.1	36.8	6.4	29.7

* Axial result is not applicable for 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

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

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

Measurement	Standby Mode	Plasma On
Mains Voltage	234.540 VAC	234.540 VAC
Mains Current	0.704 A	0.704 A
Instrument Temperature	28.8 °C	28.7 °C
RF Air Flow (sensor speed)	15.0 Hz	15.0 Hz
Plasma Exhaust Temperature	No measurement	26.7 °C
Water Flow Oscillator	No measurement	1.64 L/min
Water Flow Detector	1.06 L/min	1.06 L/min
Water Inlet Temperature	18.0 °C	18.0 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-33.8 °C	-33.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	677.94 kPa	677.33 kPa
Purge Gas Supply Pressure*1	674.30 kPa	643.40 kPa
Option Gas Supply Pressure*1	N/A	N/A
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	164.63 kPa
Plasma Gas Flow	No measurement	11.98 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1200 W
RF Supply Current	No measurement	8.663 A
RF Supply Voltage	No measurement	164.660 V

*1 If option installed

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

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

Service Engineer Comments (optional)

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

Other Important Customer Web Links

How to get information on your product:

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

Service Completion

Service request number 6005025227 Date service completed 30 Nov 2022

Agilent signature Vongchai T. Customer signature [Signature]

Document part number: G8014-00075

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**Agilent 5110 and 5100 ICP-OES
Preventive Maintenance Checklist**
ICP-OES Parts List Table

Part description	Part Number	Product / Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-08014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-08015	All	1
Polyclear Cooling Fluid	G3292-80010	G8481A	1
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	
Additional Parts may be required from engineers stock:			
X axis drive belt	5410047500	SPS 3	
Z axis drive belt	5410047400	SPS 3	
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	

Restore system

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

Leave system in an idle state: on and purging.

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

Service Review

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

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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	Test Before PM
Test Completed On	11/30/2022 9:35:32 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

เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.62	
As (188.980 nm)	≤ 8.20	6.20	
C (193.027 nm)	≤ 11.50	8.35	
Mo (202.032 nm)	≤ 8.20	6.41	
Cr (205.158 nm)	≤ 13.40	9.04	
Zn (213.857 nm)	≤ 8.70	6.62	
Pb (220.353 nm)	≤ 9.50	7.13	
Co (228.615 nm)	≤ 17.20	11.71	
Ba (230.424 nm)	≤ 9.40	7.21	
Mn (257.610 nm)	≤ 13.30	9.50	
Mn (260.568 nm)	≤ 20.30	14.33	
Cr (267.716 nm)	≤ 11.00	8.14	
Cu (324.754 nm)	≤ 25.00	18.98	
Cu (327.395 nm)	≤ 14.20	11.24	
Sr (338.071 nm)	≤ 33.50	24.47	
Ba (455.403 nm)	≤ 44.00	33.88	
Sr (460.733 nm)	≤ 36.00	17.22	
Ba (493.408 nm)	≤ 36.00	25.48	
Ba (514.171 nm)	≤ 42.00	25.47	
Ar (675.283 nm)	≤ 74.00	59.62	
K (766.491 nm)	≤ 80.00	64.94	

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Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.62	
Se (196.026 nm)	≤ 2.60	0.71	
Zn (213.857 nm)	≤ 1.50	0.43	
Pb (220.353 nm)	≤ 2.60	0.76	
Mn (257.610 nm)	≤ 1.50	0.60	
Al (396.152 nm)	≤ 1.50	0.48	
Ba (493.408 nm)	≤ 1.50	0.89	
K (766.491 nm)	≤ 1.50	0.42	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.57	
Se (196.026 nm)	≤ 1.50	0.76	
Zn (206.200 nm)	≤ 1.50	0.61	
Zn (213.857 nm)	≤ 1.50	0.51	
Cd (214.439 nm)	≤ 1.50	0.55	
Pb (220.353 nm)	≤ 1.50	0.52	
Mn (257.610 nm)	≤ 1.50	0.54	
Cr (267.716 nm)	≤ 1.50	0.54	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.91	
Ba (493.408 nm)	≤ 1.50	0.85	
K (766.491 nm)	≤ 1.50	1.22	

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Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	147.7	1156.5	55.5	
Se (196.026 nm)	≥ 41.0	SRBR	111.1	1195.3	97.7	
Zn (213.857 nm)	≥ 1421.0	SRBR	4100.8	51959.5	159.6	
Pb (220.353 nm)	≥ 46.0	SRBR	192.5	2806.6	185.7	
Mn (257.610 nm)	≥ 3518.0	SRBR	11064.7	264165.0	567.6	
Al (396.152 nm)	≥ 3.4	SBR	7.5	49047.9	5770.5	
Ba (493.408 nm)	≥ 34.0	SBR	107.4	1887710.3	17407.5	
K (766.491 nm)	≥ 1.8	SBR	5.1	100805.9	16626.4	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	234.9	3056.4	152.9	
Se (196.026 nm)	≥ 159.0	SRBR	218.1	3865.1	271.6	
Zn (206.200 nm)	≥ 234.0	SRBR	1305.5	15850.4	144.5	
Zn (213.857 nm)	≥ 1743.0	SRBR	8364.0	183037.8	476.4	
Cd (214.439 nm)	≥ 4227.0	SRBR	7718.5	143240.2	342.8	
Pb (220.353 nm)	≥ 320.0	SRBR	576.3	14465.2	580.4	
Mn (257.610 nm)	≥ 10625.0	SRBR	31842.1	1411257.3	1958.9	
Cr (267.716 nm)	≥ 1048.0	SRBR	4492.1	183110.6	1632.2	
Cu (324.754 nm)	≥ 19.0	SBR	46.2	371487.5	7892.9	
Al (396.152 nm)	≥ 6.0	SBR	14.9	278447.4	17552.6	
Ba (493.408 nm)	≥ 60.0	SBR	190.6	10061527.3	52519.8	
K (766.491 nm)	≥ 24.0	SBR	36.8	1922153.4	50858.1	

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Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	GB011A/GB015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	PM Functional test	
Test Completed On	11/30/2022 11:43:36 AM	
Result Summary		
Subsystem Communications Test		Pass
Air Flow Test		Pass
Water Flow Test		Pass
Gas Flows Test		Pass
RF Generator Test		Pass
Camera Test		Pass
Optics Test		Skipped
Advanced Valve System Test		Skipped
Resolution Test		Skipped
Sensitivity Test		Skipped
Precision Test		Skipped
Subsystem Communications Test		Pass
Air Flow Test		Pass
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
14.00	19.00	
Water Flow Test		Pass
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.44	1.05	18.51

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Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	163.37	2.00	1.99	108.49
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	112.85	18.00	17.91	23.46
RF Generator Test			Pass		
RF Power Supply Test		Passed			
RF Power Supply (V)		147.437			
RF Oscillator Test		Passed			
RF Oscillator Frequency (MHz)		0.000			
Work Coil Current (A)		45.069			
RF Power Supply Current (A)		1.997			
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.305	Passed		
Dark Current Test	6000	0.578	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

Page 2 of 2

เอกสารไม่ควบคุม

Resolution Test			Pass		
Element Wavelength	Specification	Width			
N (174.213 nm)	≤ 9.40	6.79			
As (188.980 nm)	≤ 8.20	6.09			
C (193.027 nm)	≤ 11.50	8.29			
Mo (202.032 nm)	≤ 8.20	6.30			
Cr (206.158 nm)	≤ 13.40	9.05			
Zn (213.857 nm)	≤ 8.70	6.77			
Pb (220.353 nm)	≤ 9.50	7.02			
Co (228.615 nm)	≤ 17.20	11.67			
Ba (230.424 nm)	≤ 9.40	7.39			
Mn (257.610 nm)	≤ 13.30	9.48			
Mn (260.568 nm)	≤ 20.30	14.25			
Cr (267.716 nm)	≤ 11.00	7.94			
Cu (324.754 nm)	≤ 25.00	18.99			
Cu (327.395 nm)	≤ 14.20	11.33			
Sr (338.071 nm)	≤ 33.50	24.44			
Ba (455.403 nm)	≤ 44.00	33.86			
Sr (460.733 nm)	≤ 36.00	17.51			
Ba (493.408 nm)	≤ 36.00	25.56			
Ba (614.171 nm)	≤ 42.00	24.96			
Ar (675.283 nm)	≤ 74.00	59.38			
K (766.491 nm)	≤ 80.00	65.63			

