

ภาคผนวก จ
เอกสารการสอบเทียบเครื่องมือ

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)	Thermo Scientific	G25A 158M	Jiranatee Associates Co., Ltd.	COF-001-66	14 Jul 23	13 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1402	9 May 23	8 May 24	-
3	Aneroid Barometer	Total Suspended Particulate (TSP)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1859	2 Jun 23	1 Jun 24	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP)	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387039	UAE Consultant Co.,Ltd.	07112023	7 Nov 23	6 Nov 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387040	UAE Consultant Co.,Ltd.	07112023	7 Nov 23	6 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-67174-356	UAE Consultant Co.,Ltd.	01112023	1 Nov 23	31 Oct 24	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540065	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540066	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540067	UAE Consultant Co.,Ltd.	09112023	9 Nov 23	8 Nov 24	-
12	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 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	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0113	Thai Meteorological Department	390/23	1 Nov 23	31 Oct 24	-
14	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2311DR0037	Thai Meteorological Department	123/24	13 Mar 24	12 Mar 25	-
15	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2205DT0008	Thai Meteorological Department	122/24	13 Mar 24	12 Mar 25	-
16	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6171	Innovative Instrument Co.,Ltd.	23-ACT-118	4 Aug 23	3 Aug 24	-
17	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{Adn} , L_{Amax} , เสียงรบกวน	Rion, Japan	NL-62 00130355	Sithiporn Associates Co., Ltd.	ACT23199	27 Jun 23	26 Jun 24	-
18	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{Adn} , L_{Amax} , เสียงรบกวน	Rion, Japan	NL-62 00130356	ELECTRICAL SND ELECTRONICS INSTITUTE FOUNDATION FOR INDUSTRIAL DEVELOPMENT	CP20230290EA	3 Aug 23	2 Aug 24	-
19	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{Adn} , L_{Amax} , เสียงรบกวน	Rion, Japan	NL-62 00130357	ELECTRICAL SND ELECTRONICS INSTITUTE FOUNDATION FOR INDUSTRIAL DEVELOPMENT	CP20230291EA	3 Aug 23	2 Aug 24	-
20	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{Adn} , L_{Amax} , เสียงรบกวน	Rion, Japan	NL-62 00391458	Sithiporn Associates Co., Ltd.	ACL24063	18 Jan 24	17 Jan 25	-
21	Sound Level Meter	$L_{Aeq\ 24\ hrs}$, L_{Adn} , L_{Amax} , เสียงรบกวน	Rion, Japan	NL-62 00391494	Sithiporn Associates Co., Ltd.	ACL24064	18 Jan 24	17 Jan 25	-

CERTIFICATE OF CALIBRATION

Certificate No. : COF-001-66

Page 1 of 2 Pages

MEASUREMENT ITEM

: Top Load Orifice

MANUFACTURER

: Graseby GMW

MODEL/TYPE

: G25A

SERIAL NUMBER

: 158M

ID NUMBER

: UAE.EMA2.033/2554

CONDITION AS-RECEIVED

: Used item

CUSTOMER

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

Calibration procedure:

The Orifice gas flow device was calibrated against
Standard Rotary Displacement Meter (Roots
Meter) Model G65/MC/W2-da, The WIL-CL-004
was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The
measurement to recognized the national
standards and to realization of the International
system of units (SI) through the VSL (National
Metrology Institute of Netherlands) via Certificate
number: G2211901

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"

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

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

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.

Measurement Condition : The average values during measurement are 23.7 °C and 52.9 %RH.

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

TABULATION OF RESULTS:

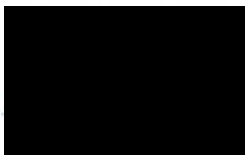
The table on next page give the measured values.

Calibrated by:

☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:



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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

Continuation of Certificate of Calibration Number COF-001-66

Page 2 of 2 Pages

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots 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	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{\text{Orifice}}$ inH ₂ O	γ	Standard Flow [Q_s]
	m^3/min							m^3/min
1	0.700	753.503	23.71	23.16	48.213	1.565	1.248	0.653
2	1.003	753.442	23.75	23.36	52.965	3.186	1.781	0.930
3	1.115	753.274	23.95	23.57	35.125	4.160	2.034	1.059
4	1.175	753.263	23.94	23.73	26.925	4.729	2.169	1.127
5	1.412	753.351	24.03	23.75	25.751	6.920	2.623	1.358

Slope (m): 1.95114

Intercept (b): -0.02950

Correlation coefficient (r): 0.99975

Uncertainty ($k=2$): 0.015 m^3/min

Table 2: The results of Q actual calibration data

Plate	Flow rate	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{\text{Orifice}}$ inH ₂ O	γ	Standard Flow [Q_s]
	m^3/min							m^3/min
1	0.700	753.503	23.71	23.16	48.213	1.565	0.785	0.656
2	1.003	753.442	23.75	23.36	52.965	3.186	1.120	0.934
3	1.115	753.274	23.95	23.57	35.125	4.160	1.281	1.064
4	1.175	753.263	23.94	23.73	26.925	4.729	1.366	1.133
5	1.412	753.351	24.03	23.75	25.751	6.920	1.652	1.365

Slope (m): 1.22204

Intercept (b): -0.01853

Correlation coefficient (r): 0.99975

Uncertainty ($k=2$): 0.015 m^3/min

End of Certificate of Calibration



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

Certificate of Calibration

Certificate No. : 23P1402
Page : 1 of 2

Equipment : U Tube Manometer
Manufacturer: Dwyer
Model : 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.180/2561

Condition As-Received: Used Item
Received Date: 26 April 2023
Calibration Date: 09 May 2023

Reference: 2304-0703WSC Submitted by: United Analyst and Engineering Consultant Co.,Ltd.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

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

81 Soi Udomsuk 41, Sukhumvit Road, 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 CP-P04, using " DKD-R 6-1 ; Calibration of Pressure
Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

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

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussarnee
Issue Date : 11 May 2023

Approved Signatory :

[Signature]
Sura Suwanmasri
Attapol Panurach

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Cert.No.: 23P1402
Page: 2 of 2

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

Range : 0 inH₂O to 36 inH₂O
Scale Interval : 0.1 inH₂O (The Fifth Estimate)

UUC Indication				
Applied Pressure	High-port side	Low-port side	ΔP	Error
(inH ₂ O)	(inH ₂ O)	(inH ₂ O)	(inH ₂ O)	(inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00
4.00	2.00	-2.00	4.00	0.00
6.00	3.00	-3.00	6.00	0.00
8.00	4.00	-4.00	8.00	0.00
10.00	5.00	-5.00	10.00	0.00
12.00	6.00	-6.00	12.00	0.00
14.00	7.00	-7.02	14.02	0.02
16.00	8.00	-8.02	16.02	0.02
18.00	9.02	-9.04	18.06	0.06
20.00	10.02	-10.04	20.06	0.06
22.00	11.00	-11.04	22.04	0.04
24.00	12.02	-12.06	24.08	0.08
26.00	13.02	-13.06	26.08	0.08
28.00	14.02	-14.04	28.06	0.06
30.00	15.02	-15.02	30.04	0.04
32.00	16.00	-16.02	32.02	0.02
34.00	17.00	-17.00	34.00	0.00
35.80	17.96	-17.98	35.94	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 %.

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Certificate of Calibration

Certificate No. : 23P1859

Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer: Barigo

Model : -

Serial No.: -

ID No.: UAE.ANV.123/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

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

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

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

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

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP142	1422505046	MP-0094-23	03 May 2024

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 08 June 2023

Approved Signatory :

[] Sura Suwannasri
[x] Attapol Panurach

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Cert.No.: 23P1859
Page: 2 of 2

Result of calibration:- Without adjustment

Range : 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	958.80	969.94	981.10	991.92	1003.33	1013.39	1024.48	1035.27
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	1.20	0.06	-1.10	-1.92	-3.33	-3.39	-4.48	-5.27

Decreasing Pressure

Applied Pressure (hPa)	1035.27	1023.97	1013.46	1003.54	992.07	981.34	970.00	959.03
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-5.27	-3.97	-3.46	-3.54	-2.07	-1.34	0.00	0.97

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 %.

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Certificate of Calibration

Certificate No.: 23H1201

Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.EMA2.014/2555

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023
to 06 June 2023

Reference: 2305-0919WSC

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

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

Condition of this result of calibration

1. Reference standards instruments:

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

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

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

- National Institute of Standards and Technology (NIST), The United States of America
- Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by: Somchai Dumwor
Issue Date: 07 June 2023

Approved Signatory:

[] Pornthippa Tameyakul
[] Viporn Tantiyawutti

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Cert. No.: 23H1201

Page.: 2 of 2

Result of Calibration:-

Function:

Before Adjustment
Humidity Measurement

Reference Temperature	Standard Humidity	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(%R.H.)	(%R.H.)	(%R.H.)	(±%R.H.)
25.0	40.1	55	14.9	1.6
25.0	60.0	66	6.0	1.7
25.0	80.0	78	-2.0	1.9

Result of Calibration:-

Function:

After Adjustment
Humidity Measurement

Reference Temperature	Standard Humidity	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(%R.H.)	(%R.H.)	(%R.H.)	(±%R.H.)
25.0	40.1	46	5.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	72	-8.0	1.9

Result of Calibration:-

Function:

Without Adjustment
Temperature Measurement

Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.0	-0.944	0.72

UUC* : Unit Under Calibration

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

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MULTI-POINT GAS TEST REPORT

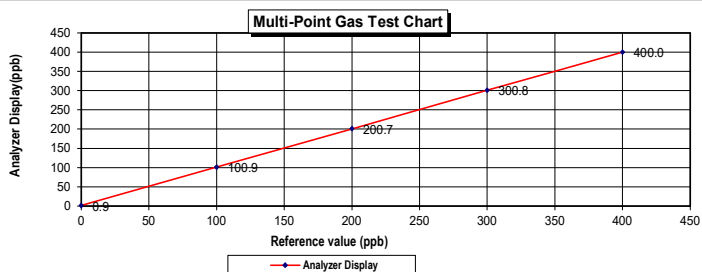
Test Date : Nov 7, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM22387039

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.90	0.90	0.90
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)			0.48



Calculate by

07 Nov 2023

Approve by

08 Nov 2023



MULTI-POINT GAS TEST REPORT

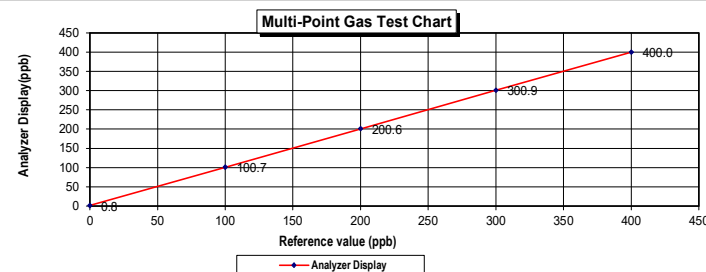
Test Date : Nov 7, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM22387040

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.80	0.80	0.80
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.42



Calculate by

07 Nov 2023

Approve by

08 Nov 2023



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

MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

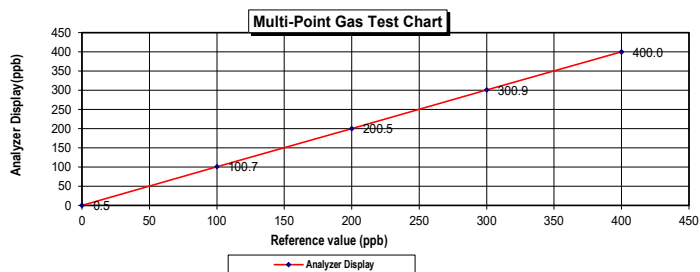
Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C- 67174-356

Standard Gas Concentration

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.5	0.50	0.50	0.50
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.35	



Calculate by

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A01D3	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:	660
Gas Code:	CO,NO,NOX,SO ₂ ,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 800R-12/931, 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 mixture. All concentrations are on a methane basis unless otherwise noted.

Do Not Use This Cylinder below 150 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708098	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D85025	6.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423858102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 16, 2023
NTRM	16011043	CC473277	45.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR6801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR6801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR6801333 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR6801333 SO ₂	FTIR	Jun 03, 2021

Test Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



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

Approved for Release



CERT 3082.01

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MULTI-POINT GAS TEST REPORT

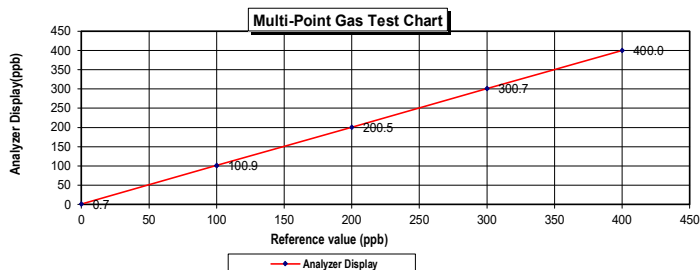
Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540065

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 24, 2024			

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70	0.70
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.41	



Calculate by  Approve by 
03 / Nov / 2023 03 / Nov / 2023



MULTI-POINT GAS TEST REPORT

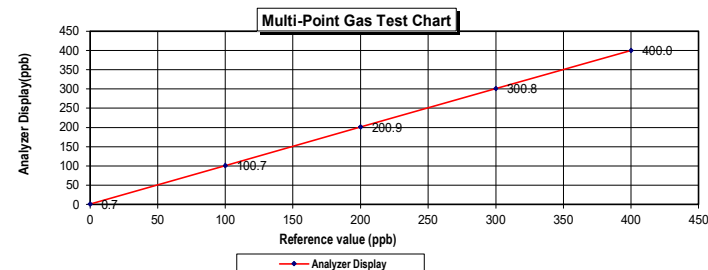
Test Date : Nov 9, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540066

Standard Gas Concentration			Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 24, 2024			

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70	0.70
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.42



Calculate by  Approve by 
03 / Nov / 2023 03 / Nov / 2023



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

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2023

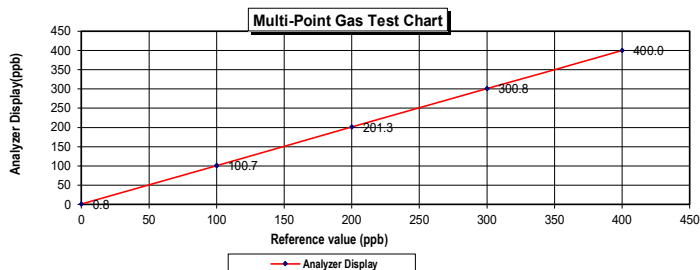
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1180540067

Standard Gas Concentration

Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.68 PPM	Manufacturer : Thermo SCIENTIFIC
Nitric Oxide (NO) 45.94 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 984.8	
Cylinder No. : EB0143262	
Expiration Date : Jun 24, 2024	

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.80	0.80	0.80
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	201.3	1.30	0.65	0.65
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.48



9 / 11 / 66 9 / Nov / 2023

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A01D3	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:	660
Gas Code:	CO,NO,NOX,SO ₂ ,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 800R-12/931, 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 mixture. All concentrations are on a methane basis unless otherwise noted.

Do Not Use This Cylinder below 150 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
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	20061120	CC708098	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D85025	6.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423856102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 16, 2023
NTRM	16011043	CC473277	45.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	986.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR6801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR6801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR6801333 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR6801333 SO ₂	FTIR	Jun 03, 2021

Test Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



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



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 1 November, 2023

Certification No. 390/23

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0113

Wind Sensor 2205DT0113

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 1013.5 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

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

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

Serial Number 110730029 (sensor 120629586)

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Calibrated by : (Signature)

Mr. Watcharapol Subwat

Mechanical Engineer

Vaisala Type PTB220 No. K4320001

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

1 November, 2023

Certification No. 390/23

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
m/sec	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.0
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.0
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.9	0.12
11.02	-	-	-	9.0	2.02
13.01	-	-	-	13.0	0.01
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 : (Signature)

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. 390/23

1 November, 2023

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
1009.68	1009	0.68
1007.51	1007	0.51
1007.13	1007	0.13
1006.90	1007	-0.10
1006.72	1007	-0.28
1006.59	1006	0.59
1006.28	1006	0.28
1006.05	1006	0.05
1005.84	1006	-0.16
1005.48	1005	0.48
1009.61	1010	-0.39
1009.76	1010	-0.24
1009.69	1009	0.69
1009.45	1009	0.45
1009.24	1009	0.24
1006.89	1009	-0.11
1007.66	1008	-0.34
1006.99	1007	-0.01
1006.29	1006	0.29
1004.56	1005	-0.44

Average

0.22

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 390/23

1 November, 2023

Page : 4 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction
757.32	757	0.32
755.69	756	-0.31
755.41	755	0.41
755.24	755	0.24
755.10	755	0.10
755.00	755	0.00
754.77	755	-0.23
754.60	754	0.60
754.44	754	0.44
754.17	754	0.17
757.27	757	0.27
757.36	757	0.36
757.33	757	0.33
757.15	757	0.15
756.99	757	-0.01
756.73	757	-0.27
755.81	756	-0.19
755.90	755	0.30
754.78	755	-0.22
753.48	753	0.48

Average

0.16

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

1 November, 2023

Certification No. 390/23

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.12	45	0.12
30.21	30	0.21
15.42	15	0.42

Calibrated by

Mr. W.