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	PM Performance test
Test Completed On	11/30/2022 12:10:42 PM
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	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass
Optics Test	
Pass	
Intensity	5674608
Wavelength	737.212

Page 1 of 4

เอกสารไม่ควบคุม

Sensitivity Test					
Pass					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	147.8	1149.3	54.8
Se (196.026 nm)	≥ 41.0	SRBR	111.6	1222.8	101.0
Zn (213.857 nm)	≥ 1421.0	SRBR	4375.0	52582.3	143.7
Pb (220.353 nm)	≥ 46.0	SRBR	199.8	2744.4	166.5
Mn (257.610 nm)	≥ 3518.0	SRBR	12801.7	285591.3	496.0
Al (396.152 nm)	≥ 3.4	SBR	9.9	52686.6	4873.6
Ba (493.408 nm)	≥ 34.0	SBR	154.6	2287291.6	14698.1
K (766.491 nm)	≥ 1.8	SBR	6.4	106701.6	14350.9
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 206.0	SRBR	242.4	3170.1	154.8
Se (196.026 nm)	≥ 159.0	SRBR	226.1	4134.5	289.3
Zn (206.200 nm)	≥ 234.0	SRBR	1128.6	13782.0	146.5
Zn (213.857 nm)	≥ 1743.0	SRBR	8400.8	177166.3	442.5
Cd (214.439 nm)	≥ 4227.0	SRBR	7001.9	125884.2	321.6
Pb (220.353 nm)	≥ 320.0	SRBR	536.3	12909.3	532.6
Mn (257.610 nm)	≥ 10625.0	SRBR	30846.2	1287989.0	1738.8
Cr (267.716 nm)	≥ 1048.0	SRBR	4396.0	167335.6	1424.4
Cu (324.754 nm)	≥ 19.0	SBR	52.1	373690.7	7033.1
Al (396.152 nm)	≥ 6.0	SBR	16.8	266357.7	15112.4
Ba (493.408 nm)	≥ 60.0	SBR	225.2	10173441.5	44971.7
K (766.491 nm)	≥ 24.0	SBR	39.7	1874136.2	48055.7

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เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.60	
Se (196.026 nm)	≤ 2.60	0.84	
Zn (213.857 nm)	≤ 1.50	0.29	
Pb (220.353 nm)	≤ 2.60	0.59	
Mn (257.610 nm)	≤ 1.50	0.28	
Al (396.152 nm)	≤ 1.50	0.28	
Ba (493.408 nm)	≤ 1.50	0.59	
K (766.491 nm)	≤ 1.50	0.23	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.71	
Se (196.026 nm)	≤ 1.50	0.43	
Zn (208.200 nm)	≤ 1.50	0.46	
Zn (213.857 nm)	≤ 1.50	0.37	
Cd (214.439 nm)	≤ 1.50	0.48	
Pb (220.353 nm)	≤ 1.50	0.48	
Mn (257.610 nm)	≤ 1.50	0.74	
Cr (267.716 nm)	≤ 1.50	0.26	
Cu (324.754 nm)	≤ 1.50	0.51	
Al (396.152 nm)	≤ 1.50	0.45	
Ba (493.408 nm)	≤ 1.50	0.81	
K (766.491 nm)	≤ 1.50	0.84	

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เอกสารไม่ควบคุม

Serial-No.: K170A0153 Customer-No.: C04-006
Date: 12 February 2024 Carried out by: Mr. Srichai Fak-On

Maintenance with following Operational Qualification (OQ)
(requires a separate OQ protocol)

☐

Company	บริษัท อูโนเค็ด แอนนาไลส์ แอนด์ เอ็นจิเนียริงคอนซัลแตนท์ จำกัด
User	คุณกรวิทย์
Department	ห้องปฏิบัติการ (Mercur Analysis)
Street	3 ซอยอุดมสุข 41 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง
Zip Code, City	กรุงเทพมหานคร 10260
Country	ประเทศไทย
Phone	
Fax	
E-mail	

Maintenance Protocol mercur DUO / mercur DUO plus | update 27.06.2016 Version 2.1 final
Analytik Jena AG | Jena | Contact: Jena-DE 1 | 052046 Jena | Germany

เอกสารไม่ควบคุม

Maintenance Protocol

Atomic Fluorescence Spectrometer mercur DUO / mercur DUO plus

Maintenance works basic unit

tightness visual check inside the Mercur	<input checked="" type="checkbox"/>
visual check if gold-traps are broken	<input checked="" type="checkbox"/>
visual check if spectrometer is contaminated	<input checked="" type="checkbox"/>
visual check of the fluorescence cell	<input checked="" type="checkbox"/>
visual check of the absorption cell, incl. window	<input checked="" type="checkbox"/>
reactor cleaning	<input checked="" type="checkbox"/>
check pump-hose, if necessary change it	<input checked="" type="checkbox"/>
check swivel drive (SEV)	<input checked="" type="checkbox"/>
check drying-hose, output gas-liquid-separator	<input checked="" type="checkbox"/>
test Bubble-Sensor	<input checked="" type="checkbox"/>
check gas flows	<input checked="" type="checkbox"/>
check volume flows, reagents	<input checked="" type="checkbox"/>
recording stray light values	<input checked="" type="checkbox"/>
measurement with 30 ng/l	<input checked="" type="checkbox"/>

Maintenance works Autosampler

Serial No.: N/A

lubricate the dosing-winding (Teflon-grease-spray)	<input type="checkbox"/>
clean the dosing cylinder, if necessary exchange it	<input type="checkbox"/>
lubricate the winding system of the height drive with some drops of oil	<input type="checkbox"/>
check the toothed belt	<input type="checkbox"/>
check the position of the mechanical stopper (height: 13mm)	<input type="checkbox"/>
check the pump rate of mixing pump (<14s AS52, typ.7s/<20s AS52S, typ.10s)	<input type="checkbox"/>
check the pump rate of washing cup	<input type="checkbox"/>
check the electrical hose connections for good contact	<input type="checkbox"/>
check the connectors of the magnetic valves	<input type="checkbox"/>
check the dosing hose for buckling, if necessary exchange it	<input type="checkbox"/>

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Analytik Jena AG | Jena | Contact: Jena-DE 1 | 052046 Jena | Germany

เอกสารไม่ควบคุม

Device parameter	nominal value	actual value
visual check general tightness inside the Mercur	o.k.:	changed: <input type="checkbox"/>
visual check Goldtraps	o.k.:	changed: <input type="checkbox"/>
visual check spectrometer		
Fluorescence cell	o.k.:	changed: <input type="checkbox"/>
Absorption cell, incl. window	o.k.:	changed: <input type="checkbox"/>
lens	o.k.:	changed: <input type="checkbox"/>
Swivel drive (SEV)	o.k.:	changed: <input type="checkbox"/>
check pump hoses	o.k.:	changed: <input type="checkbox"/>
check hoses and hose connectors	o.k.:	changed: <input type="checkbox"/>
check and clean reactor	o.k.:	changed: <input type="checkbox"/>
check drying hose output Gas-liquid-separator	o.k.:	changed: <input type="checkbox"/>
check bubble-sensor	o.k.:	not o.k.:
Check gasflow		
Argon pressure valve 4	1.2 - 1.5 bar	1.5 bar
Valve 1	10 Nl/h or 0.166 NL/min	0.166 NL/min
Valve 2	50 Nl/h or 0.833 NL/min	0.833 NL/min
Valve 3	5 Nl/h or 0.083 NL/min	0.083 NL/min
Valve 4	10 Nl/h or 0.166 NL/min	0.166 NL/min
Check liquidflow		
Acid	2.5 ml/min ± 1 ml	2.5 ml/min
Red.-agent	2.5 ml/min ± 1 ml	2.5 ml/min
Sample	10 ml/min ± 2 ml	10 ml/min
Adventitious light - values	(V)	from file
100	0	0
200	0	0
300	0	0
350	0	0
400	1	1
450	3	3
500	8	8
550	18	17
575	26	25
600	36	35