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024

Certification No. 123/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2311DR0037

Wind Sensor 2112DT0102

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 1013.1 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

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

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

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

Serial Number 110730029 (sensor 120629586)

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Barometer Vaisala Type PTB350 No. 44320001

Calibrated by :

Mr. Watcharap

Mechanical E

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 123/24

13 March, 2024

Page : 2 of 5

Standard Ultrasonic Anemometer	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
	m/sec	inches H2O	inches H2O	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by :

Mr. W

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. 123/24

13 March, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1009.59	1009	0.59
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	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	1013	0.63

Average

0.09

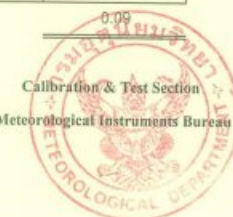
Calibrated by :

Mr. W

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

13 March, 2024

Certification No. 123/24

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
758.66	759	-0.34
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	760	0.42
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.79	762	-0.21
761.48	761	0.48
759.71	760	-0.29
760.28	760	0.28

Average

0.02

Calibrated by :

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

13 March, 2024

Certification No. 123/24

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

Calibrate

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม

THAI METEOROLOGICAL DEPARTMENT



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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 13 March, 2024

Certification No. 122/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2205DR0008

Wind Sensor 2205DT0008

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft 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 120629586)

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

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

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

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

Barometer Vaisala Type PTB330 No. K4320001

Calibrated by

Mr. Watcha

Mechanics

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

13 March, 2024

Certification No. 122/24

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	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	-	-	-	8.9	0.12
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by

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. 122/24

13 March, 2024

Page : 3 of 5

Standard Barometer Pressure	Tested Barometer Pressure	Correction mbar
1009.59	1009	0.59
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1012	-0.54
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	1013	0.63

Average

0.14

Calibrated by

Mr.

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. 122/24

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	759	-0.34
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	760	0.42
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

0.08

Calibrated by

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. 122/24

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

Mr. Watthanasak Sutwari
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAE0,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 06610-2116-5869-1 FAX: 06610-2116-7140



Page 1 of 2

Certificate of Calibration

Customer

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

Certificate No : 23-ACT-118

Request No : Req-2023-1547

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : LARSON DAVIS
Model : CAL150
Serial Number : 6171
ID : UAE.EFM.117/2562

Class : 2
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 21 July 2023
Calibration Date : 4 August 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

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

Note

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

Calibrated By :

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 4 August 2023

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

FM-708 Rev.1 (2019) 001-000-0000-0000-0000-0000

เอกสารไม่ควบคุม

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty ($\pm$ dB)	Acceptance limit Class 2 ($\pm$ dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.14	0.14	-	-	0.13	0.40
114 dB / 1000 Hz	114.15	0.15	-	-	0.13	0.40

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	1.7
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	1.7

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty ($\pm$ %)	Acceptance limit Class 2 ($\pm$ %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.04	-	0.40	3.0
114 dB / 1000 Hz	0.20	-	0.40	3.0

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

OF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL23199
Job No. : VC66AC0067
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).

Continuation of Calibration Certificate

Cert. No. : ACL23199
Job No. : VC66AC0067
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	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

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

Continuation of Calibration Certificate

Cert. No. : ACL23199
Job No. : VC66AC0067
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	11.0
C - weight	15.7
Flat	24.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.0
1000	-0.1	-0.1	-0.1	± 0.7
8000	-0.7	-0.6	-0.6	+ 1.5, - 2.5

Continuation of Calibration Certificate

Cert. No. : ACL23199
Job No. : VC66AC0067
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	0.1	0.0	0.0	±1.0
125	0.0	0.1	0.1	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.1	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	± 0.2

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

Continuation of Calibration Certificate

Cert. No. : ACL23199
Job No. : VC66AC0067
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	137.1	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	133.1	0.1	±0.8
132.0	132.1	0.1	±0.8
131.0	131.1	0.1	±0.8
129.0	129.1	0.1	±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	53.9	-0.1	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	38.9	-0.1	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	26.9	-0.1	±0.8
26.0	25.9	-0.1	±0.8
25.0	25.0	0.0	±0.8

Continuation of Calibration Certificate

Cert. No. : ACL23199
Job No. : VC66AC0067
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	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.8	-0.2	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (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	135.2	-0.2	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

Continuation of Calibration Certificate

Cert. No. : ACL23199
Job No. : VC66AC0067
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	±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

Certificate No.: CP20230290EA
Operation No.: CP2023070044

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: RION
Model/Type: NL-62 (Meter), UC-59L (Microphone), NH-26 (Preamplifier)
Serial No.: 00130356 (Meter), 01891 (Microphone), 00951 (Preamplifier)
ID No.: UAE.EMA2.103/2556
Customer: United Analyst and Engineering Consultant Co.,Ltd.
Address: 81 Soi Udornsuk 41, Sukhumvit Road, Bangchak
Phrakhanong, Bangkok 10260
Received Date: 24 July 2023
Calibrated Date: 3 - 4 August 2023
Issued Date: 7 August 2023
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k)
providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except
with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230290EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: RION
Model/Type: NL-62 (Meter), UC-59L (Microphone), NH-26 (Preamplifier)
Serial No.: 00130356 (Meter), 01891 (Microphone), 00951 (Preamplifier)
ID No.: UAE.EMA2.103/2556
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0034-22	30 October 2023
4) 6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20220080EA	14 February 2024 8 September 2023

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.7

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230290EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
16.3

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	11.3
C-weighting	16.5
Z-weighting	25.1

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

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

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
125	0.0	-0.1	0.0	±1.0
1000	0.1	0.1	0.1	±0.7
8000	-0.2	-0.2	-0.3	+1.5; -2.5

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	-0.2	-0.1	0.0	±1.0
125	0.0	-0.1	0.0	±1.0
250	0.0	-0.1	-0.1	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.1	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.1	0.0	-0.1	+1.5; -2.5
16000	-1.4	-1.4	0.0	+2.5; -16.0

Certificate No.: CP20230290EA

Calibration Report

Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

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

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
130.0	130.0	0.0	±0.8
131.0	131.0	0.0	±0.8
132.0	132.0	0.0	±0.8
133.0	133.0	0.0	±0.8
134.0	134.0	0.0	±0.8
135.0	135.0	0.0	±0.8
136.0	136.0	0.0	±0.8
137.0	137.0	0.0	±0.8

Certificate No.: CP20230290EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	33.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	126.0	0.0	±0.5
	2	109.0	0.0	+1.0 ; -1.5
	0.25	99.9	-0.1	+1.0 ; -3.0
Slow	200	119.6	0.0	±0.5
	2	100.0	0.0	+1.0 ; -3.0
	200	120.0	0.0	±0.5
LAE	2	100.0	0.0	+1.0 ; -1.5
	0.25	90.9	-0.1	+1.0 ; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.2	-0.2	±2.0
Positive half cycle	124.4	124.0	-0.4	±1.0
Negative half cycle	124.4	124.0	-0.4	±1.0



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Certificate No.: CP20230290EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.4	139.5	0.1	±1.5

Function : 11. High-Level Stability

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

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.1

Uncertainty of measurement

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

Remarks: 1. The acceptance limit is for the deviated value.
2. Acceptance limits was IEC61672-3:2013 Class 1.
3. The coverage factor $k = 2.00$

-- End of Report --

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Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280
Tel: +66 2709 4860 Fax: +66 2324 0917



Certificate No.: CP20230291EA

Operation No.: CP2023070045

Certificate of Calibration

Equipment: Sound Level Meter
Manufacturer: RION
Model/Type: NL-62 (Meter), UC-59L (Microphone), NH-26 (Preamplifier)
Serial No.: 00130357 (Meter), 02373 (Microphone), 00391 (Preamplifier)
ID No.: UAE.EMA2.104/2556
Customer: United Analyst and Engineering Consultant Co.,Ltd.
Address: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak
Phrakhanong, Bangkok 10260
Received Date: 24 July 2023
Calibrated Date: 3 - 4 August 2023
Issued Date: 7 August 2023
Calibrated by: Ms. Juntaporn Kunhakom

Approved by: _____

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.
The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k)
providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full except
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Certificate No.: CP20230291EA

Calibration Report

Equipment: Sound Level Meter
Manufacturer: RION
Model/Type: NL-62 (Meter), UC-59L (Microphone), NH-26 (Preamplifier)
Serial No.: 00130357 (Meter), 02373 (Microphone), 00391 (Preamplifier)
ID No.: UAE.EMA2.104/2556
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Pressure: (101.3 ± 1.5) kPa

Method of Calibration :-

IEC 61672-3:2013.

Condition of this result of calibration

1. Reference standards instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Standard microphone	4180	2787490	AA-1024-22	6 November 2023
2) Arbitrary Function Generator	AFG2021	C010063	CK20230040EA	26 June 2024
3) Programmable Attenuator	PA5	2755	EF-0034-22	30 October 2023
4) 6.5 Digit precision multimeter	8846A	9610014	CB20220223EA	14 November 2023
5) Pressure humidity and Temperature Transmitter	PTU301	F0640002	CL1-P230024 CD20230196EA	20 March 2024 23 July 2024
6) Pressure humidity and Temperature Transmitter	PTU301	F0640003	CL1-P230032 CD20230197EA	4 April 2024 23 July 2024
7) Performance Audio Analyzer	U8903B	MY56510003	CB20230038EA CK20220080EA	14 February 2024 8 September 2023

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

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

Reference standards instrument for Acoustic function

- National Institute of Metrology (Thailand)

Reference standards instrument for Electrical function

- National Institute of Metrology (Thailand)

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

Result of Calibration:-

Function : 1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)	Deviation (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.7

Note : Absolute sensitivity was established by the use of the Sound Calibrator RION Type NC-74 S/N : 34615278.

Certificate No.: CP20230291EA

Calibration Report

Function : 2. Self-generated Noise

2.1 Microphone Installed

Measured value (dB)
16.3

2.2 Microphone replaced by the electrical input signal device

Frequency Weighting	Measured value (dB)
A-weighting	12.1
C-weighting	18.5
Z-weighting	27.5

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

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

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

Function : 4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various Frequency Weighting Response Curve			
	C-Weighting (dB)	A-Weighting (dB)	Z-Weighting (dB)	Acceptance limits (dB)
63	0.0	0.0	0.1	±1.0
125	0.1	-0.1	0.0	±1.0
250	0.0	0.0	0.1	±1.0
500	0.0	0.0	0.1	±1.0
1000	0.0	0.0	0.0	±0.7
2000	0.1	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.1	0.1	0.0	+1.5; -2.5
16000	-1.3	-1.3	0.1	+2.5; -16.0



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Function : 5. Frequency and time weighting at 1 kHz

5.1 Frequency weighting at 1 kHz

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

5.2 Time weighting at 1 kHz

Time Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	94.0	0.0	±0.1
Slow	94.0	0.0	±0.1
L _{Aeq}	94.0	0.0	±0.1

Function : 6. Long-Term Stability

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

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

Function : 7. Level Linearity on the reference level range

7.1 Level Linearity on the reference level range, Upper

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
99.0	99.0	0.0	±0.8
104.0	104.0	0.0	±0.8
109.0	109.0	0.0	±0.8
114.0	114.0	0.0	±0.8
119.0	119.0	0.0	±0.8
124.0	124.0	0.0	±0.8
129.0	129.0	0.0	±0.8
130.0	130.0	0.0	±0.8
131.0	131.0	0.0	±0.8
132.0	132.0	0.0	±0.8
133.0	133.0	0.0	±0.8
134.0	134.0	0.0	±0.8
135.0	135.0	0.0	±0.8
136.0	136.0	0.0	±0.8
137.0	137.0	0.0	±0.8



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Certificate No.: CP20230291EA

Calibration Report

7.2 Level Linearity on the reference level range, Lower

Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
29.0	28.9	-0.1	±0.8

Function : 8. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Fast	200	126.0	0.0	±0.5
	2	108.9	-0.1	+1.0 ; -1.5
	0.25	99.9	-0.1	+1.0 ; -3.0
Slow	200	119.6	0.0	±0.5
	2	100.0	0.0	+1.0 ; -3.0
	0.25	90.8	-0.2	+1.0 ; -3.0

Function : 9. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limits (dB)
Complete cycle	125.4	125.2	-0.2	±2.0
Positive half cycle	124.4	124.1	-0.3	±1.0
Negative half cycle	124.4	124.1	-0.3	±1.0



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Certificate No.: CP20230291EA

Calibration Report

Function : 10. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limits (dB)
Positive one-half cycle	Negative one-half cycle		
139.5	139.5	0.0	±1.5

Function : 11. High-Level Stability

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

Time Period to Apply Signal (min)	Reference SPL (dB)	Record SPL at Conclusion of Time Period (dB)	Deviated value (dB)	Acceptance limits (dB)
5	129.0	129.0	0.0	±0.1

Uncertainty of measurement

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

Remarks: 1. The acceptance limit is for the deviated value.
2. Acceptance limits was IEC61672-3:2013 Class 1.
3. The coverage factor $k = 2.00$

-- End of Report --

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Cert. No. : ACL24063

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62 / Microphone UC-59L / Preamplifier NH-26
Serial No.: 00931458 / 01748 / 01553
ID No.: UAE.EFM.025/2564

Condition As Found : GOOD

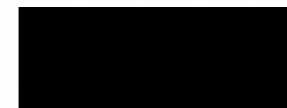
Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 21 DECEMBER 2023
Calibration Date : 18-19 JANUARY 2024
Date of Issue : 22 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :



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

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Cert. No. : ACL24063
Job No. : VC67AC0034
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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).

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Cert. No. : ACL24063
Job No. : VC67AC0034
Pages : 3 of 8

Summary of Measurement Result :

Parameter	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

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Cert. No. : ACL24063

Job No. : VC67AC0034

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)
15.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.8
C - weight	16.5
Flat	23.7

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	-0.7	-0.6	-0.6	± 1.0
1000	0.2	0.2	0.2	± 0.7
8000	0.2	0.2	0.2	+ 1.5, - 2.5

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Cert. No. : ACL24063

Job No. : VC67AC0034

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	0.1	0.0	0.0	±1.0
125	0.1	0.1	0.1	±1.0
250	0.1	0.0	0.0	±1.0
500	0.0	0.1	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	0.0	-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

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Cert. No. : ACL24063
Job No. : VC67AC0034
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	38.9	-0.1	±0.8
34.0	34.0	0.0	±0.8
30.0	29.9	-0.1	±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

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Job No. : VC67AC0034
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	108.0	0.0	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.1	0.1	±0.5

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
One	136.4	136.1	-0.3	±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

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Cert. No. : ACL24063
Job No. : VC67AC0034
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	89.5	0.0	±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

เอกสารควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24064
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62 / Microphone UC-59L / Preamplifier NH-26
Serial No.: 00391494 / 01184 / 01589
ID No.: UAE.EFM.026/2564

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 : 21 DECEMBER 2023
Calibration Date : 18-19 JANUARY 2024
Date of Issue : 22 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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

เอกสารควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24064
Job No. : VC67AC0034
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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).

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Cert. No. : ACL24064
Job No. : VC67AC0034
Pages : 3 of 8

Summary of Measurement Result :

Parameter	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

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Cert. No. : ACL24064
Job No. : VC67AC0034
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)
14.0

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

Frequency Weighting	Measured value (dB)
A - weight	10.4
C - weight	15.5
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.7	0.7	0.7	± 1.0
1000	0.6	0.6	0.6	± 0.7
8000	0.7	0.8	0.8	+ 1.5, - 2.5

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Cert. No. : ACL24064
Job No. : VC67AC0034
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	0.1	0.0	0.0	±1.0
125	0.0	0.0	0.1	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.1	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	± 0.2

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24064
Job No. : VC67AC0034
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	49.1	0.1	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.1	0.1	±0.8
30.0	30.0	0.0	±0.8
29.0	29.1	0.1	±0.8
28.0	28.1	0.1	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	25.1	0.1	±0.8

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Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : ACL24064
Job No. : VC67AC0034
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	1.0 ; -3.0
	2	8	117.0	117.0	0.0	1.0 ; -1.5
	200	800	134.0	134.1	0.1	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.9	-0.1	1.0 ; -3.0
	2	8	108.0	108.0	0.0	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

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	136.1	-0.3	±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

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Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACL24064

Job No. : VC67AC0034

Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-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	136.9	136.9	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

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List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate Chromium Sodium Hydroxide Phosphoric Acid Hydrochloric Acid	Apex Instruments, USA.	XC-572-V 0807047	Envi Equipment Service Co., Ltd.	E23-08072	17 Aug 23	16 Aug 24	-
2	Pre-Test Console	Total Suspended Particulate Chromium Sodium Hydroxide Phosphoric Acid Hydrochloric Acid	Apex Instruments, USA.	XC-572-V 0807048	Envi Equipment Service Co., Ltd.	E23-08069	9 Aug 23	8 Aug 24	-
3	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 2376344	Entech Industrial Solution Co., Ltd.	G 660610	4 Oct 23	3 Oct 24	-
4	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide	Testo	Testo 350 60723967	Entech Industrial Solution Co., Ltd.	G 660472	10 Aug 23	9 Aug 24	-



Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No. : E23-08072

Page : 1 of 6

CERTIFICATE OF CALIBRATION

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

Address : 81 Soi Udumsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Description of Equipment : Console meter

Manufacturer : Apex Instrument

Model Number : XC-572-V

Serial Number : 0807047

ID./Control No. : -

Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH

Cal. Date : 17/08/2023

Issue Date : 17/08/2023

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (IS).

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level

Calibrated by :



Technical Manager

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Certificate No. : E23-08072

Page : 2 of 6

METHOD 5 CONSOLE CALIBRATION USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425 5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2023	09:35 AM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.		SER23-08029		Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure		756.74	mmHg	K _t	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma		0.999		Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P _m)	(V _m)	(V _m)	(t _m)	(t _m)	(V _w)	(V _w)	(t _w)	(t _w)
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.58	13.0	791.0910	791.2310	29	29	162.88294	163.01908	28	28
12.67	13.0	791.2310	791.3710	29	29	163.01908	163.15584	28	28
8.62	26.0	791.3820	791.5220	28	28	163.16666	163.30406	28	28
8.63	26.0	791.5220	791.6620	28	28	163.30406	163.44110	28	28
14.05	40.0	791.6690	791.9490	28	28	163.44794	163.72240	27	27
14.03	40.0	791.9490	792.2290	28	28	163.72240	163.99618	27	27
10.30	70.0	792.2430	792.5230	29	29	164.00884	164.28298	26	26
10.27	70.0	792.5230	792.8030	29	29	164.28298	164.55634	26	26
9.03	90.0	792.8150	793.0950	29	29	164.56056	164.83294	26	26
9.02	90.0	793.0950	793.3750	29	29	164.83294	165.10484	26	26



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METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2023	09:35 AM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER23-08029			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.74		mmHg	K ₁	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data								
Results								
Standardized Data				Dry Gas Meter				
				Calibration Factor		Flowrate		
Dry Gas Meter	Calibration Meter	Value	Variation	Std & Corr	.0212 m ³ /min	Variation		
(V _{m(std)})	(Q _{m(std)})	(V _{w(std)})	(Q _{w(std)})	(Y)	(ΔY)	(Q _{m(std,corr)})	(ΔH _g)	(ΔH _g)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O	
0.136	0.011	0.132	0.010	0.970	-0.001	0.010	51.902	3.446
0.136	0.011	0.132	0.010	0.975	0.003	0.010	52.116	3.660
0.136	0.016	0.133	0.015	0.978	0.007	0.015	47.907	-0.549
0.136	0.016	0.133	0.015	0.975	0.004	0.015	48.345	-0.111
0.273	0.019	0.267	0.019	0.975	0.004	0.019	49.080	0.624
0.273	0.019	0.266	0.019	0.973	0.002	0.019	49.207	0.751
0.275	0.027	0.267	0.026	0.971	0.000	0.026	46.382	-2.075
0.275	0.027	0.266	0.026	0.969	-0.002	0.026	46.345	-2.111
0.276	0.031	0.266	0.029	0.963	-0.008	0.029	46.642	-1.814
0.276	0.031	0.265	0.029	0.962	-0.010	0.029	46.635	-1.821
				0.971	Y Average			ΔH _g Average
						48.456		

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm H₂O).

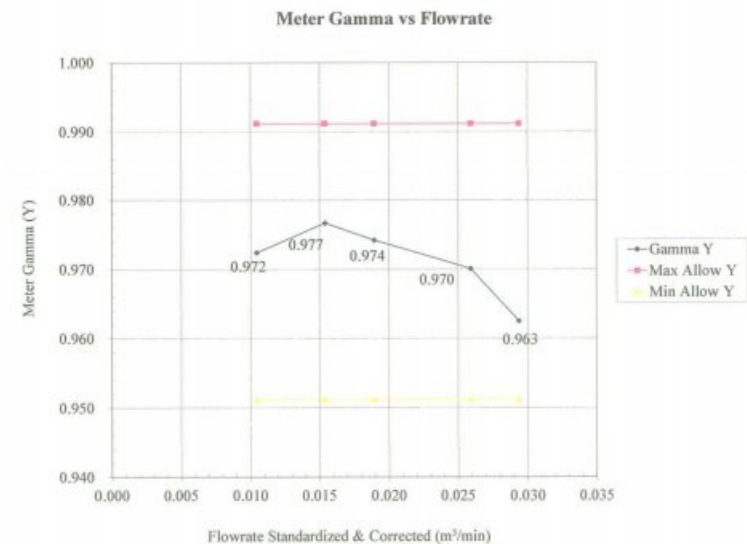


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Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2023	09:35 AM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER23-08029			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.74		mmHg	K ₁	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Date: 17-8-2023

Calibration Reference No: SER23-08029



Console Serial: 0807047

Console Model: XC-572-V

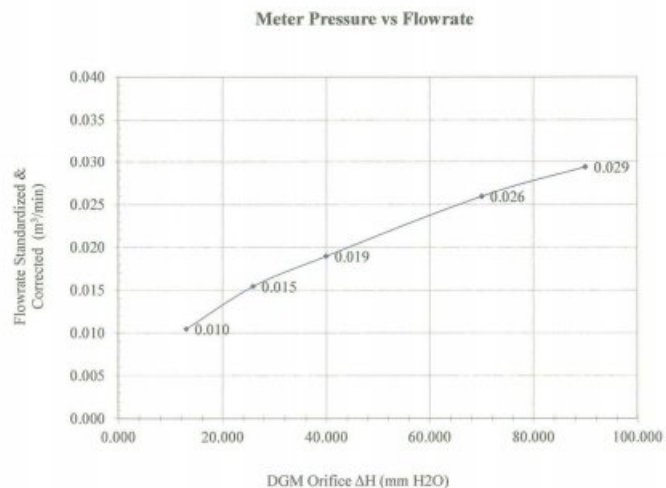


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Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2023	09:35 AM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER23-08029			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.74	mmHg		K ₁	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Date: 17-8-2023

Calibration Reference No: SER23-08029



Console Serial: 0807047

Console Model: XC-572-V



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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	17/08/2023	02:45 PM
Console Serial Number	0807047	Calibration Reference No.	SER23-08029		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00003580	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 19777				

Results										
Console Thermocouple Simulator										
Channel and test point	Meter Box Channel Temperature Reading (°C)									
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0
Stack	-17.0	24.0	37.0	95.0	149.0	259.0	372.0	483.0	595.0	817.0
Aux	-17.0	24.0	37.0	95.0	149.0					
Probe	-17.0	24.0	37.0	95.0	149.0					
Filter	-17.0	24.0	37.0	95.0	149.0					
Exit	-17.0	24.0	37.0							

Stack ± 1.50% Absolute
Probe ± 3.0 °C
Filter ± 3.0 °C

Tolerance Range

Meter ± 3.0 °C
Exit ± 2.0 °C



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Envi Equipment Service Co., Ltd.
110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Rua Thong, Nonthaburi 11110
Tel. 098 362 9152, 089 478 7885
E-mail: sales@envi-ees.com

Certificate No. : E23-08069
Page : 1 of 6

CERTIFICATE OF CALIBRATION

Customer : United Analyst and Engineering Consultant Co., Ltd.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment : Console meter
Manufacturer : Apex Instrument
Model Number : XC-572-V
Serial Number : 0807048
ID./Control No. : -
Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH
Cal. Date : 09/08/2023
Issue Date : 09/08/2023

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (IS).

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of $k=2$, providing a 95% confidence level

Calibrated by :



Technical Manager

เอกสารไม่ควบคุม



Certificate No. : E23-08069
Page : 2 of 6

METHOD 5 CONSOLE CALIBRATION USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425 5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.		SER23-08028		Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure		758.24		K _i	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma		0.999		Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed (Q)	(P _a)	(V _m)	(V _m)	(t _m)	(t _m)	(V _{wi})	(V _{wf})	(t _{wi})	(t _{wf})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.83	13.0	1149.315	1149.455	29	29	160.47814	160.62142	27	27
12.87	13.0	1149.455	1149.595	29	29	160.62142	160.76496	27	27
9.27	26.0	1149.606	1149.746	29	29	160.78130	160.92678	27	27
9.23	26.0	1149.746	1149.886	29	29	160.92678	161.07252	26	26
14.58	40.0	1149.894	1150.174	29	29	161.08058	161.37034	26	26
14.60	40.0	1150.174	1150.454	29	29	161.37034	161.65974	26	26
11.07	70.0	1150.467	1150.747	29	29	161.67304	161.95980	26	26
11.07	70.0	1150.747	1151.027	29	29	161.95980	162.24604	25	25
9.52	90.0	1151.038	1151.318	29	29	162.25684	162.54152	25	25
9.50	90.0	1151.318	1151.598	30	30	162.54152	162.82528	25	25



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METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data								
Results								
Standardized Data				Dry Gas Meter				
				Calibration Factor		Flowrate		
Dry Gas Meter	Calibration Meter	Value	Variation	Std & Corr	.0212 m ³ /min	Variation		
(V _{m(std)})	(Q _{m(std)})	(V _{w(std)})	(Q _{w(std)})	(Y)	(ΔY)	(Q _{m(std)(corr)})	(ΔH _g)	(ΔH _g)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O	
0.137	0.011	0.139	0.011	1.021	-0.001	0.011	48.480	0.343
0.137	0.011	0.140	0.011	1.023	0.001	0.011	48.556	0.419
0.137	0.015	0.142	0.015	1.035	0.014	0.015	49.161	1.024
0.137	0.015	0.142	0.015	1.037	0.016	0.015	48.472	0.335
0.275	0.019	0.283	0.019	1.030	0.008	0.019	47.188	-0.949
0.275	0.019	0.283	0.019	1.029	0.007	0.019	47.414	-0.724
0.276	0.025	0.280	0.025	1.016	-0.005	0.025	48.836	0.699
0.277	0.025	0.281	0.025	1.014	-0.007	0.025	48.850	0.713
0.277	0.029	0.279	0.029	1.007	-0.015	0.029	47.137	-1.000
0.277	0.029	0.278	0.029	1.004	-0.018	0.029	47.277	-0.860
				1.022	Y Average		48.137	ΔH _g Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

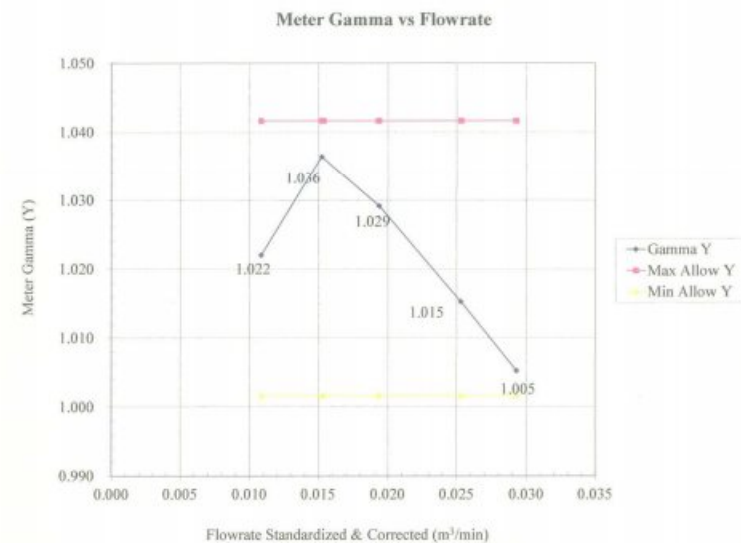
For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm H₂O).



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Date: 9-8-2023 Calibration Reference No: SER23-08028



Console Serial: 0807048

Console Model: XC-572-V

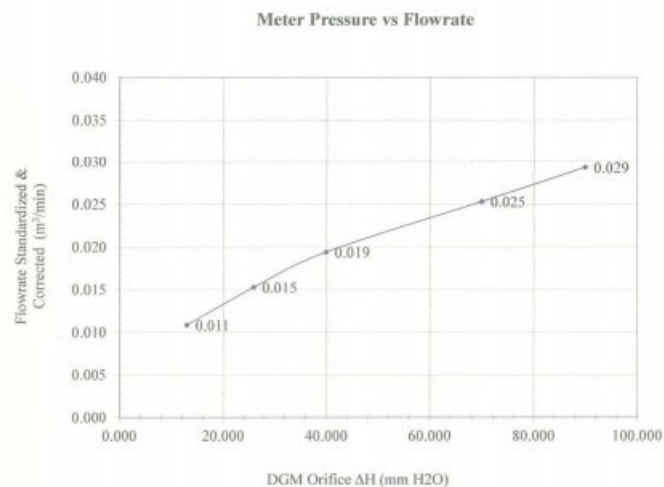


เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24		mmHg	K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Date: 9-8-2023

Calibration Reference No: SER23-08028



Console Serial: 0807048

Console Model: XC-572-V



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	09/08/2023	11:45 AM
Console Serial Number	0807048	Calibration Reference No.	SER23-08028		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00003811	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 08944				

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-19.0	24.0	37.0	92.0	148.0	257.0	370.0	481.0	593.0	815.0	1038.0
Aux	-19.0	23.0	37.0	92.0	147.0						
Probe	-19.0	23.0	37.0	92.0	148.0						
Filter	-19.0	23.0	37.0	92.0	147.0						
Exit	-18.0	23.0	37.0								

Tolerance Range			
Stack	± 1.50%	Absolute	Meter ± 3.0 °C
Probe	± 3.0 °C		Exit ± 2.0 °C
Filter	± 3.0 °C		



เอกสารไม่ควบคุม

Certificate No: G 660610
Date of issue : 05-Oct-23

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Control unit serial no. : 02398589/208
Instrument serial no. : 02376344/208
ID no. or control no. : UAE.EMA2.113/2555
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Customer address : 81 SOI UDOMSUK41,SUKHUMVIT ROAD,BANGCHAK PRAKANONG BANGKOK 10260

Total pages of certificate : 2 Pages
Receiving no. : L-233244
Receiving date. : 28-Sep-23
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 30.34,80.96,201.9 ppm, Nitric Oxide 30.01,151.5,322.5 ppm, Sulphur Dioxide 50.36,100.8,600.8 ppm)

Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory

Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurand multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition.
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 04-Oct-23

Certificate No.: G 660610

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide (NO2) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO2) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitrogen Dioxide (NO2) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.5 °C Humidity : 66.7 %RH Pressure : 1007.5 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,100 ml/min Gas pressure : 1019.4 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.53	0.032	0.15
O2 (%Vol)	10.04	10.09	0.05	0.20
O2 (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1003	1000	-3	12
NO2 (ppm)	30.34	28.2	-2.14	8.0
NO2 (ppm)	80.96	79.4	-1.56	8.0
NO2 (ppm)	201.9	200.8	-1.1	12
NO (ppm)	30.01	28	-2.01	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	325	2.5	12
SO2 (ppm)	50.36	51	0.64	6.0
SO2 (ppm)	100.8	101	0.2	6.0
SO2 (ppm)	600.8	600	-0.8	13

Remark : 1 cmol/mol = 1 %vol, 1 µmol/mol = 1 ppm.