Maintenance Protocol mercur (2022) mercur (2022) plus | update 27.08.2018 Version 2.1 Kios
Analytik Jena AG | Normal Data File | © 2018 Jena, Germany

เอกสารไม่ควบคุม

Service Report

Customer's address		Customer's Ref. No. <u>CO 16 SP2024-036</u>	
<u>25 หมู่ 5, 345 ถนน, คลองขุด, ปากเกร็ด</u>		<u>2 หมู่ 5, 345 ถนน, คลองขุด, ปากเกร็ด</u>	
<u>3 หมู่ 5, 345 ถนน, คลองขุด, ปากเกร็ด</u>		<u>3 หมู่ 5, 345 ถนน, คลองขุด, ปากเกร็ด</u>	
E-mail		Phone	Fax
Job No. <u>SP2024-036</u>		User <u>gmsd</u>	Service Engineer <u>nsk/ shad</u>
Instrument model		Serial No. <u>4170A0153</u>	Date <u>12/02/2024</u> Page <u>1/1</u>
<input type="checkbox"/> Repair (RE) <input checked="" type="checkbox"/> Maintenance (MT) <input type="checkbox"/> Installation (IN) <input type="checkbox"/> Warranty <input type="checkbox"/> Application (AP) <input type="checkbox"/> Site Prep (SP) <input type="checkbox"/> Visit (V)		Software Version No. <u>4.7.9.0</u>	
Fault / Claim: <u>Preventive Maintenance (PM 3/6)</u>		<input type="checkbox"/> Error Code	
Action taken:			
<ul style="list-style-type: none">- Maintenance not Basic Unit- Check device parameters- Check gas flow- Check liquid flow- Check Adventitious light - values- Test run Analytical parameter Fluorescence cell- Test run Analytical parameter Absorption cell			
Action Performed / Recommendation:			
Sensitivity check (Without enrichment / FBR / 100 ng/L)			
Int. Blank = 0.0006			
Int. 100 ng/L = 0.0089			
RSD % = 0.69			
<input type="checkbox"/> Spare Part <input type="checkbox"/> Instrument Configuration			
Name			
Quantity			
Unit Price			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Hereby the undersigned confirm the time devoted, the work performed, the perfect function of the device, and the receipt/delivery of the specified spare parts.			
Date / Signature of Customer			
Date / Signature of Service Engineer			
Work completed?			
<input checked="" type="checkbox"/> Yes			
<input type="checkbox"/> No			

Services are subject to the General Terms and Conditions of Analytik Jena AG, which will be sent on request.

เอกสารไม่ควบคุม

12/02/2024 16:11 Page 1/4

Device parameter	nominal value	actual value
Analytical parameters Fluorescence cell		
Conditions.: max conc.: 10 µg/L PMT-voltage: <u>451</u> V		
Blank-solution	Int > 0.0015	Int <u>0.0005</u>
without enrichment / FBR 30 ng/L	RSD < 3 %	Int. <u>0.0027</u>
Conditions.: max conc.: 1.7 µg/L PMT-voltage: <u>444</u> V		
Blank-solution	Int > 0.008	Int <u>0.0043</u>
with enrichment / FBR 30 ng/L	RSD < 3 %	Int. <u>0.0171</u>
Fok.- factor (Int ₂ / Int ₁)	> 3.5	RSD <u>1.81</u> %
6.33		
Analytical parameters Absorption cell		
Blank-solution	Ext. > 0.0012	Ext. <u>0.0004</u>
without enrichment / FBR 100 ng/L	RSD < 5 %	Ext. <u>0.0025</u>
3.17		
Comments		
# Sensitivity check (Without enrichment / FBR / 100 ng/L)		
Int. Blank = 0.0008		
Int. 100 ng/L = 0.0097		
RSD % = 0.96		

Signature Technician

12/02/2024

Place, Date (DD/MM/YYYY)

Signature Customer

12/02/2024

Place, Date (DD/MM/YYYY)

Maintenance Protocol mercur (2022) mercur (2022) plus | update 27.08.2018 Version 2.1 Kios
Analytik Jena AG | Normal Data File | © 2018 Jena, Germany

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WO\Pro_008
Program version: 4.7.9.0 Printed on: 12/02/2024 16:11
Recording started on 12/02/2024 16:00 GMT+7.0
Operator:
Laboratory:
Code:
Remarks:

Method parameters

Method Without Enr. / FBR/0.10 ng/L_12-02-2024
Created on 12/02/2024 Time 15:54
Program

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm	
Lamp type	Hg-LP	
Peak height		Integr. time
Integr. mode		35 s
PMT	464 V	
AZ time	5 s	Peak smoothing
Delay	0 s	12/5
Working mode	w/o enrich.	
FBR technique	on	System cleaning
Pump speed	3	Off
Sample load time	10 s	Wash time acid
Reaction time	6 s	10 s
Waiting time AZ	5 s	Soaking time
Delay	0 s	20 s
Purge time1	30 s	Gas load time
Purge time2	15 s	5 NL/h
		Gas wash time2
		10 NL/h

Mercur

เอกสารไม่ควบคุม

QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(100.000 µg/L)	QC std.2 no.	3(0.100 µg/L)
QC std.1 limit	± 20.00%	QC std.2 limit	± 20.00%
QC std. act.	flag + continue	Reaction	flag + continue
Expect. blank abs.	0.0100± 0.0100	Reaction	off
QC precision	off	QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	µg/L
No. standards	1	Conversion fac.	1000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	3
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	off		

Calibration standards

No	Name	State	Pos	Conc./ µg/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.000878 A: 0.01998	0.000052 0.001015	6.030 5.081
2	Cal-Std1	(--)	##	100.000	H: 0.009799 A: 0.1316	0.000094 0.000882	0.969 0.670

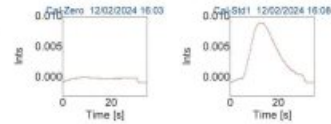
Hg

Mercur

เอกสารไม่ควบคุม

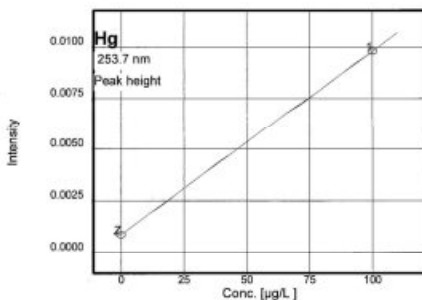
Peak plots

Hg



Calibration function 1 12/02/2024 16:10 Calibration (Peak height)

Ints=k1+k2*conc			
k1=0.000878	k2=0.000089	Recal. factor:	---
Slope	0.00009 Ints/(µg/L)	R2-adjusted	1.0000
sc0	1.00000 µg/L		
Lower limit	0 µg/L	Upper limit	110. µg/L
Detection limit	---	Deter. limit	---



Measurements and events (sorted by time)

Hg	Without Enr. / FBR/0.10 ng/L_12-02-2024	12/02/2024	16:00
ID	Conc.	Ints	BG SD RSD/% Int. type Time
Cal-Zero		0.000939	
		0.000845	
		0.000849	
	0µg/L	0.000878	0.000052940 6.030
Cal-Std1		0.008996	
		0.009708	
		0.009794	
	100.0µg/L	0.009799	0.000094990 0.969
Calibration	Calibration function: 01		16:10

Mercur

เอกสารไม่ควบคุม

Mercur

Report file:	C:\WinAAS\TMP\2024\Result\WOPPro_008
Program version:	4.7.9.0
Printed on:	12/02/2024 14:32
Recording started on:	12/02/2024 14:21 GMT+7.0
Operator:	
Laboratory:	
Code:	
Remarks:	

Method parameters

Hg

Method	Without Enrichment / FBR / 30 µg/L_PM_12-02-2024		
Created on	12/02/2024	Time	11:09
Program	---		
Parameters Mercur Technique: Hg fluorescence			
Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	35 s
PMT	451 V		
AZ time	5 s	Peak smoothing	12/6
Delay	0 s		

Working mode	w/o enrich.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	12 s	Gas load time	10 NL/h
Reaction time	12 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	30 s		
Purge time2	15 s	Gas wash time2	10 NL/h

Mercur

เอกสารไม่ควบคุม

QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(30.000 ng/L)	QC std.2 no.	3(0.100 ng/L)
QC std.1 limit	± 20.00%	QC std.2 limit	± 20.00%
QC std. act.	flag + continue	Reaction	flag + continue
Expect. blank abs.	0.0100± 0.0100	Reaction	off
QC precision	off	QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	3
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	off		

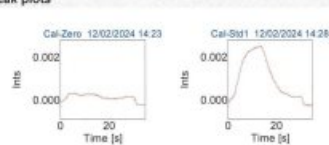
Calibration standards

No	Name	State	Pos	Conc./ ng/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.000587 A: 0.01363	0.000024 0.000359	4.137 2.597
2	Cal-Std1	(--)	##	30.000	H: 0.002754 A: 0.04276	0.000049 0.000186	1.814 0.437

Mercur

เอกสารไม่ควบคุม

Peak plots



Hg

Calibration function 1

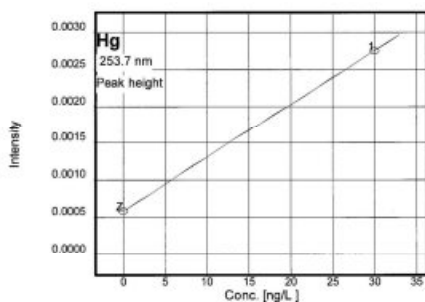
12/02/2024 14:31 Calibration (Peak height)

Ints=k1+k2*conc

k1=0.000588 k2=0.000072

Recal. factor: ---

Slope	0.00007 Ints/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L		
Lower limit	0 ng/L	Upper limit	33.0 ng/L
Detection limit	---	Deter. limit	---



Measurements and events (sorted by time)

Hg	Without Enrichment / FBR / 30 µg/L_PM_12-02-2024	12/02/2024	14:21
ID	Conc.	Ints	BG SD RSD/% Int. type Time
Cal-Zero		0.000588	
		0.000584	
		0.000612	
	0 ng/L	0.000587	0.000024310 4.137
Cal-Std1		0.002810	
		0.002740	
		0.002713	
	30.00ng/L	0.002754	0.000049960 1.814
Calibration	Calibration function: 01		14:31

Mercur

เอกสารไม่ควบคุม

Mercur

Report file: C:\WinAAS\TMP\2024\Result\WOIPro_007
 Program version: 4.7.9.0 Printed on: 12/02/2024 14:55
 Recording started on 12/02/2024 14:41 GMT+7.0
 Operator:
 Laboratory:
 Code:
 Remarks:

Method parameters

Method With Enrichment / FBR / 30 µg/L_PM_12-02-2024
 Created on 12/02/2024 Time 11:37
 Program ---

Parameters Mercur Technique: Hg fluorescence

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	20 s
PMT	444 V		
AZ time	5 s	Peak smoothing	12/5
Delay	0 s		
Working mode	Enr. w/o reload.	System cleaning	Off
FBR technique	on	Wash time acid	10 s
Pump speed	3	Soaking time	20 s
Sample load time	10 s	Gas load time	5 NL/h
Reaction time	10 s		
Waiting time AZ	5 s		
Delay	0 s		
Purge time1	20 s		
Purge time2	15 s	Gas wash time2	5 NL/h
Purge time3	10 s	Gas wash time3	10 NL/h
Heat time coll.1	20 s	Cool. time coll.1	25 s

Hg

Mercur

เอกสารไม่ควบคุม

QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(30.000 µg/L)	QC std.2 no.	1(30.000 µg/L)
QC std.1 limit	± 50.00%	QC std.2 limit	± 50.00%
QC std. act.	flag + continue	Reaction	flag + continue
Expect. blank abs.	0.0100± 0.0100	Reaction	off
QC precision	off	QC Recal.factor	Off

Calibration settings

Calib. meth	Standard calib.	Calibr. unit	µg/L
No. standards	1	Conversion fac.	1000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	Zero
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	off	Meas. cycles	1
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

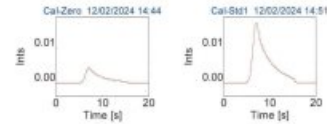
No	Name	State	Pos	Conc./µg/L	Ints	SD	RSD/%
1	Cal-Zero	(--)	##	0.000	H: 0.004358 A: 0.01859	0.000018 0.000277	0.417 1.673
2	Cal-Std1	(--)	##	30.000	H: 0.01710 A: 0.06278	0.000152 0.000616	0.889 0.982

Mercur

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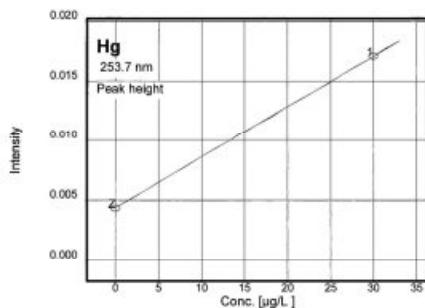
Peak plots

Hg



Calibration function 1 12/02/2024 14:55 Calibration (Peak height)

Ints=k1+k2*conc		Recal. factor:	---
k1=0.004358	k2=0.000425		
Slope	0.00042 Ints/(µg/L)	R2-adjusted	1.0000
sc0	1.00000 µg/L		
Lower limit	0 µg/L	Upper limit	33.0 µg/L
Detection limit	---	Deter. limit	---



Measurements and events (sorted by time)

Hg	With Enrichment / FBR / 30 µg/L_PM_12-02-2024	12/02/2024	14:41
ID	Conc.	Ints	SD
Cal-Zero		0.004343	
		0.004378	
		0.004352	
	0 µg/L	0.004358	0.000018180
Cal-Std1		0.01726	
		0.01695	
		0.01708	
	30.00 µg/L	0.01710	0.0001520
Calibration	Calibration function: 01		14:55

Mercur

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Mercur

Report file:	C:\WinAAS\TMP\2024\Result\WOP\ro_008
Program version:	4.7.9.0
Printed on:	12/02/2024 15:22
Recording started on:	12/02/2024 15:10 GMT+7.0

Operator:
Laboratory:
Code:

Remarks:

Method parameters

Method	Without enrichment / FBR 100 ng/L PM_12-02-2024
Created on	12/02/2024 Time 11:54
Program	---

Parameters Mercur Technique: Hg absorption

Line	253.7 nm		
Lamp type	Hg-LP		
Integr. mode	Peak height	Integr. time	40 s
PMT	238 V	Peak smoothing	12/5
A7 time	5 s		
Delay	0 s		
Working mode	w/o enrich.	System cleaning	Acid
FBR technique	off	Wash time acid	15 s
Pump speed	4	Soaking time	20 s
Sample load time	8 s	Gas load time	10 NL/h
Reaction time	12 s		
Waiting time AZ	15 s		
Purge time1	40 s		

QC parameters

QC type	Conc. check	QC check samp. 2	---
QC check samp. 1	---	Conc.	---
Error limit	---	Error limit	---
Rep. measurement	off	Reaction	flag + continue
QC std.1 no.	1(100.00 ng/L)	QC std.2 no.	1(100.00 ng/L)
QC std.1 limit	± 50.00%	QC std.2 limit	± 0.00%
QC std. act.	flag + continue	Reaction	flag + continue
Expect. blank abs.	0.0100± 0.0100	Reaction	off
QC precision	off	QC Recal.factor	Off

Mercur

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Calibration settings

Calib. meth	Standard calib.	Calibr. unit	ng/L
No. standards	1	Conversion fac.	1000000
Type of standards	---	Standard prep.	Premixed
		Blank correct.	---
		Recalib. std. no.	---
Output unit	µg/L	Conversion fac.	1000
Calib. stat.	Mean	Meas. cycles	3
		Blind cycles	1
Stock sol. 1	---	Stock sol. 2	---
Stock sol. 3	---	Stock sol. 4	---
Type of cal. curve	linear	Intercept	calculated
Weighted cal.	off	Grubbs stat.	off
Check of cal. curve	no outlier test		