End of Report

Certificate No: G 660472
Date of issue : 11-Aug-23

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Control unit serial no. : 03064673/609
Instrument serial no. : 60723967/609
ID no. or control no. : UAE.EFM.027/2559
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Customer address : 81 SOI UDOMSUK41, SUKHUMVIT ROAD, BANGCHAK, PRAKANONG BANGKOK 10260

Total pages of certificate : 2 Pages
Receiving no. : I-232591
Receiving date. : 04-Aug-23
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 30.34, 80.96, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

Condition of UUC. : Used

Ambient condition : All of the Measurement were carried out the stabilized laboratory

Temperature : 23 ±5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration work instration no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition.
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 10-Aug-23



Certificate No.: G 660472

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	15-Feb-27
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	16-Feb-27
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO ₂) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitrogen Dioxide (NO ₂) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.6 °C Humidity : 68.1 %RH Pressure : 1007.1 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1020.3 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.498	2.55	0.052	0.15
O ₂ (%Vol)	10.04	10.08	0.04	0.20
O ₂ (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1003	999	-4	12
NO ₂ (ppm)	30.34	26.5	-3.84	8.0
NO ₂ (ppm)	80.96	78.4	-2.56	8.0
NO ₂ (ppm)	201.9	204.5	2.6	12
NO (ppm)	30.01	28	-2.01	8.0
NO (ppm)	151.5	152	0.5	8.0
NO (ppm)	322.5	318	-4.5	12
SO ₂ (ppm)	50.36	49	-1.36	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	600.8	599	-1.8	13

Remark : 1 cmol/mol = 1 %vol. 1 µmol/mol = 1 ppm.

End of Report

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA1G0019	Technology Promotion Association (Thailand-Japan)	23CH1226	27 Sep 23	26 Sep 24	-
2	Conductivity Meter	Conductivity	YSI	Pro30 18K100976	Technology Promotion Association (Thailand-Japan)	23CH1488	22 Nov 23	21 Nov 24	-



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.: 23CH1226
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA1G0019
ID No. : UAE.EFM.202/2564(EFM.pH.10/64)
Condition As-Received: Used Item
Received Date : 26 September 2023
Calibration Date : 27 September 2023
Reference : 2309-0881WSC-4
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lernagatrakul

Approved by :

(✓) Saithip Meangmai
() Warakorn Lernagatrakul
() Ponpan Paipim

Issue Date : 2 October 2023

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 23CH1226
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

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

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.986	CPA chem	863833	28 Dec 2023
pH 9.997	CPA chem	913600	14 July 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH		mV	pH		
pH Meter S/N.: HA1G0019	4.00	177.48	177.6	4.01	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	7.00	0.00	0.2	7.00	0.058	2.00
	10.00	-177.48	-177.2	10.01	0.058	2.00

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Cert.No.: 23CH1226

Page.: 3 of 3

Calibration Results**Function : pH Measurement****Performing three buffers standard curve by using buffer nominal pH (4,7,10)**

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: -	4.008	4.01	141.5	0.0079	2.00
	6.986	6.98	-34.9	0.011	2.00
	6.986	7.00	-34.2	0.011	2.00
	9.997	10.01	-205.7	0.0085	2.00

Function : Temperature Measurement**(*) Without adjustment**

This equipment was connected with Temperature Probe;

- Model : 9652

- Serial No. : -

Dimension of probe;

- Length : 103 mm

- Diameter : 16 mm

- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.004	30.0	-0.004	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

-o0o-

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a 1182399TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-9000-29 FAX: 0-2719-9484

Cert.No.: 23CH1488

Page.: 1 of 3

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : YSI
Model : Pro 30
Serial No. : 18K100976
ID No. : UAE EFM.071/2562(ENV.SCT.01/62)
Condition As-Received: Used Item
Received Date : 21 November 2023
Calibration Date : 22 November 2023
Reference : 2311-0721WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure: In-house method :
- CP-CH6 by direct measurement
with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lernagatrakul**Approved by :**(✓) Saitthip Meangmai
() Warakorn Lernagatrakul
() Ponpan Paipim**Issue Date :** 27 November 2023**The Uncertainties are for a confidence probability of approximately 95%**This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.เอกสารไม่ควบคุม
A 0061267



Cert.No.: 23CH1488

Page.: 2 of 3

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	23I1051	05 Sep 2024
2) Ref. Std. Thermometer	4982054	110RC044	23I908	26 July 2024

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

2. Certified Reference Materials :-

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

Conductivity Solution	Manufacturer	Lot No.	Exp. date
1413.0 μ S/cm	CPA Chem	913596	14 July 2024
12.880 mS/cm	CPA Chem	913597	14 July 2024

- Control Conductivity calibration solution temperature by Water bath (25 $\pm$ 0.1) $^{\circ}$ C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 μ S/cm

Conductivity Electrode Serial No.: 18L100008

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ($\pm$)	Coverage factor k
1413.0 μ S/cm	1393 μ S/cm	1413 μ S/cm	9.2 μ S/cm	2.00
12.880 mS/cm	12.36 mS/cm	12.42 mS/cm	0.086 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

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a 1191350



Cert.No.: 23CH1488

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :	PRO 30 COND-T
- Serial No. :	18L100008

Dimension of probe;

- Length :	7 mm
- Diameter :	2.4 mm
- Immersion Depth :	95 mm

Calibration Point ($^{\circ}$ C)	Standard Temperature ($^{\circ}$ C)	UUC* Reading ($^{\circ}$ C)	Error ($^{\circ}$ C)	Uncertainty of Measurement ($\pm$ $^{\circ}$ C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040014	Innovative Instrument Co.,Ltd.	23-TPM-339	14 Jul 23	13 Jul 24	-
2	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040017	Innovative Instrument Co.,Ltd.	23-TPM-342	14 Jul 23	13 Jul 24	-
3	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040009	Innovative Instrument Co.,Ltd.	23-TPM-334	14 Jul 23	13 Jul 24	-
4	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040016	Innovative Instrument Co.,Ltd.	23-TPM-341	14 Jul 23	13 Jul 24	-
5	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040013	Innovative Instrument Co.,Ltd.	23-TPM-338	14 Jul 23	13 Jul 24	-
6	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040018	Innovative Instrument Co.,Ltd.	23-TPM-343	14 Jul 23	13 Jul 24	-

Certificate of Calibration

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

Certificate No : 23-TPM-336
Request No : Req-2023-1488
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEX040011
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 12 July 2023
Calibrated Date : 14 July 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO-GINGO, Model: GT11/RTD180, 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 Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :

Issue Date :

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

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-338

Request No : Req-2023-1488

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.039	20.1	-0.1	0.13
	25.022	25.1	-0.1	0.13
	30.022	30.1	-0.1	0.13
	35.022	35.1	-0.1	0.13
	40.023	40.1	-0.1	0.13
	45.034	45.1	-0.1	0.13
	50.033	50.1	-0.1	0.13
	60.038	60.1	-0.1	0.13
DRY	20.028	20.0	0.0	0.13
	25.028	25.0	0.0	0.13
	30.028	30.0	0.0	0.13
	35.022	35.0	0.0	0.13
	40.023	40.0	0.0	0.13
	45.034	45.0	0.0	0.13
	50.025	50.0	0.0	0.13
	60.037	60.0	0.0	0.13
GLOBE	20.028	20.0	0.0	0.13
	25.029	25.0	0.0	0.13
	30.036	30.0	0.0	0.13
	35.032	35.0	0.0	0.13
	40.032	40.0	0.0	0.13
	45.025	45.0	0.0	0.13
	50.034	50.0	0.0	0.13
	60.036	60.0	0.0	0.13

End of Certificate

Calibrated By :

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

Certificate of Calibration

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

Certificate No : 23-TPM-342
Request No : Req-2023-1488
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEX040017
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 12 July 2023
Calibrated Date : 14 July 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO-GINGO, Model: GT11/RTD180, 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 Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :

Issue Date :

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

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-342

Request No : Req-2023-1488

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.030	20.0	0.0	0.13
	25.034	25.0	0.0	0.13
	30.023	30.0	0.0	0.13
	35.031	35.0	0.0	0.13
	40.023	40.0	0.0	0.13
	45.027	45.0	0.0	0.13
	50.028	50.0	0.0	0.13
	60.040	60.0	0.0	0.13
DRY	20.028	20.0	0.0	0.13
	25.023	25.0	0.0	0.13
	30.022	30.0	0.0	0.13
	35.021	35.0	0.0	0.13
	40.023	40.0	0.0	0.13
	45.036	45.1	-0.1	0.13
	50.027	50.1	-0.1	0.13
	60.042	60.1	-0.1	0.13
GLOBE	20.030	20.0	0.0	0.13
	25.023	25.0	0.0	0.13
	30.021	30.1	-0.1	0.13
	35.021	35.1	-0.1	0.13
	40.026	40.1	-0.1	0.13
	45.026	45.1	-0.1	0.13
	50.026	50.1	-0.1	0.13
	60.042	60.1	-0.1	0.13

End of Certificate

Calibrated By :

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



Certificate of Calibration

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

Certificate No : 23-TPM-334
Request No : Req-2023-1488
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEX040099
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 12 July 2023
Calibrated Date : 14 July 2023

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

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO-GINGO, Model: GT11/ RTD100, SN:
08000037, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No.: QR23-
0494
Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:
Calibration 0292

Note

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

Approved By :

Issue Date :

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



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-334

Request No : Req-2023-1488

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.032	20.1	-0.1	0.13
	25.028	25.1	-0.1	0.13
	30.031	30.1	-0.1	0.13
	35.030	35.1	-0.1	0.13
	40.031	40.1	-0.1	0.13
	45.035	45.1	-0.1	0.13
	50.034	50.1	-0.1	0.13
	60.046	60.1	-0.1	0.13
DRY	20.030	20.0	0.0	0.13
	25.025	25.0	0.0	0.13
	30.029	30.0	0.0	0.13
	35.026	35.0	0.0	0.13
	40.032	40.0	0.0	0.13
	45.034	45.0	0.0	0.13
	50.039	50.0	0.0	0.13
	60.046	60.0	0.0	0.13
GLOBE	20.029	20.0	0.0	0.13
	25.023	25.0	0.0	0.13
	30.029	30.0	0.0	0.13
	35.027	35.0	0.0	0.13
	40.032	40.0	0.0	0.13
	45.030	45.0	0.0	0.13
	50.040	50.0	0.0	0.13
	60.046	60.0	0.0	0.13

End of Certificate

Calibrated By :

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



Certificate of Calibration

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

Certificate No : 23-TPM-341
Request No : Req-2023-1488
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEX040016
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 12 July 2023
Calibrated Date : 14 July 2023

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

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO-GINGO, Model: GT11/ RTD100, SN:
08000037, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No.: QR23-
0494
Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:
Calibration 0292

Note

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

Approved By :

Issue Date :

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



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-341

Request No : Req-2023-1488

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.021	20.0	0.0	0.13
	25.027	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.030	35.0	0.0	0.13
	40.037	40.0	0.0	0.13
	45.034	45.0	0.0	0.13
	50.036	50.0	0.0	0.13
	60.042	60.0	0.0	0.13
DRY	20.021	20.1	-0.1	0.13
	25.027	25.1	-0.1	0.13
	30.035	30.1	-0.1	0.13
	35.037	35.1	-0.1	0.13
	40.038	40.1	-0.1	0.13
	45.036	45.1	-0.1	0.13
	50.037	50.1	-0.1	0.13
	60.044	60.1	-0.1	0.13
GLOBE	20.020	20.1	-0.1	0.13
	25.026	25.1	-0.1	0.13
	30.023	30.1	-0.1	0.13
	35.039	35.1	-0.1	0.13
	40.038	40.1	-0.1	0.13
	45.039	45.1	-0.1	0.13
	50.037	50.1	-0.1	0.13
	60.044	60.1	-0.1	0.13

End of Certificate

Calibrated By :

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

Certificate of Calibration

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

Certificate No : 24-TPM-146
Request No : Req-2024-4541

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSE QUEST
Model : QT-32
Serial Number : TP9020001
Resolution : 0.1 °C
ID Number : UAE-EFM-1212565

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 9 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11/ RTD100, SN: 12000077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No.: QR23-2574

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

Note

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

Approved By :

Issue Date :

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

เอกสารไม่ควบคุม

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-146

Request No : Req-2024-4541

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.000	20.2	-0.2	0.13
	25.000	25.2	-0.2	0.13
	30.000	30.2	-0.2	0.13
	35.000	35.2	-0.2	0.13
	40.000	40.2	-0.2	0.13
	45.000	45.2	-0.2	0.13
DRY	20.000	20.1	-0.1	0.13
	25.000	25.1	-0.1	0.13
	30.000	30.1	-0.1	0.13
	35.000	35.2	-0.2	0.13
	40.000	40.2	-0.2	0.13
	45.000	45.1	-0.1	0.13
GLOBE	20.000	20.2	-0.2	0.13
	25.000	25.2	-0.2	0.13
	30.000	30.2	-0.2	0.13
	35.000	35.2	-0.2	0.13
	40.000	40.2	-0.2	0.13
	45.000	45.2	-0.2	0.13

End of Certificate

Calibrated By :

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

เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 23-TPM-138
Request No : Req-2023-1488

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSE QUEST
Model : QT-34
Serial Number : TEX040013
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 12 July 2023
Calibrated Date : 14 July 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

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

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

Note

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

Approved By :

Issue Date :

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

เอกสารไม่ควบคุม

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-138

Request No : Req-2023-1488

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.007	20.1	-0.1	0.13
	25.000	25.1	-0.1	0.13
	30.000	30.1	-0.1	0.13
	35.004	35.1	-0.1	0.13
	40.042	40.1	-0.1	0.13
	45.004	45.1	-0.1	0.13
DRY	20.007	20.1	-0.1	0.13
	25.000	25.1	-0.1	0.13
	30.000	30.1	-0.1	0.13
	35.004	35.1	-0.1	0.13
	40.042	40.1	-0.1	0.13
	45.004	45.1	-0.1	0.13
GLOBE	20.007	20.1	-0.1	0.13
	25.000	25.1	-0.1	0.13
	30.000	30.1	-0.1	0.13
	35.004	35.1	-0.1	0.13
	40.040	40.1	-0.1	0.13
	45.040	45.1	-0.1	0.13

End of Certificate

Calibrated By :

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

เอกสารไม่ควบคุม



Certificate of Calibration

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

Certificate No : 23-TPM-343
Request No : Ray-2023-1488
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEX040018
Resolution : 0.1 °C
ID Number : -

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 12 July 2023
Calibrated Date : 14 July 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/ RTD100, SN:
08000037, 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 Rehm Co., Ltd., NSC-ONSC Accreditation No.:
Calibration 0292

Note

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

Approved By :

Issue Date :

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuance/Signatory in full.

PM เอกสารไม่ควบคุม



Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 23-TPM-343
Request No : Ray-2023-1488
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ± °C
WET	20.028	19.9	+0.1	0.13
	25.033	24.9	+0.1	0.13
	30.034	29.9	+0.1	0.13
	35.035	34.9	+0.1	0.13
	40.036	39.9	+0.1	0.13
	45.038	44.9	+0.1	0.13
	50.043	49.9	+0.1	0.13
	60.045	59.9	+0.1	0.13
DRY	20.028	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.032	35.0	0.0	0.13
	40.036	40.0	0.0	0.13
	45.040	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
	60.048	60.0	0.0	0.13
GLDRE	20.027	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.0	0.0	0.13
	35.033	35.0	0.0	0.13
	40.033	40.0	0.0	0.13
	45.037	45.0	0.0	0.13
	50.041	50.0	0.0	0.13
	60.046	60.0	0.0	0.13

End of Certificate

Calibrated By :

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuance/Signatory in full.