Sample statistics

Stat. mode	Mean	Meas. cycles	2
Confid. level	95.4 %	Blind cycles	1
Grubbs stat.	---		

Calibration standards

Hg

No	Name	State	Pos	Conc./ ng/L	Abs	SD	RSD/%
1	Cal-Zero	(-)	##	0.00	H: 0.000478 A: 0.005393	0.000331 0.002260	69.26 41.90
2	Cal-Std1	(-)	##	100.00	H: 0.002580 A: 0.034199	0.000081 0.002697	3.171 7.887

Calibration function 1 12/02/2024 15:22 Calibration (Peak height)

Abs=k1+k2*conc

k1=0.000478

k2=0.000021

Recal. factor:

Slope	0.00002 Abs/(ng/L)	R2-adjusted	1.0000
sc0	1.00000 ng/L	Charact. conc.	207.402 (ng/L)/1%
Lower limit	0 ng/L	Upper limit	110. ng/L
Detection limit	---	Deter. limit	---

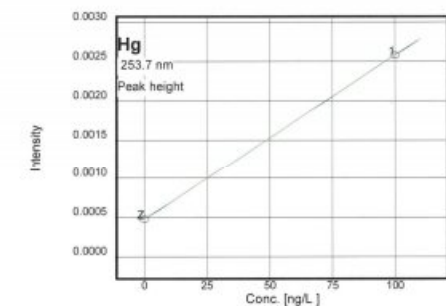
Mercur

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เอกสารไม่ควบคุม

SITHIPORN
associates

DMA-80 DIRECT MERCURY ANALYZER System

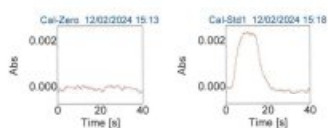


Measurements and events (sorted by time)

Hg	Without enrichment / FBR 100 ng/L PM_12-02-2024					12/02/2024	15:10	
ID	Conc.	Abs	BG	SD	RSD/%	Int. type	Time	
Cal-Zero		0.000328				PkH	15:13	
		0.000248					15:14	
		0.000858					15:15	
	0ng/L	0.000478		0.00033131	69.26		15:15	
Cal-Std1		0.002638				PkH	15:18	
		0.002615					15:19	
		0.002487					15:21	
	100.ng/L	0.002580		0.000081841	3.171		15:21	
Calibration	Calibration function: 01							15:22

Peak plots

Hg



Mercur

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เอกสารไม่ควบคุม

DMA-80 Direct Mercury Analyzer

SERVICE PROTOCOL REPORT

To be filled in before service visit (1st page)

Customer information:

Company:	บริษัท แอนนาลิสต์ จำกัด. (สง.ใหญ่)
Department:	LAB
Person in charge:	คุณ ภูชงค์ พาณิชยเลิศอำไพ
Address:	ซอยอุดมสุข 41 ถนนสุขุมวิท กรุงเทพมหานคร 10260
Tel.:	+66 (86) 3191292
E-mail:	bhuchonk@uaconsultant.co.th

Technical data:

Unit Serial Number:	11030982		
Terminal type or USB-640 Gateway:	Termianl-640	SN	1012000091
Software, type and revision:	Easy Control	Rev.	
Air Compressor (if present)	-	SN	-
Gas system pump (if present)	-	SN	-
Installation and last maintenance dates:	Inst. on: -	Maint. on:	17-11-66

NOTE: after achievement of the following protocol a filled and signed copy of this report has to be sent to Milestone srl at: service@milestonesrl.com

For the best result of the test below we recommended to use the Milestone DMA-80 Service Kit (PN DMA-SKIT).

เอกสารไม่ควบคุม

1. VISUAL INSPECTION

	Good	Damaged	Corroded/Dirty
External chassis	✓		
Inside	✓		
Electric parts	✓		
Screws	✓		

2. ELECTRICAL SAFETY TEST

Using a suitable testing device check the below reported parameters and take note of the results.

Parameter	Result	OK	Not OK
Voltage : 230 VAC (±10%)	Actual value : 224 VAC	✓	
Ground : ≤ 2	Actual value: 0.9 VAC	✓	

3. PRESSURE CHECK

	Oxygen (purity O ₂ >99,95%)	Milestone air compressor
Gas carrier	Purity:	✓

The pressure at the supply source manometer should be approx. 4.0bar
The flow rate depends by type of cuvette installed on the DMA-80 unit.



	Correct value	Actual value	Final value	Correct value	Actual value	Final value	Correct value	Actual value	Final value
Inlet pressure	3,1 bar	-	-	3,1 bar	-	-	3,1 bar	3,1 bar	Pass
Flow rate	10-12 l/h	-	-	8-10 l/h	-	-	6-8 l/h	6 l/h	Pass

Check all possible leakage points and their conditions:

	Good	Damaged	Corroded
Tubing	✓		
Silicon joints	✓		
O-rings	✓		
Cuvette sealing O-rings	✓		
Gas connections	✓		
Valves	✓		
Sample boat carrier	✓		
Catalyst flange	✓		

เอกสารไม่ควบคุม

4. AUTOSAMPLER SYSTEM

	OK	Not OK	Re-Adjusted
Calibration of autosampler motor	✓		
Cylinders alignment	✓		

	Fast	Slow	Normal
Speed of pneumatic cylinders			✓

Using the maintenance grease, periodically lightly lubricate all exposed steel rods of the horizontal and vertical cylinders.

5. COMPONENTS CHECK

Conditions of the different parts used/installed on DMA unit:

	OK	Not OK	Replaced	Cleaned
Catalyst tube	✓			
Amalgamator	✓			
Quartz boats	✓			
Nickel boats	-			
Autosampler plate	✓			
Gas kit accessories	-			

6. TEMPERATURES

		Correct value	Actual value	Final value (Pass)
Drying/ Decomposition furnace	If controlled by Infrared sensor	850°C ± 10°C	-	-
	If controlled by thermocouple	650°C ± 10°C	650	Pass
Catalyst furnace	Type 1	515°C ± 5°C	-	-
	Type 2,3	565°C ± 10°C	565°C	Pass

เอกสารไม่ควบคุม

Amalgamator stand by temperature	If controlled by Infrared sensor	170°C ± 10°C	170°C	Pass
	If IR sensor is not present	145°C ± 25°C	-	-
Amalgamator heating temperature	850°C ± 10°C		850°C	Pass
Cuvette	125°C ± 5°C		125°C	Pass

7. SPECTROMETER

The spectrometer can be equipped with a single beam system (ducon lamp) or with a dual beam system (tricon lamp)

	Old cuvette type						Actual cuvette type					
	Gain			Offset			Gain			Offset		
	Correct value	Actual value	Final value	Correct value	Actual value	Final value	Correct value	Actual value	Final value	Correct value	Actual value	Final value
Dualcell system	3.6VDC	-	-	0.015VDC ± 0.005VDC	-	-	3.93VDC	3.9V	Pass	0.015VDC ± 0.005VDC	0.015V	Pass
Tricell system*	-	-	-	-	-	-	3.96VDC	-	-	0.015VDC ± 0.005VDC	-	-

(*)The recommended Hg lamp operating signal should be around 3,96VDC (for detector 2) and 3,93VDC (for detector 1).

เอกสารไม่ควบคุม

	OK	Not OK
Conditions of the spectrometer system	✓	
Alignment between lamp, cuvette and detector	✓	
Cuvette cleaning (glass windows, sealing O-rings...)	✓	
Lamp intensity	✓	
Operation of the mechanical shutter (if present)	✓	

8. MILESTONE AIR COMPRESSOR (N.A.)

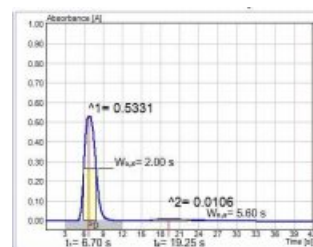
Maintenance	OK	Date last service
Drain (compressor)		
Replacing air filters (air purification module)		
Check sealing connections		

9. PARTS TO BE REPLACED

PN	DESCRIPTION	Replaced	Not Replaced
DMA8133	Catalyst tube: 6 months if the unit runs daily, 1 year if the unit is used rarely. <i>In case of analyse of sample with high organic concentration the lifetime of the catalyst can be less than 6 months.</i>	✓	
DMA8134	Amalgamator: 6 months if the unit runs daily 1 year if the unit is used rarely	✓	
DMA8195A	Hg lamp tri-cell (model 2011): 5 years		✓
DMA8137	Hg lamp dual-cell: 5 years	-	-
70200	Hg trap 1 year		✓
DMA8058/B	Amalgamator coil 6 months/1 year or as soon as the heating is not more homogeneous		✓
DMA8142	Nickel sample boats (set of 40pcs) 2 years if strongly used, replace after 1 year	-	-
DMA8347	Quartz sample boats (set of 10pcs) 2/3 years		✓
DMA8335	Metal sample boat carrier 2 years		✓
SL0108	PL-tube diam. 6/4 mm for internal O ₂ /air supply 2 years		✓
SO0376D	Heating coil for drying/decomposition 2 years		✓

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เอกสารไม่ควบคุม



- The shape of the peak must be regular.
- The distance between Peak Cell 1 and Peak Cell 2 must be between 11 to 15 seconds.

- Results

Pos	Sample name	Amount	State	Height	Hg (ppb)	Cal. Factor	1
1	Stability 10ng		M		100.290	1.0000	
2	Stability 10ng	0.1000g	✓	0.4931	9.9095	99.0951	1.0000
3	Stability 10ng	0.1000g	✓	0.4965	9.9934	99.9335	1.0000
4	Stability 10ng	0.1000g	✓	0.4991	10.059	100.597	1.0000
5	Stability 10ng	0.1000g	✓	0.4976	10.022	100.221	1.0000
6	Stability 10ng	0.1000g	✓	0.5031	10.160	101.602	1.0000

- The obtained absorbance (height) must be > 0.42 in cell 1 for each 100ppb analysis (0.22 with cuvette installed until December 2005, DMA s/n 05120292).
- The relative standard deviation (rsd) is < 3 %.
- After two blanks (after 10ng measurements), the absorbance is < 0.0030 in cell 1(*).

(*) This condition is valid only in case the unit has: catalyst and amalgamator new, conditioned and never use before, sample boat carrier new and/or perfectly cleaned, catalyst flange new and/or perfectly cleaned, cuvette new and/or perfectly cleaned, tubes, silicon joints and o-rings replaced. Otherwise other blanks (more than 2) might be necessary.

- Temperatures & signal profiles

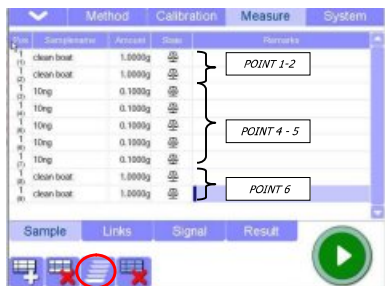
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เอกสารไม่ควบคุม

10. TESTING PROCEDURE

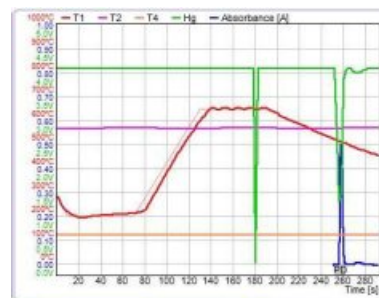
It consists to run some measurements for the evaluation of the analytical performance of the unit, like: absorbance, peaks shape, temperatures, lamp signal and verify the proper working of whole system.

- Run minimum 2 blanks on the same sample boat (quartz if possible) in manner to clean it
- Run blanks until absorbance value (Height) decrease under 0,0030 in cell 1
- Set a fresh and stabilized 100µg/L Hg standard according to the prescriptions reported on the DMA80 User Manual. The quality of the used standard is fundamental for the success of the entire procedure
- Weight approximately 100µg of the fresh 100µg/L – Standard (10ng) and start the analysis as a single measurement mode
- Repeat five times the test
- Run again two blanks measurements



Now, it is possible to evaluate:

- Peaks



- The Hg lamp signal must be between 3,8 and 4,5V and stable. A few minutes after the start of the analysis the lamp does switch off because of the zero detection but then it instantly returns to the original condition. In case of TriCell configuration two green colour graphics are reported. After the zero shuttering the time necessary to return to full signal is longer on TriCell compare to Ducon lamp.
- During the run the catalyst oven temperature must be stable around to 565°C or 515°C.
- The drying and ashing furnace must be follow the set temperature method.
- During the run the Amalgamator furnace temperature must be stable at the stand by temperature (170°C or 145°C). Then at the release step it must raise up to 850/900°C.
- The Cuvette temperature must be stable at approximately 125°C.
- The Hg absorbance peaks must be correctly detected and reported.

11. FINAL REPORT

All screws inserted and tightened	✓
All tubing sealing connections checked, cleaned or replaced and tightened	✓
All heating elements are working	✓
Sensors installed, checked and tightened	✓
Safety devices (thermo switch) fully checked	✓
All cooling fans are functioning	✓
Testing procedure successfully passed	✓
Necessary tools available at customer's site	✓
Last revision of User Manual available at customer's site	✓
Advised customer about care and maintenance instructions	✓

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เอกสารไม่ควบคุม

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เอกสารไม่ควบคุม

Remarks:

Working hours of Service Engineer

Service Engineer Name	Signature	Date
งานนิเทศน์ วัลย์ศรี	งานนิเทศน์ วัลย์ศรี	17-11-2023

Laboratory Manager / Operator
acceptance signature:

Verification Certificate

Certificate No.: 2304455-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Sol Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Equipment: Digestion Unit (Heating Block)
Manufacturer: VELP SCIENTIFICA
Model: DKL20
Serial No.: 213517
ID No.: UAE.WAS.005/2555
Order No.: 2304455
Operation No.: 2304455-001
Date of Receipt: 28 August 2023
Date of Calibration: 28-29 August 2023

Page 1 of 4

Calibrated by Mr. Manee Somsak Specialist
Approved by (Mr. Pheraphat Tuanjit) Manager, Division of Calibration Laboratory Responsible for the Technical Management Team
Date of Issue: 1 September 2023

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

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

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

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เอกสารไม่ควบคุม

Verification Report

Certificate No.: 2304455-001-01
Equipment: Digestion Unit (Heating Block)
Model: DKL20 **Serial No.:** 213517
Resolution: 1 °C **ID No.:** UAE.WAS.005/2555
Manufacturer: VELP SCIENTIFICA
Date of Calibration: 28-29 August 2023

Location: Dry Laboratory (312) , UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (28 ± 1) °C
Relative Humidity (56 ± 3) %
Line Voltage (224 ± 2) Volt

Page 2 of 4

Condition of this results of Calibration:

- This instrument was calibrated by insert standard thermocouples type R into its Digestion blocks and Calibration according to NFI Method W-TE-026 based on BS 4309 : 1968
- The temperature scale used was based on ITS - 90
- All data show below were final values and the initial data may be obtained upon request.