PM เอกสารไม่ควบคุม

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Primary Flow Calibrator	Calibrate personal pump	TSI.Inc	4146 41462317052	Innovative Instrument Co., Ltd.	23-AFM-122	26 May 23	25 May 24	-
2	Aneroid Barometer	Total Dust Respirable Dust Zinc Oxide Fume Chromium Fume Sodium Hydroxide Sulphuric Acid Chromium Fume Sodium Hydroxide Phosphoric acid Hydrochloric Acid Oil Mist Toluene Xylene Acetone Chromium	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1858	2 Jun 23	1 Jun 24	-
3	Digital Thermo - Hygrometer	Total Dust Respirable Dust Zinc Oxide Fume Chromium Fume Sodium Hydroxide Sulphuric Acid Chromium Fume Sodium Hydroxide Phosphoric acid Hydrochloric Acid	Digicon	TH-02 395034176	Technology Promotion Association (Thailand-Japan)	23H1100	24 May 23	23 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
Workplace									
		Oil Mist Toluene Xylene Acetone Chromium							
4	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	23-ACT-117	4 Aug 23	3 Aug 24	-
5	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143224	Innovative Instrument Co.,Ltd.	23-NDM-178	7 Aug 23	6 Aug 24	-
6	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143226	Innovative Instrument Co.,Ltd.	23-NDM-180	7 Aug 23	6 Aug 24	-
7	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143229	Innovative Instrument Co.,Ltd.	23-NDM-183	7 Aug 23	6 Aug 24	-
8	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143230	Innovative Instrument Co.,Ltd.	23-NDM-184	7 Aug 23	6 Aug 24	-
9	Sound Level Meter	L _{Aeq} 8 hrs* L _{Amax}	Rion, Japan	NL-42 00709670	Sithiporn Associates Co., Ltd.	ACL24061	18 Jan 24	17 Jan 25	-
10	Sound Level Meter	L _{Aeq} 8 hrs* L _{Amax}	Rion, Japan	NL-42 00558212	Sithiporn Associates Co., Ltd.	ACL24100	29 Jan 24	28 Jan 25	-
11	Sound Level Meter	L _{Aeq} 8 hrs* L _{Amax}	Rion, Japan	NL-62 00901739	Sithiporn Associates Co., Ltd.	ACL23151	9 May 23	8 May 24	-
12	Sound Level Meter	L _{Aeq} 8 hrs* L _{Amax}	Rion, Japan	NL-62 00511776	Sithiporn Associates Co., Ltd.	ACL23183	8 Jun 23	7 Jun 24	-
13	Sound Level Meter	L _{Aeq} 8 hrs* L _{Amax}	Rion, Japan	NL-42 01010781	Sithiporn Associates Co., Ltd.	ACL23147	9 May 23	8 May 24	-
14	Sound Level Meter	L _{Aeq} 8 hrs* L _{Amax}	Rion, Japan	NL-42 00409109	Sithiporn Associates Co., Ltd.	ACL24054	18 Jan 24	17 Jan 25	-

Certificate of Calibration

Customer

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

Certificate No : 23-AFM-122

Request No : Req-2023-1071

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : TSI

Model : 4146

Sensor Model : -

Serial Number : 41462317052

Sensor Serial Number : -

ID : -

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 hPa ± 10 hPa

Received Date : 18 May 2023

Calibration Date : 26 May 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	19031011003	Sensidyne	15 June 2023
Temperature meter	GT 11	12000077	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	7 November 2023

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

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 :



Service Calibration Engineer

Approved By :



Calibration Engineer Supervisor

Issue Date : 26 May 2023

Certificate No : 23-AFM-122

Request No : Req-2023-1071

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (L/min)	UUC (L/min)	Error (L/min)	Uncertainty (L/min)
24.80	100.70	0.020	0.021	0.001	0.001
24.80	100.70	0.050	0.050	0.000	0.003
24.80	100.70	0.101	0.098	-0.003	0.003
25.50	100.70	0.202	0.196	-0.006	0.006
25.70	100.60	0.506	0.491	-0.015	0.007
24.70	100.60	1.001	0.982	-0.019	0.014
24.30	100.60	1.701	1.680	-0.021	0.024
24.40	100.60	2.010	1.981	-0.029	0.028
25.00	100.90	3.004	2.966	-0.038	0.042
26.60	100.90	4.002	3.955	-0.047	0.055
26.70	100.90	5.006	4.952	-0.054	0.069

Note

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- 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



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



Certificate of Calibration

Certificate No. : 23P1858

Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer: Barigo
Model : -
Serial No.: -
ID No.: UAE.ANV.124/2550

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: 2305-0919WSC

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

Ambient Temperature: (23 $\pm$ 2) °C

Relative Humidity: (50 $\pm$ 15) %

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

Atmospheric Pressure: 1007 mbar

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

Condition of this result of calibration

1.Reference standards instruments :

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 08 June 2023

Approved Signatory : _____

[] Sura Suwannasri
[x] Attapol Panurach

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Cert.No.: 23P1858

Page: 2 of 2

Result of calibration:- Without adjustment

Range : 960 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval : 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	959.93	970.47	981.93	991.32	1002.29	1011.64	1021.14	1032.30
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	0.07	-0.47	-1.93	-1.32	-2.29	-1.64	-1.14	-2.30

Decreasing Pressure

Applied Pressure (hPa)	1032.30	1021.44	1011.67	1002.36	992.35	981.94	970.49	959.94
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-2.30	-1.44	-1.67	-2.36	-2.35	-1.94	-0.49	0.06

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 %.

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CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H1100

Page : 1 of 2

Equipment : Digital Thermo-Hygrometer

Manufacturer: Digicon

Model : TH-02

Serial No.: 395034176

ID No.: UAE.EFM.183/2565

Condition As-Received: Used Item

Received Date: 18 May 2023

Calibration Date: 22 May 2023
to 24 May 2023

Reference: 2305-0641WSC

Ambient Temperature: (25 $\pm$ 3) °C

Relative Humidity: (50 $\pm$ 20) %

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

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

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

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Chilled Mirror Hygrometer	Dew Master	44730	20563A	14 Jun 2023
2) Handheld Thermometer With Sensor	1521	A5A339	22I1251	12 Oct 2023

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

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

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

Calibrated by : Kraipop Onrat

Issue Date : 25 May 2023

Approved Signatory :

- [☒] Chakrit Waewwanjua
[☐] Pornthippa Tameyakul
[☐] Viporn Tantiyawutti

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Cert. No.: 23H1100

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Humidity Measurement

<u>Reference Temperature</u> (°C)	<u>Standard Humidity</u> (%R.H.)	<u>UUC* Reading</u> (%R.H.)	<u>Error</u> (%R.H.)	<u>Uncertainty of Measurement</u> (±%R.H.)
25.0	40.1	42	1.9	1.3
25.0	50.1	52	1.9	1.6
25.0	60.0	61	1.0	1.6
25.0	70.2	69	-1.2	1.6

Result of Calibration:-

Without Adjustment

Function:

Temperature Measurement

<u>Standard Temperature</u> (°C)	<u>UUC* Reading</u> (°C)	<u>Error</u> (°C)	<u>Uncertainty of Measurement</u> (±°C)
20.014	20.4	0.386	0.42
25.022	25.6	0.578	0.42
30.033	30.2	0.167	0.42
40.000	40.0	0.000	0.42

UUC* : Unit Under Calibration

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

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

Unit Under Calibration Details

Measurement item : Acoustic Calibrator : Class : 1
Manufacturer : SVANTEK : Range : 94 , 114 dB / 1000 Hz
Model : SV 36 : Instrument Status : Used
Serial Number : 107224
ID : UAE.EFM.171/2564

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 21 July 2023
Calibration Date : 4 August 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

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

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

Note

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

Calibrated By :

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 4 August 2023

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

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

Sound pressure level

Calibration Results : Without Adjustment

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

Frequency of Sound pressure level

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

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

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

Note :

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

End of Calibration

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

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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-NDM-178
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement item : Noise Dosimeter : Microphone Class : 2
Manufacturer : SVANTEK : Microphone Model : SV 27
Model : SV 104 : Microphone S/N : 132054
Serial Number : 143234 : Pre-amplifier Model : -
ID : - : Pre-amplifier S/N : -
Resolution : 0.1 dB : Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 12 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-val	188272	21 July 2024	TSE
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	Swaatch	Swa481	131	17 October 2023	WK Electric
Timer	EXTTECH	-	95-ACT	20 March 2024	TPA

Note

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

Calibrated By :

Issue Date : 7 August 2023

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

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Certificate No : 23-NDM-178
Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(Pa ² /s)	(Pa ² /s)	(Pa ² /s)	(Pa ² /s)	(%)		
Calibrator Setting	60	60	3.18	3.13	-1.57	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A	C		
FAST / 55-140	(dB)	(dB)		
STD Setting				
763 Hz	0.0	0.1	0.40	2.0
125 Hz	0.3	0.2	0.40	1.5
250 Hz	-0.2	0.3	0.40	1.5
500 Hz	-0.1	0.3	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.1	0.3	0.40	2.0
4000 Hz	2.4	2.3	0.40	3.0
8000 Hz	-2.9	-2.9	0.40	5.0

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

เอกสารไม่ควบคุม

Certificate No : 23-NDM-178
Request No : Req-2023-1488

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High									
	Ref	(dB)	55.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0
1000 Hz	Level A	(dB)	54.7	59.1	63.5	67.9	72.3	76.7	81.1	85.5
	Error	(dB)	-0.3	-0.9	-1.5	-2.1	-2.7	-3.3	-3.9	-4.5
			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Level A	(dB)	85.5	85.8	86.1	86.4	86.7	87.0	87.3	87.6
	Error	(dB)	0.0	0.3	0.6	0.9	1.2	1.5	1.8	2.1
			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63 Hz	Level A	(dB)	87.8	87.8	87.8	87.8	87.8	87.8	87.8	87.8
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tolerances Limit		(dB)	1.0							
UNCERTAINTY		(dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	5.6	-21, +26
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)		
1000 Hz 110 dB	27	27	0.35	0.35	0.00		
1000 Hz 110 dB	45	45	0.35	0.35	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00	5.6	-21, +26
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63		
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85	5.6	-21, +26
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
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Certificate No : 23-NDM-178
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	5.6	-21, +26
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)		
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00		

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
	Ref	UUC	Ref	UUC	Error		Limit
FAST / A / 55-140							
Calibrator Setting	60	60	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ +41
Burst 1 ms, 100 dB	143	143	1.00	1.01	+1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	UUC	UUC	Different	Limit		
Calibrator Setting	(s)	(Pa ² /s)	(%)	(%)	(%)	
Continuous Rectangle +	20	10.37	0.00	3.7	-21 - +26	
Continuous Rectangle -		10.37				

* 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 Innovative Instrument Co., Ltd.
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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udonrak 41, Sukhewit Road, Bangkhak, Prakanong, Bangkok 10250

Certificate No : 23-NDM-180
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTER
Model : SV 104
Serial Number : 143226
ID :
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone S/N : 132120
Pre-amplifier Model :
Pre-amplifier S/N :
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 0.2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 12 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61251:2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Date calibration	Traceability
Multi-frequency Calibrator	Quest	Quasi-eol	188272	25 July 2024	TSE
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Size Generator	Scansonic	Scansonic	131	12 October 2023	WK Electric
Timer	EXTRECH	-	05-AC7	20 March 2024	TPA

Note

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

Calibrated By :

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

Certificate No : 23-NDM-180
Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.20	+0.63	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation From various Frequency Weighting		UNCERTAINTY	Tolerances
FAST / A55-140	A	C	(± dB)	Limit (± dB)
STD Setting	(dB)	(dB)		
70 Hz	0.0	0.1	0.40	2.0
125 Hz	-0.2	0.3	0.40	1.5
250 Hz	-0.6	-0.1	0.40	1.5
500 Hz	-0.4	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.3	0.7	0.40	2.0
4000 Hz	1.8	1.9	0.40	3.0
8000 Hz	-2.3	-2.4	0.40	3.0

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

Certificate No : 23-NDM-180
Request No : Req-2023-1488

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High									
	Ref	(dB)	95.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0
1000 Hz	Level A	(dB)	84.5	85.1	90.1	100.1	110.0	120.0	130.0	140.0
	Error	(dB)	-0.5	0.1	0.1	0.1	0.0	0.0	0.0	0.0
	Ref	(dB)			88.0	98.0	108.0	118.0	128.0	138.0
8000 Hz	Level A	(dB)			89.0	89.0	93.0	103.0	113.0	123.0
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	0.0
	Ref	(dB)			89.0	89.0	93.0	103.0	113.0	123.0
63 Hz	Level A	(dB)						87.8	95.8	103.8
	Error	(dB)						-0.2	-0.2	-0.2
	Ref	(dB)						87.8	95.8	103.8
Tolerances Limit		(±dB)	1.0							
UNCERTAINTY		(±dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140							
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
1000 Hz 110 dB	27	27	0.35	0.30	0.00	5.6	-21 ~ +26
1000 Hz 110 dB	45	45	0.35	0.30	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	4.02	+0.55		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	-21 ~ +26
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.40	+0.61		

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-180
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140							
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 ~ +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140							
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		
Burst 1 ms, 105 dB	143	143	1.00	1.01	+1.00		

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Different		
FAST / A / 55-140							
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
Continuous Rectangle +	29		10.13		0.00	3.7	-21 ~ +26
Continuous Rectangle -			10.13				

* 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 Innovator Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 23-NDM-183
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement Item : Noise Distometer
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143229
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone SN : 116867
Pre-amplifier Model : -
Pre-amplifier SN : -
Instrument Status : New

Calibration Environment and Details

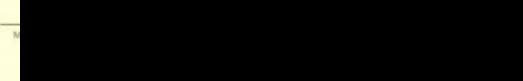
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 12 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61251:2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Size Generator	Scantek	Scantek01	131	12 October 2023	WK Electric
Timer	EXTTECH	-	89-ACT	20 March 2024	TPA

Note

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

Calibrated By : 

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

Certificate No : 23-NDM-183
Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140							
Calibrator Setting	(s)	(s)	(Pa ² /s)	(Pa ² /s)	(%)		
1000 Hz 114 dB	120	120	3.18	3.13	-1.57	3.1	-21 ~ +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 55-140			(± dB)	(± dB)
STD Setting	(dB)	(dB)		
63 Hz	0.1	0.2	0.40	2.0
125 Hz	-0.5	0.0	0.40	1.5
250 Hz	-0.6	-0.1	0.40	1.5
500 Hz	-0.3	0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.1	0.5	0.40	2.0
4000 Hz	1.5	1.6	0.40	3.0
8000 Hz	-1.9	-2.0	0.40	3.0

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

Certificate No : 23-NDM-183
Request No : Req-2023-1488

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High									
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0
1000 Hz	Level A	(dB)	54.9	80.1	90.1	100.0	110.0	120.0	130.0	140.0
	Error	(dB)	-0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	99.9	108.9	117.9	126.9	135.9
	Level A	(dB)			89.0	99.0	108.0	117.0	126.0	135.0
	Error	(dB)			0.1	0.1	0.0	0.0	0.0	0.1
63 Hz	Ref	(dB)						87.8	95.8	103.8
	Level A	(dB)						87.8	95.8	103.8
	Error	(dB)						0.0	0.0	0.0
Tolerances Limit		(+dB)	1.0							
UNCERTAINTY		(+dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140							
Calibrator Setting	(0)	(0)	(Pa ² /s)	(Pa ² /s)	(%)		
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.99	-0.50		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	-21, +26
1000 Hz 120 dB	90	90	16.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

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

Certificate No : 23-NDM-183
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140							
Calibrator Setting	(0)	(0)	(Pa ² /s)	(Pa ² /s)	(Pa ² /s)	(Pa ² /s)	(Pa ² /s)
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.032	+0.29 -0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140							
Calibrator Setting	(0)	(0)	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	0.99	-2.00		-29 - +41
Burst 1 ms, 105 dB	143	143	1.00	0.99	-1.00		-29 - +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	UUC	UUC	Different			Limit
Calibrator Setting	(s)	(Pa ² /s)	(%)	(%)	(%)	
Continuous Rectangle +	29	10.11	0.86	3.7	-21 - +26	
Continuous Rectangle -		10.13				

* 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 Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udonrak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 23-NDM-184
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement Item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143250
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone S/N : 110996
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 12 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multi-frequency Calibrator	Quant	Quant-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Size Generator	Svantech	Svantech	131	13 October 2023	WK Electric
Timer	EXTRECH	-	05-AC7	29 March 2024	TPA

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

Calibrated By : [Signature]
Issue Date : 7 August 2023

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

Certificate No : 23-NDM-184
Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140							
Calibrator Setting	(0)	(0)	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.57	3.1	-21, +26

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

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting				
93 Hz	0.4	0.3	0.40	2.0
125 Hz	-0.3	0.2	0.40	1.5
250 Hz	-0.3	0.2	0.40	1.5
500 Hz	0.0	0.4	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.1	0.5	0.40	2.0
4000 Hz	1.4	1.3	0.40	3.0
8000 Hz	-2.0	-2.0	0.40	5.0

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-184
Request No : Req-2023-1488

3. Linearity of response to steady signals

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

UUC Setting	FAST / A / High									
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0
1000 Hz	Level A	(dB)	54.7	80.5	90.1	100.0	110.0	114.0	120.0	129.9
	Error	(dB)	-0.3	0.5	0.1	0.0	0.0	0.0	0.0	-0.1
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9
	Error	(dB)			0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	95.8	103.8
	Level A	(dB)						87.8	95.8	103.8
	Error	(dB)						0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0							
UNCERTAINTY		(±dB)	0.3							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(dB)	(dB)	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Calibrator Setting	(dB)	(dB)					
1800 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21 ~ +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
900 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	1.98	-1.00		
1000 Hz 120 dB	36	36	4.00	3.94	-1.50		
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6	-21 ~ +26
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

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เอกสารไม่ควบคุม

Certificate No : 23-NDM-184
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(dB)	(dB)	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Calibrator Setting	(dB)	(dB)					
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-0.29 ~ +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(dB)	(dB)	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Calibrator Setting	(dB)	(dB)					
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	990	990	1.00	0.98	-2.00		-20 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Different		
FAST / A / 55-140	(dB)	(dB)	(Pa ² /s)	(Pa ² /s)	(%)	(%)	(%)
Calibrator Setting	(dB)	(dB)					
Continuous Rectangle +	28		10.13		0.00	3.7	-21 ~ +26
Continuous Rectangle -			10.13				

* 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 Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

450-451/1 Srinthorn Road, Bangburum, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24061
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709670 / 188531 / 01221
ID No.: UAE.EFM.022/2564

Condition As Found : GOOD

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

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

Received Date : 21 DECEMBER 2023
Calibration Date : 18-19 JANUARY 2024
Date of Issue : 22 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

450-451/1 Srinthorn Road, Bangburum, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24061
Job No. : VC67AC0034
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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 test 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).