Reference Standard Instrument:

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	899404552/09453	TC23/0048	2-Jun-2024	N.M. Technical Center Laboratory

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

UUC* Description

Time of Record 1 Hour 6 Minute At 380 °C

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

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

เอกสารไม่ควบคุม

FOSS
Customer Service Report

Date: 8 Feb 2024
Customer: UAE
Instrument: DT510

Hours	Travel To Customer	Labour	Travel From Customer
Start	08:00	14:00	16:00
Finish	09:10	14:45	16:30

Application	Special	Job Type	Standard
Normal	Courtesy Visit	Installation	Training
Distributor	PMA Onboarding	Quote	In House
Internal	Warranty	Repair	PM
Digital Service	Sales Support	Remote	Other

PQ/Quote Number: **Contract No.:**

Details of Work / Test	Condition / Status
8 PM DT510 - ตรวจสอบอุณหภูมิ - ตรวจสอบ connection - ตรวจสอบ cable kit, keep out out - ตรวจสอบ cable kit - 30°C - 100°C x 18 min - 30°C - 45°C x 57 min - instrument 419.0 °C x 419.0	OK

Part No.	Batch	Description	Qty
60039452	1.5.09.2023	Cable kit digester	1
10011656	05.09.2023	Temperature control	1

I confirm this report is accurate and complete
Signed FOSS **Signed Customer**
Name **Name**
 Would you be willing to participate in a brief survey in order to tell us how we performed? Email

เอกสารไม่ควบคุม

Verification Report

Certificate No.: 2304455-001-01
Equipment: Digestion Unit (Heating Block)
Model: DKL20 Serial No.: 213517
Resolution: 1 °C ID No.: UAE.WAS.005/2555
Manufacturer: VELP SCIENTIFICA

Date of Calibration: 28-29 August 2023 **Page 3 of 4**

Calibration point: 380 °C

Calibration result:

Table 1: Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.16	378.59	2.0
2	380	380	0.18	378.65	2.0
3	380	380	0.18	381.62	2.0
4	380	380	0.24	380.23	2.0
5	380	380	0.26	379.86	2.0
6	380	380	0.26	380.93	2.0
7	380	380	0.25	381.11	2.0
8	380	380	0.19	382.35	2.0
9	380	380	0.26	381.55	2.0
10	380	380	0.25	380.20	2.0
11	380	380	0.29	382.08	2.0
12	380	380	0.19	382.26	2.0
13	380	380	0.19	382.26	2.0
14	380	380	0.21	382.15	2.0
15	380	380	0.12	382.15	2.0
16	380	380	0.20	381.91	2.0
17	380	380	0.15	381.09	2.0
18	380	380	0.13	381.42	2.0
19	380	380	0.13	381.77	2.0
20	380	380	0.29	382.08	2.0

Note:

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

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

F-CS-012 Revision: 01 Date: 28-04-65

Verification Report

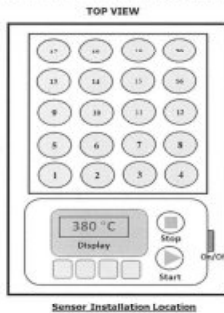
Certificate No.: 2304455-001-01
Equipment: Digestion Unit (Heating Block)
Model: DKL20 Serial No.: 213517
Resolution: 1 °C ID No.: UAE.WAS.005/2555
Manufacturer: VELP SCIENTIFICA

Date of Calibration: 28-29 August 2023 **Page 4 of 4**

Calibration point: 380 °C

Calibration result:

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



Sensor Installation Location

----- End -----

F-CS-012 Revision: 01 Date: 28-04-65

Certificate of Calibration

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

Equipment: Incubator
Manufacturer: Binder
Model: KB 400 E6
Serial No.: 20200000015635
ID No.: UAE.MIC.018/2564
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong,
Bangkok 10260
Location: Microbiology Laboratory (302)
Received Order: 01 April 2024
Calibration Date: 01 April 2024
Ambient Temperature: (28 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Man Pattanapongsaboon
Approved by: 
() Penpan Paipim
(✓) Suwit Intai
() 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.

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

Cert. No.: 24TM647
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	MY49023832	23LM122	TPA	28 Jul 2024

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

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

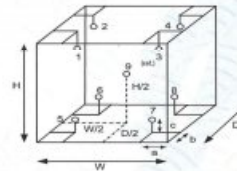
Remark: TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration >: (*) 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 m³

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 %.

-oOo-



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 MY49023632 23LM122 TPA 26 Jul 2024

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

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

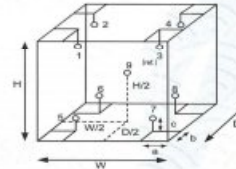
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) 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 m³

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

เอกสารไม่ควบคุม



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



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, Phraekhanong,
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 :
Approved Signatory

() 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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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



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.: 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, 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 :
() Preechaya Tameyakul
(x) Unnophol 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-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	44.483	44.496	44.518	44.528	0.15

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

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

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

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

UUC* : Unit Under Calibration

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

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

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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 certificate is traceable to the International System of Unit.

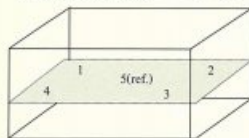
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply (Volt)
	(°C)	(%R.H.)	
Beginning of Calibration	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



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



Certificate of Calibration

Cert. No.: 24TM614
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L414.1407
ID No. : UAE.MIC.006/2558
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 : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hahib
Approved by :
() Porpan Palpin
(x) Suwit Imjai
() Kunchit Promprat

Issue Date : 25 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 : Water Bath
Condition As-Received : Used Item
Reference : 2404-0003OC-7
Procedure Used :-

Cert. No.: 24TM614
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 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	MY44073361	23LM95	TPA	19 May 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	29	63	222
Finished of Calibration	27	66	221

Position :	Ref. Std. S/N.:
1	480398B-006
2	480398B-007
3	480453B-014
4	480453B-015
5(ref.)	480453B-016



Front

เอกสารไม่ควบคุม



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



Calibration Certificate

Certificate No.: 2304203-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Order No.: 2304203
Operation No.: 2304203-001
Date of Receipt: 10 August 2023
Date of Calibration: 10 August 2023

Calibrated by Mr. Worapob Sookkong Scientist
Approved by (Mr. Phraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 15 August 2023

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

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

F-CS-003 Revision: 01 Date: 20-04-65



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



Calibration Report

Certificate No.: 2304203-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP
Date of Calibration: 10 August 2023

Page 2 of 3

Location: 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (28 ± 1) °C
Relative Humidity (65 ± 2) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

1. 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	S25601	NC-22-11-22-178	9-Nov-23	MADETECH INC.
	HTemp140-2	S25602	NC-22-11-22-175	9-Nov-23	MADETECH INC.
	HTemp140-2	R54918	TE 660383-01	8-Apr-24	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

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

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2404-0003OC-7
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM614
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.529	44.462	44.470	44.482	44.489	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor K
44.5	0.077	0.049	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

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

เอกสารไม่ควบคุม

Calibration Report

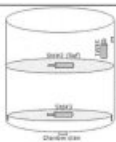
Certificate No.: 2304203-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

Date of Calibration: 10 August 2023

Page 3 of 3

Calibration point: 121 °C

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	27.0	63.5	223.3
Max	28.3	67.3	225.9



Standard at Default:
SPT1 = Attached to the top temperature probe, within 20 mm.
SPT2 = In the upper half of the chamber.
SPT3 = In the chamber door, within 200 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	
121	121.68	121.70	121.66	0.66

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPa			
121	121	121	121	0.10	0.11	0.12	0.23

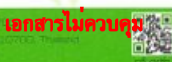
Note

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

2008 ฐานการสนับสนุนและพัฒนาบุคลากร
ศูนย์บริการความรู้ทางวิทยาศาสตร์และเทคโนโลยี
2008 Soi 35, Asoi Asoi Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2-642 8568 Fax: +66(0) 2-642 8545



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.
- Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HTemp140-2	854918	TE 660363-01	8 April 2024	NATIONAL FOOD INSTITUTE
	HTemp140-2	S25901	TE 670033-01	9 November 2024	MADGETECH INC.
	HTemp140-2	S25902	TE 670034-01	9 November 2024	MADGETECH 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

2008 ฐานการสนับสนุนและพัฒนาบุคลากร
ศูนย์บริการความรู้ทางวิทยาศาสตร์และเทคโนโลยี
2008 Soi 35, Asoi Asoi Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2-642 8568 Fax: +66(0) 2-642 8545



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

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

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

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ศูนย์บริการความรู้ทางวิทยาศาสตร์และเทคโนโลยี
2008 Soi 35, Asoi Asoi Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2-642 8568 Fax: +66(0) 2-642 8545



Calibration Report

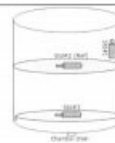
Certificate No.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 808763
Resolution: 0.1 °C ID No.: UAE.MIC.026/2563
Manufacturer: ALP