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24061
Job No. : VC67AC0034
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Srinthorn Road, Bangbunru, Bangkok, 10700 Thailand
Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24061
Job No. : VC67AC0034
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)	93.9	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	12.0
C - weight	18.2
Flat	23.9

3. Acoustical signal tests of frequency weightings

Mean 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	0.0	0.0	0.0	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	3.0	3.1	3.1	±5.0

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CALIBRATION LABORATORY

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Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24061
Job No. : VC67AC0034
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	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

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	± 0.3

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Cert. No. : ACL24061
Job No. : VC67AC0034
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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Cert. No. : ACL24061
Job No. : VC67AC0034
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

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

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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Cert. No. : ACL24061
Job No. : VC67AC0034
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive	Negative		
one-half cycle	one-half cycle		
89.5	89.5	0.0	±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	137.1	-0.1	±0.3

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

End of Calibration Certificate

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Cert. No. : ACL24100
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00558212 / 157973 / 48067
ID No.: UAE.EFM.044/2558

Condition As Found : GOOD

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

Location : -

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

Received Date : 18 JANUARY 2024
Calibration Date : 29-30 JANUARY 2024
Date of Issue : 02 FEBRUARY 2024

Calibrated by : Nadhakorn Pisutpaisan

Approved by :

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

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Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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).

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Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 3 of 8

Summary of Measurement Result :

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

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Cert. No. : ACL24100
Job No. : VC67AC0057
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)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.7

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

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	19.3
Flat	25.0

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	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.0	1.1	1.1	±5.0

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Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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	94.0	0.0	± 0.3

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Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
135.0	135.0	0.0	±1.1
134.0	134.0	0.0	±1.1
133.0	133.0	0.0	±1.1
132.0	132.0	0.0	±1.1
131.0	131.0	0.0	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.1	0.1	±1.1
29.0	29.1	0.1	±1.1
28.0	28.2	0.2	±1.1
27.0	27.2	0.2	±1.1
26.0	26.3	0.3	±1.1
25.0	25.3	0.3	±1.1

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Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	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
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.9	-0.5	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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Cert. No. : ACL24100
Job No. : VC67AC0057
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.7	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

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Cert. No. : ACL23151
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62 / Microphone UC-59L / Preamplifier 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 : Natchakorn Pisuapaisan

Approved by :

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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	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).

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Continuation of Calibration Certificate

Cert. No. : ACL23151
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	✓	-	0.4	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

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Continuation of Calibration Certificate

Cert. No. : ACL23151
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)
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)	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

Continuation of Calibration Certificate

Cert. No. : ACL23151
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	0.1	-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	-1.3	+ 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

Continuation of Calibration Certificate

Cert. No. : ACL23151
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	137.1	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

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	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
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	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

11. Overload indication

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



Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-62 / Microphone UC-591 / 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 UDOMSUKE 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHAMONG 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 : Nathakorn Pisutpaisan

Approved by :

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

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

Continuation of Calibration Certificate

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	✓	-	0.2	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

Continuation of Calibration Certificate

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 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
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

Continuation of Calibration Certificate

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

Continuation of Calibration Certificate

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

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	±0.5

9. Tone burst response

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

10. Peak C sound level

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

11. Overload indication

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



Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01010781 / 194536 / 14659
ID No.: UAE.EFM.084/2565

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 : Nathakorn Pisutpaisan

Approved by :

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QF-TS12-04-04-020664

เอกสารไม่ควบคุม

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 :

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

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓		0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	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

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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	17.1
Flat	22.8

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)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.4	0.5	0.5	±5.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

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)			Acceptance Limits
	Flat	C-weight	A-weight	
63	-0.1	0.0	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

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	94.0	0.0	± 0.3

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00409109 / 189688 / 90554
ID No.: UAE.EFM.013/2564

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 : 21 DECEMBER 2023
Calibration Date : 18-19 JANUARY 2024
Date of Issue : 22 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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

เอกสารไม่ควบคุม

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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-62KAI	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).

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Srinthorn Road, Bangburnu, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24054
Job No. : VC67AC0034
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

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CALIBRATION LABORATORY

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Tel. +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24054
Job No. : VC67AC0034
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)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.7

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

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.2
Flat	24.0

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	0.0	0.0	0.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	2.5	2.6	2.6	±5.0

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Tel. +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24054
Job No. : VC67AC0034
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

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	94.0	0.0	± 0.2

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

459-459/1 Srinthorn Road, Bangburnu, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24054
Job No. : VC67AC0034
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.3
136.0	136.0	0.0	± 1.3
135.0	135.0	0.0	± 1.3
134.0	134.0	0.0	± 1.3
133.0	133.0	0.0	± 1.3
132.0	132.0	0.0	± 1.3
131.0	131.0	0.0	± 1.3
129.0	129.0	0.0	± 1.3
124.0	124.0	0.0	± 1.3
119.0	119.0	0.0	± 1.3
114.0	114.0	0.0	± 1.3
109.0	109.0	0.0	± 1.3
104.0	104.0	0.0	± 1.3
99.0	99.0	0.0	± 1.3
94.0	94.0	0.0	± 1.3
89.0	89.0	0.0	± 1.3
84.0	84.0	0.0	± 1.3
79.0	79.0	0.0	± 1.3
74.0	74.0	0.0	± 1.3
69.0	69.0	0.0	± 1.3
64.0	64.0	0.0	± 1.3
59.0	59.0	0.0	± 1.3
54.0	54.0	0.0	± 1.3
49.0	49.0	0.0	± 1.3
44.0	44.0	0.0	± 1.3
39.0	38.9	-0.1	± 1.3
34.0	34.0	0.0	± 1.3
30.0	29.9	-0.1	± 1.3
29.0	28.9	-0.1	± 1.3
28.0	27.9	-0.1	± 1.3
27.0	26.9	-0.1	± 1.3
26.0	25.9	-0.1	± 1.3
25.0	24.9	-0.1	± 1.3

เอกสารไม่ควบคุม

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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 Tel: +66 2433 8331 Email: calibration@sithiporn.com



Cert. No. : ACL24054
 Job No. : VC67AC0034
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	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
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-0.8	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Banglumnu, Bangkok, 10700 Thailand
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Cert. No. : ACL24054
 Job No. : VC67AC0034
 Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	(dB)	(dB)
89.5	89.7	0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Air Quality Analysis									
1	Analytical Balance (Readability 0.1 mg)	Total Dust Respirable Dust	Mettler-Toledo	MS204TS/00 C252436235	Mettler Toledo (Thailand) Co., Ltd.	TH2036-017- 050623-ACC-TH	6 May 23	5 May 24	-
2	Analytical Balance (Readability 0.001 mg)		Mettler-Toledo	XPE205 / B748058497	Mettler Toledo (Thailand) Co., Ltd.	TH3067-038- 092023-ACC-TH	20 Sep 23	19 Sep 24	-
3	UV-VIS Spectrophotometer	Sodium Hydroxide	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP23-021	20 May 23	18 May 24	-
4	Ion Chromatrography Anion (IC)	Sulphuric Acid, Phosphoric acid Hydrochloric Acid	Dionex	DionexAquionRFIC / 220380031	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#1047)	27 Apr 23	26 Apr 24	-
5	Atomic Absorption Spectrophotometer (AAS)	Zinc Oxide Fume, Chromium Fume Chromium	Perkin Elmer	PinAAcle 900F / PFBS20031902	Perkin Elmer Co.,Ltd.	PM Service No. WO-02273773	26 Jun 23	24 Jun 24	-
6	Gas Chromatrography (GC)	Toluene, Xylene, Acetone	Agilent Technologies	System ID:CN11021007 7890 / CN11021007	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	21 Feb 24	19 Feb 25	-

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

Calibration Certificate

Certificate No.: 2402420-003-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: MS204TS/00

Serial No.: C252436235

ID No.: UAE.AIR.023/2566

Order No.: 2402420

Operation No.: 2402420-003

Date of Receipt: 19 April 2024

Date of Calibration: 19 April 2024

Calibrated by Mr. Pheraphat Tuanjit
Scientist
Approved by [Signature]
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

2009 ถนนสุขุมวิท 35 แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10110 เอกสารไม่ควบคุม
2009 Soi 35, Asoke-Annam Road, Bang Na Khan Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel +66(0)2 2452 8585 Fax +66(0)2 2452 8545

nfi.com

Calibration Report

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

Page 2 of 3

Date of Calibration: 19 April 2024

Environment Condition: Ambient Temperature: 21.7 ± 1.5 °C Relative Humidity: 65 ± 5.7 %

Place of Calibration: Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibrations:

1. Calibration Method: NFI Method W-MA-001 In House Method based on UKAS Lab 31 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1.000mg	15880	TCS	PC2111005	28 November 2024
Standard Weight Class E2	1.000g	15882	TCS	PC2111005	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH.010/23	Quality Room	QR24-0482	4 March 2025

3. This certificate is traceable to SI UNIT

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

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

Calibration Results:

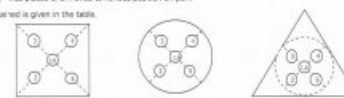
1. Repeatability of Reading:

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

2. Off-Center Error:

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

The balance reading observed is given in the table.



1	2	3	4	5	6	7	8	9	10
(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0005	100.0006	100.0003	100.0006	100.0003	100.0005	100.0005	100.0005	100.0005	100.0005

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

2009 ถนนสุขุมวิท 35 แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10110 เอกสารไม่ควบคุม
2009 Soi 35, Asoke-Annam Road, Bang Na Khan Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel +66(0)2 2452 8585 Fax +66(0)2 2452 8545

nfi.com

Calibration Report

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

Date of Calibration: 19 April 2024

Page 2 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.00000	0.0000	0.0000	0.000094	2.00
0.1	0.10000	0.1000	0.0000	0.000094	2.00
1	0.99998	1.0000	0.0000	0.000097	2.00
5	4.99997	5.0000	0.0000	0.000096	2.00
10	10.00002	10.0000	0.0000	0.00012	2.00
20	20.00003	20.0000	-0.0001	0.00014	2.00
30	30.00000	30.0000	-0.0003	0.00012	2.00
40	40.00000	40.0000	-0.0003	0.00017	2.00
50	50.00000	50.0000	-0.0003	0.00017	2.00
100	99.99997	100.0006	-0.0006	0.00017	2.00
150	149.99994	150.0012	-0.0013	0.00022	2.00
200	200.00001	200.0015	-0.0015	0.00028	2.00

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 %.

***** End *****

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

2009 ถนนสุขุมวิท 35 แขวงคลองตันเหนือ เขตวัฒนา กรุงเทพมหานคร 10110 เอกสารไม่ควบคุม
2009 Soi 35, Asoke-Annam Road, Bang Na Khan Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel +66(0)2 2452 8585 Fax +66(0)2 2452 8545

nfi.com

Calibration Certificate ID
TH0007-008-000023-ACC-TN

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.
849/4 - 849/5 Lualaba Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServiceSupport@mtl.com

IAC-MRA
NAC-180-18 13025
CALIBRATION 0002

Accuracy Calibration Certificate

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udomsuk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong
Zip / Postal: 10260
State / Province: Bangkok
Order Number: [Barcode]
Contact: Suwit Chotnook

Weighing Device

Manufacturer: Mettler Toledo
Model: XPE205
Serial No.: B74805697
Building: N/A
Floor: 4
Room: Calibration Laboratory
Instrument Type: Weighing Instrument
Asset Number: UAE.CAL.0042561
Terminal Model: PEAT
Terminal Serial No.: B74805697
Terminal Asset No.: N/A

Range	Max. Capacity	Repeatability (g)
1	220 g	0.00001 g

Procedure

Calibration Guidelines: EURAMET cg-18 v. 4.0 (11/2015)

METTLER TOLEDO Work Instruction: CPW000203

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/typical of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature	Humidity
As Found	Start: 21.8 °C End: 21.8 °C	Start: 41.1 % End: 45.7 %
As Left	Start: 21.6 °C End: 21.3 °C	Start: 45.3 % End: 43.8 %

As Found Calibration Date: 20-Sep-2023
As Left Calibration Date: 20-Sep-2023
Issue Date: 20-Sep-2023

Calibrator:

Approved Signatory:

Technician [Signature]

Software Version: 1.023.37
Report Version: 2.0.14
Form Number: F1002

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Page 1 of 5

เอกสารไม่ควบคุม

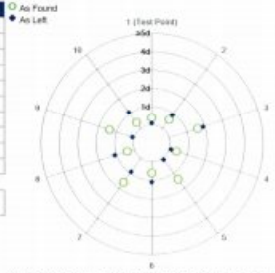
Measurement Results

Repeatability

Test Load: 100 g

Position	As Found	As Left
1	99.99992 g	100.00005 g
2	99.99991 g	100.00004 g
3	99.99990 g	100.00003 g
4	99.99992 g	100.00005 g
5	99.99993 g	100.00005 g
6	99.99991 g	100.00006 g
7	99.99990 g	100.00004 g
8	99.99992 g	100.00005 g
9	99.99993 g	100.00005 g
10	99.99992 g	100.00005 g

Standard Deviation	0.000011 g	0.000010 g
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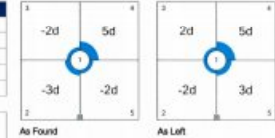
The "10" in the graph represents the readability of the range interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	99.99992 g	100.00010 g
2	99.99989 g	100.00008 g
3	99.99990 g	100.00012 g
4	99.99997 g	100.00015 g
5	99.99990 g	100.00013 g

Maximum Deviation	0.00005 g	0.00005 g
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The "10" in the graph represents the readability of the range interval in which the test was performed.

เอกสารไม่ควบคุม

Error of Indication

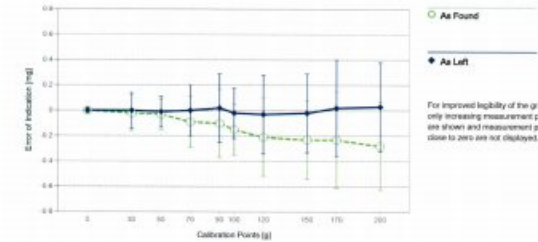
As Found

Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.022 mg	2
2	9.99999 g	9.99999 g	0.022 mg	2
3	30.00001 g	29.99999 g	0.14 mg	2
4*	50.00001 g	49.99999 g	0.12 mg	2
5*	70.00003 g	69.99997 g	0.20 mg	2
6	90.00005 g	89.99995 g	0.27 mg	2
7*	100.00007 g	99.99993 g	0.25 mg	2
8*	120.00008 g	119.99992 g	0.31 mg	2
9*	150.00008 g	149.99992 g	0.31 mg	2
10	170.00009 g	169.99991 g	0.38 mg	2
11	199.99998 g	199.99998 g	0.35 mg	2

As Left

Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.021 mg	2
2	9.99999 g	9.99999 g	0.022 mg	2
3	30.00001 g	29.99999 g	0.14 mg	2
4*	50.00001 g	49.99999 g	0.12 mg	2
5*	70.00003 g	69.99997 g	0.20 mg	2
6	90.00005 g	89.99995 g	0.27 mg	2
7*	100.00007 g	99.99993 g	0.25 mg	2
8*	120.00008 g	119.99992 g	0.31 mg	2
9*	150.00008 g	149.99992 g	0.31 mg	2
10	170.00009 g	169.99991 g	0.38 mg	2
11	199.99998 g	199.99998 g	0.35 mg	2

*The calculated uncertainty was replaced by the GNC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the GNC value.



The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor k - which can be larger than 2 according to EURAMET cg-16. The value of the measured lies within the assigned range of values with a probability of approximately 95%.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

เอกสารไม่ควบคุม

The results of this calibration certificate relate only to the calibrated item.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	W952	Date of Issue:	22-Nov-2022
Certificate Number:	182272	Calibration Due Date:	21-May-2024

Thermo Hygrometer

Equipment No.:	IN155	Date of Issue:	19-May-2023
Certificate Number:	SG-44-00416/66	Calibration Due Date:	18-May-2024

Remarks

FACT adjustment functionality activated
Value of the built-in weight adjusted
Equipment condition: Good
Next calibration according to customer's procedure
Calibration date not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

เอกสารไม่ควบคุม

Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use:	$1.8 \cdot 10^{-4} / K$
Temperature range on site for the evaluation of the measurement uncertainty in use:	3 K

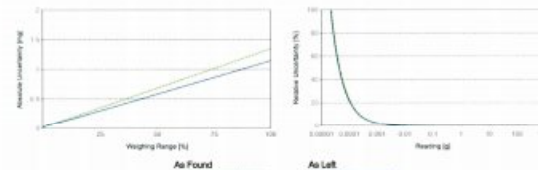
Uncertainty of Uncertainty Equation

Range			As Found	As Left
	g	Max		
1	0.00001 g	233 g	$U_1 = 0.023 \text{ mg} + 0.00002 \text{ mg/g} \cdot R$	$U_1 = 0.021 \text{ mg} + 0.00011 \text{ mg/g} \cdot R$

To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found	As Left
0.00220 g	0.023 mg	0.021 mg
0.02200 g	0.23 mg	0.21 mg
0.22000 g	2.3 mg	2.1 mg
2.20000 g	23 mg	21 mg
22.00000 g	230 mg	210 mg



เอกสารไม่ควบคุม

GWP® Certificate



As
Found



As
Left



The weighing device meets the given
process requirements.

The weighing device meets the given
process requirements.

Tests Performed:



As Found



As Left

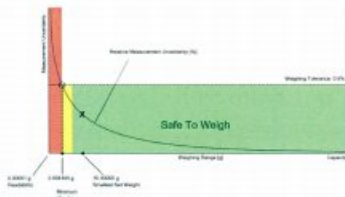
Process Requirements

Weighing Tolerance: 0.5%

Smallest Net Weight: 10.0000 g

Safety Factor: 2

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

เอกสารไม่ควบคุม

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.023137 g	0.048594 g	0.076262 g	0.118568 g	0.244714 g
0.2%	0.011534 g	0.023137 g	0.034811 g	0.056373 g	0.118556 g
0.5%	0.004605 g	0.009221 g	0.013849 g	0.02137 g	0.040556 g
1%	0.002301 g	0.004605 g	0.006912 g	0.011534 g	0.023137 g
2%	0.001150 g	0.002301 g	0.003453 g	0.005759 g	0.011534 g
5%	0.000460 g	0.000920 g	0.001380 g	0.002290 g	0.004605 g



Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.021610 g	0.043443 g	0.065502 g	0.110314 g	0.226566 g
0.2%	0.010777 g	0.021610 g	0.032468 g	0.054444 g	0.110314 g
0.5%	0.004304 g	0.008617 g	0.012909 g	0.021610 g	0.043443 g
1%	0.002151 g	0.004304 g	0.006460 g	0.010777 g	0.021610 g
2%	0.001075 g	0.002151 g	0.003227 g	0.005382 g	0.010777 g
5%	0.000430 g	0.000860 g	0.001290 g	0.002151 g	0.004304 g



Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with $k = 2$ and based on the linear formula of the measurement uncertainty of the weighing device is used.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

เอกสารไม่ควบคุม

Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	✓	✓	✓

- ✓ = Passed
- ✗ = Failed
- ⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.000000 g	0.000011 g	✓	0.000010 g	✓
0.2%	0.010000 g		✓		✓
0.5%	0.025000 g		✓		✓
1%	0.050000 g		✓		✓
2%	0.100000 g		✓		✓
5%	0.250000 g		✓		✓

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

Tolerance	Control Limit	As Found		As Left	
		Deviation	Result	Deviation	Result
0.1%	0.000000 g	0.000000 g	✓	0.000000 g	✓
0.2%	0.010000 g		✓		✓
0.5%	0.025000 g		✓		✓
1%	0.050000 g		✓		✓
2%	0.100000 g		✓		✓
5%	0.250000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

เอกสารไม่ควบคุม

Error of Indication

As Found

Reference Value		Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
30.00001 g	-0.00002 g	0.015000 g	0.030000 g	0.075000 g	0.150000 g	0.300000 g	0.750000 g
50.00001 g	-0.00003 g	0.025000 g	0.050000 g	0.125000 g	0.250000 g	0.500000 g	1.250000 g
70.00003 g	-0.00009 g	0.035000 g	0.070000 g	0.175000 g	0.350000 g	0.700000 g	1.750000 g
90.00005 g	-0.00010 g	0.045000 g	0.090000 g	0.225000 g	0.450000 g	0.900000 g	2.250000 g
100.00007 g	-0.00015 g	0.050000 g	0.100000 g	0.250000 g	0.500000 g	1.000000 g	2.500000 g
120.00008 g	-0.00021 g	0.060000 g	0.120000 g	0.300000 g	0.600000 g	1.200000 g	3.000000 g
150.00008 g	-0.00023 g	0.075000 g	0.150000 g	0.375000 g	0.750000 g	1.500000 g	3.750000 g
170.00009 g	-0.00023 g	0.085000 g	0.170000 g	0.425000 g	0.850000 g	1.700000 g	4.250000 g
190.99998 g	-0.00028 g	0.100000 g	0.200000 g	0.500000 g	1.000000 g	2.000000 g	5.000000 g
Result		✓	✓	✓	✓	✓	✓

As Left

Reference Value		Control limits for various weighing tolerances					
		0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
30.00001 g	0.00000 g	0.015000 g	0.030000 g	0.075000 g	0.150000 g	0.300000 g	0.750000 g
50.00001 g	-0.00001 g	0.025000 g	0.050000 g	0.125000 g	0.250000 g	0.500000 g	1.250000 g
70.00003 g	0.00000 g	0.035000 g	0.070000 g	0.175000 g	0.350000 g	0.700000 g	1.750000 g
90.00005 g	0.00002 g	0.045000 g	0.090000 g	0.225000 g	0.450000 g	0.900000 g	2.250000 g
100.00007 g	-0.00002 g	0.050000 g	0.100000 g	0.250000 g	0.500000 g	1.000000 g	2.500000 g
120.00008 g	-0.00003 g	0.060000 g	0.120000 g	0.300000 g	0.600000 g	1.200000 g	3.000000 g
150.00008 g	-0.00002 g	0.075000 g	0.150000 g	0.375000 g	0.750000 g	1.500000 g	3.750000 g
170.00009 g	0.00002 g	0.085000 g	0.170000 g	0.425000 g	0.850000 g	1.700000 g	4.250000 g
190.99998 g	0.00003 g	0.100000 g	0.200000 g	0.500000 g	1.000000 g	2.000000 g	5.000000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

เอกสารไม่ควบคุม

Preventive Maintenance Report for Analytical/Micro/Ultra Micro Balances

Customer

Company: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udomsuk 41, Sukhumvit Rd., Bang Chak
City: Phra Khanong State / Province: Bangkok
Zip/Postal: 10260 Contact: Suwit Chotnoki

Weighing Instrument

Manufacturer: Mettler Toledo
Model: XPE205 Location: Calibration Laboratory
Serial No: 8748058497 Asset No: (UAE-CAL-004/2563)

Summary

Task	Completed		
	Yes	No	N/A
Balance cleaned	☒	☐	☐
Device inspection performed	☒	☐	☐
Battery check performed	☒	☐	☐
Function tests performed	☒	☐	☐
All necessary labels attached	☒	☐	☐
Documents hand over to customer	☒	☐	☐
Eccentricity performed	☒	☐	☐
Repeatability performed	☒	☐	☐

Corrective Actions

performed: N/A

Spare Parts

used: N/A

Comments

N/A

Performed by

Name: NHR Jongrod Date: 22-05-23 Signature: [Signature]

Customer: Suwit Chotnoki Date: Signature: [Signature]

Cleaning

Task	Completed		
	Yes	No	N/A
Clean draft shield windows, incl. inner draft shield (if applicable)	☒	☐	☐
Clean door, inner draft shield, guides and rails	☒	☐	☐
Remove weighing pan and clean and polish	☒	☐	☐
Clean or replace in-use cover	☒	☐	☐
Clean terminal and display	☒	☐	☐
Clean housing	☒	☐	☐

Inspection

Test	Acceptance Criteria	Result		
		Pass	No	N/A
Check housing	No for cracks or loose screws	☒	☐	☐
Check display	No cracks and transparent glass	☒	☐	☐
Check draft shield (if existing)	No cracks or broken glass & firm fit	☒	☐	☐
Check draft shield doors	Smooth movement and proper closing	☒	☐	☐
Check weighing pan	Correct fit, proper position and not touching anywhere	☒	☐	☐
Check leveling	Leveling bubble is centered and feet are not loose	☒	☐	☐
Check protective cover	Is transparent and has correct fit	☒	☐	☐
Check AC power adapter	Adapter is the original one and insulation are intact	☒	☐	☐
Check connectors and data cables	Insulations are intact	☒	☐	☐
Check for correct fit and connection	Mounting is correct and no damages on accessory is visible	☒	☐	☐

Function Test

Test	Acceptance Criteria	Result		
		Pass	No	N/A
Perform startup of balance	Balance starts up and displays correct menu, status light and a stable zero	☒	☐	☐
Perform touch screen test	All keys correspond accordingly	☒	☐	☐
Perform display test	All display segments and pixels are active	☒	☐	☐
Test draft shield motor movement	Draft shield is moving smoothly and close without gap	☒	☐	☐
Perform internal adjustment	All display segments and pixels are active	☒	☐	☐
Perform sensitivity test	Sensitivity is within Tolerance	☒	☐	☐
Perform peripheral connectivity and function test	Peripheral gets and receive data and function is according intended use	☒	☐	☐



CERTIFICATE OF CALIBRATION

Certificate No.: SP22-016

Page 1 of 5

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

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

Bangkok 10260

Location of calibration: Laboratory 315

Equipment: UV-Vis Spectrophotometer

Manufacturer: Agilent Technologies

Model: Cary 60

Serial No.: MY15410009

ID No.: N/A

Received Date: 23 May 2022

Calibration Date: 23 May 2022

Issue Date: 26 May 2022

Condition Instrument: Good

Calibrated by:

[Signature]

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

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



REPORT OF CALIBRATION

Certificate No.: SP22-016

Page 2 of 5

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

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

Certified Reference Materials:

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

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

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

Spectral Band Width of UUC: 1.5 nm.

Scan Speed of UUC: 90 nm/min

Scan Interval of UUC: 0.15 nm.

Resolution of UUC: Photometric 0.0001 Abs.

Wavelength 0.1 nm.

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

Uncontrolled Document

PM-700-02 R01 1/13/2021

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0001	-0.0001	0.0050	2.00
	0.7478	0.7421	0.0057	0.0056	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8686	0.8619	0.0067	0.0059	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2912	0.2896	0.0016	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6448	0.6403	0.0045	0.0055	2.00

Uncontrolled Document

PM-700-02 R01 1/13/2021

REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 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	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	0.18	2.00

Remark : - UUC = Unit Under Calibration

- NA = 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 TSI accredited

- End of Certificate - Uncontrolled Document

PM-700-02 R01 1/13/2021



Certificate of Calibration

AquionRFIC : Anion (ID#1047)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AquionRFIC S/N : 220380031

AS-DV S/N : 220360045



United Analyst and Engineering Consultant Co.,Ltd.

Operator Signature

Date : Apr 23, 2024

Test Engineer

เอกสารไม่ควบคุม

Qualification Report

PM Check list,CM_OQ and PQ

AquionRFIC : Anion (ID#1047)

Aquion : Cation (ID#1048)

For

United Analyst Engineering Consuland Co.,Ltd.

(Validate System 2024)

เอกสารไม่ควบคุม

PM Anion ID#1047

Preventive Maintenance

Check List

เอกสารไม่ควบคุม



Checklist ICS Preventive Maintenance

Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Namei Department
United Analyst and Engineering Consultant Co.,Ltd.	Khun.Suwan Kongthong / Lab
Engineer	Date
Mr.Chennarong Khiao-Un	23-24/Apr/2024

Instrument Detail

Instrument Model	Application
AquionRFIC	Anion
Instrument components	Serial Number
AquionRFIC	220380031
AS-DV	220360045

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS-600	-	EGC III KOH
				CR-ATC

Remark: see the Column, Guard Column see Suppressor the peak shift see tail

Perform By Archemica



Arche

Date

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Checklist ICS Preventive Maintenance

General ICS Maintenance Checklist

No.	Description	Result			
		Checked	Cleaned	Replaced	N.A.
Power on & Connection					
1	Instrument power on	☒	-	-	☐
2	Instrument connection	☒	-	-	☐
Injection Valve Rebuild		Checked	Cleaned	Replaced	N.A.
3	Rebuild injection valve 6 port	☐	☒	☐	☐
4	- Rotor seal	☐	☒	☐	☐
5	- Stator face	☐	☒	☐	☐
Optional Auxiliary Valve Rebuild		Checked	Cleaned	Replaced	N.A.
6	Rebuild auxiliary valve - port	☐	☐	☐	☒
7	- Rotor seal	☐	☐	☐	☒
8	- Stator face	☐	☐	☐	☒
Check Valve Cartridge		Checked	Cleaned	Replaced	N.A.
9	Inlet check valve assembly	☐	☒	☐	☐
10	Outlet check valve assembly	☐	☒	☐	☐
11	Verified correct flow orientation	☒	-	-	☐
Pump/Piston Rinse Seal		Checked	Cleaned	Replaced	N.A.
Piston Seal and Piston					
12	Piston rinse seal in primary pump head	☐	☒	☐	☐
13	Piston seal in primary pump head	☐	☒	☐	☐
14	Piston in primary pump head	☐	☒	☐	☐
15	Piston rinse seal in secondary pump head	☐	☒	☐	☐
16	Piston seal in secondary pump head	☐	☒	☐	☐
17	Piston in secondary pump head	☐	☒	☐	☐
Waste Valve and Priming Valve		Checked	Cleaned	Replaced	N.A.
18	Waste valve	☒	☐	☐	☐
19	Priming valve	☒	☐	☐	☐
Cell Detector		Checked	Cleaned	Replaced	N.A.
20	Check conductivity cell	☒	☐	☐	☐
21	Check electrochemical cell	☐	☐	☐	☒
22	- Working electrode	☐	☐	☐	☒
23	- Reference electrode	☐	☐	☐	☒
24	- Gasket	☐	☐	☐	☒
25	- Cell body	☐	☐	☐	☒
Other		Checked	Cleaned	Replaced	N.A.
26	Sample Loop Size 25 uL	☐	☒	☐	☐
27	End-line filter	☒	-	☐	☐
28	Leak sensor	☒	☐	☐	☐
29	Lubricate pump mechanic	☐	Lubricated	-	☐
30	Reconnected liquid lines to the valve	☒	-	-	☐
31	Reconnected liquid lines to pump heads	☒	-	-	☐
32	Primed pump	☒	-	-	☐
33	Checked pump for leaks	☒	-	-	☐
34	Checked gas for leaks	☒	-	-	☐

เอกสารไม่ควบคุม



AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial number	Firmware Version
AS-DV	220360045	1.6.0

No.	Description	Result			
Power on & Connection		Checked	Cleaned	Replaced	N.A.
1.	AS-DV power on	☒	-	-	☐
2.	AS-DV connection	☒	-	-	☐
Sampling Tip		Checked	Cleaned	Replaced	N.A.
3.	Sampling needle	☐	☒	☐	☐
4.	Sampling tubing (Transfer line)	☐	☒	☐	☐
5.	Reconnect sampling needle & tubing	☒	-	-	☐
Other		Checked	Cleaned	Replaced	N.A.
6.	Check carousel movement	☒	-	-	☐
7.	Check needle movement	☒	-	-	☐
8.	Lubricate needle drive	☐	☒	-	☐
9.	AS-DV cover	☒	☐	☐	☐
(Optional) High Pressure Valve		Checked	Cleaned	Replaced	N.A.
10.	High pressure valve - Port	☐	☐	☐	☒
11.	- Rotor seal	☐	☐	☐	☒
12.	- Stator face	☐	☐	☐	☒
13.	- Reconnected liquid line to the valve	☐	☐	☐	☒

Others / comments

เอกสารไม่ควบคุม

PM Cation ID#1048

Preventive Maintenance
Check List

เอกสารไม่ควบคุม

Dionex Ion Chromatography
Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co., Ltd.	Khun Suwan Kongthong / Lab
Engineer	Date
Mr.Channarong Khiao-Uin	23-24/Apr/2024