Date of Calibration: 2 April 2024

Page 3 of 3

Calibration point: 115.0 and 121.0 °C

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



Standard at Default:
SPT1 = Attached to the top temperature probe, within 20 mm.
SPT2 = In the upper half of the chamber.
SPT3 = In the chamber door, within 200 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)	MPa			
115.0	115.0	115.1	115.0	0.08	0.19	0.13	0.48
121.0	121.0	121.1	121.0	0.12	0.17	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

2008 ฐานการสนับสนุนและพัฒนาบุคลากร
ศูนย์บริการความรู้ทางวิทยาศาสตร์และเทคโนโลยี
2008 Soi 35, Asoi Asoi Road, Bang Yai Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2-642 8568 Fax: +66(0) 2-642 8545





Certificate of Calibration

Equipment: Balance
Model: PX623
Serial No. (or ID.): C236754745 (UAE.MIC.055/2565)
Manufacturer: Ohaus
Condition: In condition

Certificate No.: C01234158
Issued Date: 08 December 2023
Job No.: WO-00011251
Page: 1 of 3

Customer: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
Phraekhanong District, Bangkok, THAILAND 10260

Environment Condition: Temperature 25 °C ± 0.5 °C
Humidity 54 %RH ± 1.7 %RH

Calibration Place: United Analyst and Engineering Consultant Co., Ltd. (301 Microbiology Room)
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,
Phraekhanong District, Bangkok, THAILAND 10260

Calibration By: Mr. Adisai Maknoi
Calibration Date: 07 December 2023

The Method used: In-house method, CAL-WI-47, based on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02222534

Adisai Maknoi

(Mr. Adisai Maknoi)
Person in charge

Rungrat Jenkitrakulchai

(Mr. Rungrat Jenkitrakulchai)
Authorized signatory

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

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phraekhanong District, Bangkok 10260
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

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CAL-FM-C01-14: 12 Sep 2022



Certificate No.: C01234158

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After Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value		Reference Points (g)				
		A	B	C	D	E
200 (g)		-	0.001	-0.002	-0.002	0.001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0008
500	0.0008

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0013	2.10
5	5.0001	5.000	0.000	0.0013	2.10
10	10.0001	10.000	0.000	0.0013	2.10
20	20.0000	20.000	0.000	0.0013	2.10
50	50.0001	50.000	0.000	0.0013	2.10
100	100.0001	100.000	0.000	0.0014	2.09
200	200.0004	200.000	0.000	0.0014	2.07
300	300.0005	300.001	0.001	0.0015	2.05
400	400.0006	400.002	0.001	0.0017	2.04
500	500.0006	500.001	0.000	0.0019	2.02
600	600.0007	600.002	0.001	0.0021	2.01

The End of Certificate

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phraekhanong District, Bangkok 10260
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CAL-FM-C01-14: 12 Sep 2022



Certificate No.: C01234158

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Calibration Results:

Before Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value		Reference Points (g)				
		A	B	C	D	E
200 (g)		-	0.000	-0.003	0.000	0.001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0008
500	0.0008

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0013	2.10
5	5.0001	5.000	0.000	0.0013	2.10
10	10.0001	10.001	0.001	0.0013	2.10
20	20.0000	20.000	0.000	0.0013	2.09
50	50.0001	50.000	0.000	0.0013	2.09
100	100.0001	100.001	0.001	0.0013	2.09
200	200.0004	200.002	0.002	0.0014	2.07
300	300.0005	300.002	0.002	0.0015	2.05
400	400.0006	400.004	0.003	0.0016	2.03
500	500.0006	500.008	0.007	0.0019	2.02
600	600.0007	600.009	0.008	0.0021	2.01

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Refer to Certificate No.: C01234158

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Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, UKAS Lab14. Therefore, those parameters have not been assessed separately.

Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule:
- ☐ Choice A Binary Statement for Simple Acceptance Rule ($w=0$), Specific Risk < 50% PFA.
 - ☒ Choice B Non-binary statement with guard band ($w=1$ U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.
 - ☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band ($w=r$ U).
- ; PFA - Probability of False Accept

Rungrat Jenkitrakulchai

(Mr. Rungrat Jenkitrakulchai)
Authorized signatory

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phraekhanong District, Bangkok 10260
Phone: +66 2638 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

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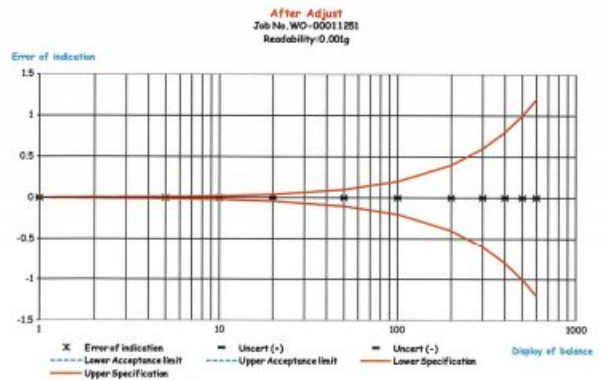
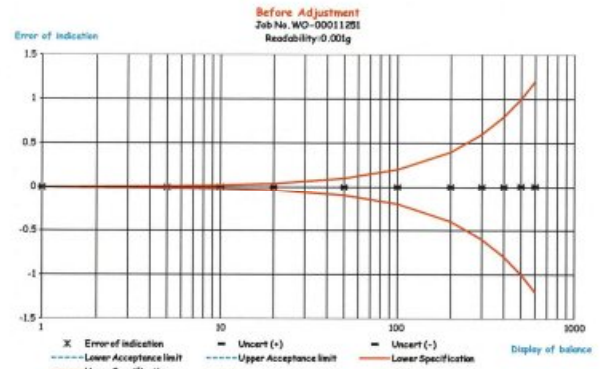
Statements of conformity:

Before Adjustment

Readability: 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (t) g	Conformity
1	0.000	0.0013	0.002	Pass
5	0.000	0.0013	0.010	Pass
10	0.001	0.0013	0.020	Pass
20	0.000	0.0013	0.040	Pass
50	0.000	0.0013	0.100	Pass
100	0.001	0.0013	0.200	Pass
200	0.002	0.0014	0.400	Pass
300	0.002	0.0015	0.600	Pass
400	0.003	0.0016	0.800	Pass
500	0.007	0.0019	1.000	Pass
600	0.008	0.0021	1.200	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.



ชื่อย่อ: DKSH Technology Limited
2533 สุขุมวิท 101/1 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

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Statements of conformity:

After Adjustment

Readability: 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (t) g	Conformity
1	0.000	0.0013	0.002	Pass
5	0.000	0.0013	0.010	Pass
10	0.000	0.0013	0.020	Pass
20	0.000	0.0013	0.040	Pass
50	0.000	0.0013	0.100	Pass
100	0.000	0.0014	0.200	Pass
200	0.000	0.0014	0.400	Pass
300	0.001	0.0015	0.600	Pass
400	0.001	0.0017	0.800	Pass
500	0.000	0.0019	1.000	Pass
600	0.001	0.0021	1.200	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of conformity

ใบตรวจสอบสภาพเครื่องชั่ง

ชนิดเครื่องมือ: Balance

รุ่น: PX623

เลขที่ใบงาน: WO-00011251

หมายเลขเครื่อง: C236754745

ตรวจสอบ (รับ)	รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
		07 Dec 2023	07 Dec 2023	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
General				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสมบูรณ์ชุดกระดกกันชน (Cover)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. ความสมบูรณ์ชุดรองรับน้ำหนัก	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การปรับระดับของน้ำหนักเครื่อง	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การสอบเทียบของน้ำหนัก	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. การแสดงผลของ Display หน้าจอหน้าหลัก	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ชุดรองรับชั่ง (Stopper) / pan support	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ความสะอาดของตัวเครื่องภายนอกและภายใน load cell	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	

หมายเหตุเพิ่มเติมเรื่องข้อบกพร่อง:

Mr. Adisai Maknoi
Service Engineer

ชื่อย่อ: DKSH Technology Limited
2533 สุขุมวิท 101/1 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10110
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/calibration-thailand

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