Instrument Detail

Instrument Model	Application
Aquion	Cation
Instrument components	Serial Number
Aquion	220340349

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
CS12A	CG12A	CDER-600	-	-

Remark: ระบบไอออนโครมาโทกราฟี, System 6100/6100

Perform By Archemica

Archemica

Date

Date

เอกสารไม่ควบคุม



General ICS Maintenance Checklist

No.	Description	Result			
Power on & Connection		Checked	Cleaned	Replaced	N.A.
1	Instrument power on	☒	-	-	☐
2	Instrument connection	☒	-	-	☐
Injection Valve Rebuild		Checked	Cleaned	Replaced	N.A.
3	Rebuilt injection valve - port	☒	☐	☐	☐
4	- Rotor seal	☒	☐	☐	☐
5	- Stator face	☒	☐	☐	☐
(Optional) Auxiliary Valve Rebuild		Checked	Cleaned	Replaced	N.A.
6	Rebuilt auxiliary valve - port	☐	☐	☐	☒
7	- Rotor seal	☐	☐	☐	☒
8	- Stator face	☐	☐	☐	☒
Check Valve Cartridge		Checked	Cleaned	Replaced	N.A.
9	Inlet check valve assembly	☒	☐	☐	☐
10	Outlet check valve assembly	☒	☐	☐	☐
11	Verified correct flow orientation	☒	-	-	☐
Pump Piston Rinse Seal, Piston Seal and Piston		Checked	Cleaned	Replaced	N.A.
12	Piston rinse seal in primary pump head	☐	☒	☐	☐
13	Piston seal in primary pump head	☐	☒	☐	☐
14	Piston in primary pump head	☐	☒	☐	☐
15	Piston rinse seal in secondary pump head	☐	☒	☐	☐
16	Piston seal in secondary pump head	☐	☒	☐	☐
17	Piston in secondary pump head	☐	☒	☐	☐
Waste Valve and Priming Valve		Checked	Cleaned	Replaced	N.A.
18	Waste valve	☒	☐	☐	☐
19	Priming valve	☒	☐	☐	☐
Cell Detector		Checked	Cleaned	Replaced	N.A.
20	Check conductivity cell	☒	☐	☐	☐
21	Check electrochemical cell	☐	☐	☐	☒
22	- Working electrode	☐	☐	☐	☒
23	- Reference electrode	☐	☐	☐	☒
24	- Gasket	☐	☐	☐	☒
25	- Cell body	☐	☐	☐	☒
Other		Checked	Cleaned	Replaced	N.A.
26	Sample Loop Size 25 uL	☒	☐	☐	☐
27	End-line filter	☐	-	☐	☐
28	Leak sensor	☒	☐	☐	☐
29	Lubricate pump mechanic	☐	Lubricated	-	☐
30	Reconnected liquid lines to the valve	☒	-	-	☐
31	Reconnected liquid lines to pump heads	☒	-	-	☐
32	Primed pump	☒	-	-	☐
33	Checked pump for leaks	☒	-	-	☐
34	Checked gas for leaks	☒	-	-	☐

เอกสารไม่ควบคุม

CM OQ

Chromeleon Operation Qualification

เอกสารไม่ควบคุม

ThermoFisher SCIENTIFIC Chromeleon Operational Qualification

General Information

Instrument Controller: DESKTOP-C4FS3L7
Client: DESKTOP-C4FS3L7
Operator: Mr.Channarong Khiao-Un

Computer Name: Version Number:
DESKTOP-C4FS3L7 7.3.1 Build 6535
DESKTOP-C4FS3L7 7.3.1.6535

Overall Test Result: **Passed**

Comparison Format:

All Parameters:	Significant Digits:	10
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เอกสารไม่ควบคุม

ThermoFisher SCIENTIFIC Chromeleon Operational Qualification, Part 1 Verification of Selected Results

Detection Algorithm: Cobra
Calibration Type: Lin, With Offset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

Report Variable	Peak Name	Status
Offset (c0)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Slope (c1)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Correlation Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Std. Deviation	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Rel. Std. Dev.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher SCIENTIFIC Chromeleon Operational Qualification, Part 1 Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Calibration Point Y	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Amount [ng]	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Resolution (EP)	Acetanilide	ok
	Acetophenone	ok
Resolution (USP)	Acetanilide	ok
	Acetophenone	ok
Peak Asymmetry (EP/USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Peak Asymmetry (AIA)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC

Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (JP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

Test Result: Passed

เอกสารไม่ควบคุม

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Chromeleon Operational Qualification, Part 2
Most Frequently Used Parameters: Comparison with Expected Results

Detection Algorithm: Cobra
Calibration Type: Lin, With Offset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

Variable Category	Report Variable	Peak Name	Status
Injection	No.		ok
	Name		ok
	Type		ok
	Position		ok
	Status		ok
	Volume		ok
	Dilution Factor		ok
	Weight		ok
	IntStd		ok
	InstrumentMethod		ok
	ProcessingMethod		ok
Chromatogram	Channel		ok
	No. of Peaks		ok
	Chromatogram Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Unit		ok
	Noise		ok
Peak Results	No.	Acetanilide	ok
	No.	Acetophenone	ok
	No.	Propiophenone	ok
	Peak Name	Acetanilide	ok
	Peak Name	Acetophenone	ok
	Peak Name	Propiophenone	ok
	Ret.Time	Acetanilide	ok
	Ret.Time	Acetophenone	ok
	Ret.Time	Propiophenone	ok

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Chromeleon Operational Qualification, Part 2
Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Abs.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(abs)	Acetophenone	ok
	Ret.Dev.(abs)	Propiophenone	ok
	Rel.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(rel)	Acetophenone	ok
	Ret.Dev.(rel)	Propiophenone	ok
	Area	Acetanilide	ok
	Area	Acetophenone	ok
	Area	Propiophenone	ok
	Rel.Area	Acetanilide	ok
	Rel.Area (Total)	Acetophenone	ok
	Rel.Area (Total)	Propiophenone	ok
	Height	Acetanilide	ok
	Height	Acetophenone	ok
	Height	Propiophenone	ok
	Rel.Height (Total)	Acetanilide	ok
	Rel.Height (Total)	Acetophenone	ok
	Rel.Height (Total)	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Concentration	Acetanilide	ok
	Concentration	Acetophenone	ok
	Concentration	Propiophenone	ok
	Rel.Amount	Acetanilide	ok
	Rel.Amount	Acetophenone	ok
	Rel.Amount	Propiophenone	ok
	Peak Width (0%)	Acetanilide	ok
	Peak Width (0%)	Acetophenone	ok
	Peak Width (0%)	Propiophenone	ok
	Peak Width (5%)	Acetanilide	ok
	Peak Width (5%)	Acetophenone	ok
	Peak Width (5%)	Propiophenone	ok
	Peak Width (10%)	Acetanilide	ok
	Peak Width (10%)	Acetophenone	ok
	Peak Width (10%)	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
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Chromeleon Operational Qualification, Part 2
Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Acetanilide	ok
	Peak Width (50%)	Acetophenone	ok
	Peak Width (50%)	Propiophenone	ok
	Left Width (0%)	Acetanilide	ok
	Left Width (0%)	Acetophenone	ok
	Left Width (0%)	Propiophenone	ok
	Right Width (0%)	Acetanilide	ok
	Right Width (0%)	Acetophenone	ok
	Right Width (0%)	Propiophenone	ok
	Peak Start	Acetanilide	ok
	Peak Start	Acetophenone	ok
	Peak Start	Propiophenone	ok
	Peak Stop	Acetanilide	ok
	Peak Stop	Acetophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Start Value	Acetanilide	ok
	Peak Start Value	Acetophenone	ok
	Peak Start Value	Propiophenone	ok
	Peak Stop Value	Acetanilide	ok
	Peak Stop Value	Acetophenone	ok
	Peak Stop Value	Propiophenone	ok
	BL-Value Peak Start	Acetanilide	ok
	BL-Value Peak Start	Acetophenone	ok
	BL-Value Peak Start	Propiophenone	ok
	BL-Value Peak Stop	Acetanilide	ok
	BL-Value Peak Stop	Acetophenone	ok
	BL-Value Peak Stop	Propiophenone	ok
	Type	Acetanilide	ok
	Type	Acetophenone	ok
	Type	Propiophenone	ok
	Resolution (EP)	Acetanilide	ok
	Resolution(EP)	Acetophenone	ok
	Resolution(USP)	Acetanilide	ok
	Resolution(USP)	Acetophenone	ok
	Asymmetry(EP)	Acetanilide	ok
	Asymmetry(EP)	Acetophenone	ok
	Asymmetry(EP)	Propiophenone	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Acetanilide	ok
	Asymmetry(AIA)	Acetophenone	ok
	Asymmetry(AIA)	Propiophenone	ok
	Theor. Plates(EP)	Acetanilide	ok
	Theor. Plates(EP)	Acetophenone	ok
	Theor. Plates(EP)	Propiophenone	ok
	Theor. Plates(USP)	Acetanilide	ok
	Theor. Plates(USP)	Acetophenone	ok
	Theor. Plates(USP)	Propiophenone	ok
	Theor. Plates(JP)	Acetanilide	ok
	Theor. Plates(JP)	Acetophenone	ok
	Theor. Plates(JP)	Propiophenone	ok
Peak Calibration	Cal.Mode	Acetanilide	ok
	Cal.Mode	Acetophenone	ok
	Cal.Mode	Propiophenone	ok
	Cal.Type	Acetanilide	ok
	Cal.Type	Acetophenone	ok
	Cal.Type	Propiophenone	ok
	Weights	Acetanilide	ok
	Weights	Acetophenone	ok
	Weights	Propiophenone	ok
	Calibr. Coefficient C0	Acetanilide	ok
	Calibr. Coefficient C0	Acetophenone	ok
	Calibr. Coefficient C0	Propiophenone	ok
	Calibr. Coefficient C1	Acetanilide	ok
	Calibr. Coefficient C1	Acetophenone	ok
	Calibr. Coefficient C1	Propiophenone	ok
	RF-Value	Acetanilide	ok
	RF-Value	Acetophenone	ok
	RF-Value	Propiophenone	ok
	No. of Points	Acetanilide	ok
	No. of Points	Acetophenone	ok

เอกสารไม่ควบคุม

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propiophenone	ok
	No. of Points(disabled)	Acetanilide	ok
	No. of Points(disabled)	Acetophenone	ok
	No. of Points(disabled)	Propiophenone	ok
	Variance	Acetanilide	ok
	Variance	Acetophenone	ok
	Variance	Propiophenone	ok
	Var.Coeff	Acetanilide	ok
	Var.Coeff	Acetophenone	ok
	Var.Coeff	Propiophenone	ok
	Std.Dev.	Acetanilide	ok
	Std.Dev.	Acetophenone	ok
	Std.Dev.	Propiophenone	ok
	Rel.Std.Dev.	Acetanilide	ok
	Rel.Std.Dev.	Acetophenone	ok
	Rel.Std.Dev.	Propiophenone	ok
	Corr.Coeff.	Acetanilide	ok
	Corr.Coeff.	Acetophenone	ok
	Corr.Coeff.	Propiophenone	ok
	R-Square	Acetanilide	ok
	R-Square	Acetophenone	ok
	R-Square	Propiophenone	ok
	Adj. R-Square	Acetanilide	ok
	Adj. R-Square	Acetophenone	ok
	Adj. R-Square	Propiophenone	ok
	X	Acetanilide	ok
	X	Acetophenone	ok
	X	Propiophenone	ok
	Y	Acetanilide	ok
	Y	Acetophenone	ok
	Y	Propiophenone	ok
	W	Acetanilide	ok
	W	Acetophenone	ok
	W	Propiophenone	ok
	F(X)	Acetanilide	ok
	F(X)	Acetophenone	ok
	F(X)	Propiophenone	ok

เอกสารไม่ควบคุม

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Acetanilide	ok
	Residual for Cal.Point X	Acetophenone	ok
	Residual for Cal.Point X	Propiophenone	ok
	Calibration Point Status	Acetanilide	ok
	Calibration Point Status	Acetophenone	ok
	Calibration Point Status	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
Component	Cal.Type	Acetanilide	ok
	Peak Type	Acetanilide	ok
	Left Limit	Acetophenone	ok
	Right Limit	Acetanilide	ok
	Group	Acetanilide	ok
	Factor	Acetophenone	ok
	Amount	Acetanilide	ok
	Conc.Unit	Acetophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Acetanilide	ok
	PPI	Acetophenone	ok
	PPI	Propiophenone	ok
	RSD PPI	Acetanilide	ok
	RSD PPI	Acetophenone	ok
	RSD PPI	Propiophenone	ok
	Match	Acetanilide	ok
	Match	Acetophenone	ok
	Match	Propiophenone	ok
	RSD Match	Acetanilide	ok
	RSD Match	Acetophenone	ok
	RSD Match	Propiophenone	ok
	Rel.Max at	Acetanilide	ok
	Rel.Max at	Acetophenone	ok
	Rel.Max at	Propiophenone	ok

Test Result: Passed

เอกสารไม่ควบคุม



Chromleon Operational Qualification, Part 3 System Suitability Test: Comparison with Expected Results

Variable Category	Report Variable	Status
System Suitability Test Case	Number	ok
	Name	ok
	Inj. Condition	ok
	Eval. Formula	ok
	Operator	ok
	Statistics	ok
	Rounding	ok
	MinimumNumberOfInjections	ok
	MaximumNumberOfInjections	ok
	Channel	ok
	Peak	ok
	Ref. Value Formula 1	ok
	Ref. Value Formula 2	ok
	N.A.	ok
System Suitability Test Case Result	Inj. Eval. Result	ok
	Eval. Result	ok
	Peak Result	ok
	Injection Condition Result	ok
	Ref. Value 1	ok
	Ref. Value 2	ok
	Result	ok
	Message	ok
	Average	ok
	Count	ok
	Maximum	ok
	Minimum	ok
	Range	ok
	Rel. Range	ok
	Rel. Std. Dev.	ok
	Std. Dev.	ok
	Sum	ok

Test Result: Passed

เอกสารไม่ควบคุม

SOFTWARE OQ



Chromleon

Part 1 - Verification of Selected Results	PASS
Part 2 - Most Frequently Used Parameters: Comparison with Expected Results	PASS
Part 3 - System Suitability Test: comparison with Expected Results	PASS



OVERALL TEST RESULT: PASS

Field Service	

เอกสารไม่ควบคุม

PQ Anion ID#1047

Performance Qualification

TEST EQUIPMENT AND STANDARDS



Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	27970244	N/A	N/A
Thermocouple	Fluke	K-Type	27970244	N/A	N/A
Balance	Mettler Toledo	AB204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	21379153	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

Standards/Chemicals

Description	Manufacturer	Concentration	Part Number	Lot Number	Expiration Date
Nitrate	Thermo Scientific	5 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	10 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	25 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	50 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	100 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	1000 ppm	060254	231226	Dec-2024
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

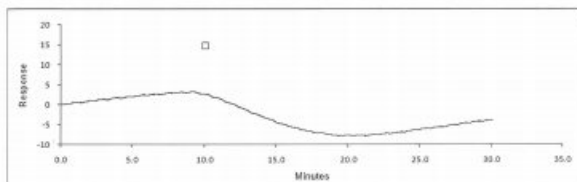


Field	

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

NOISE AND DRIFT (CD)

ThermoFisher
SCIENTIFIC

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	chrom://desktop-c4fs37/ChromleonLocal/Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ.seq/278.smp/ECD_1.channel

Noise and Drift

Test	Measured (nS)	OQ Limit (nS)	Result	Conversion Factor
Noise	1.1 nS	≤ 2.0 nS	PASS	1000
Drift	16.1 nS/hr	≤ 20.0 nS/hr	PASS	1000

OVERALL TEST RESULT: PASS



Field Service Rep	
Date	

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REPEATABILITY (CD)

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Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromleonLocal/Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Repeatability 01	25	0.265	2.825
Repeatability 02	25	0.265	2.822
Repeatability 03	25	0.265	2.831
Repeatability 04	25	0.265	2.835
Repeatability 05	25	0.265	2.834
Repeatability 06	25	0.265	2.836

Repeatability

Test	Measured (% RSD)	OQ Limit (% RSD)	Result
Retention Time	0.0	≤ 5.0	PASS
Area	0.2	≤ 1.0	PASS

OVERALL TEST RESULT: PASS



Field Service Rep	
Date	

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CARRYOVER (CD)

ThermoFisher
SCIENTIFIC

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromleonLocal/Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.265	0.053
High Standard	25	0.265	49.734
Carryover	25	0.265	0.051

Results

Test	Observed (%)	OQ Limit (%)	Result
AREA	0.00	≤ 0.10	PASS

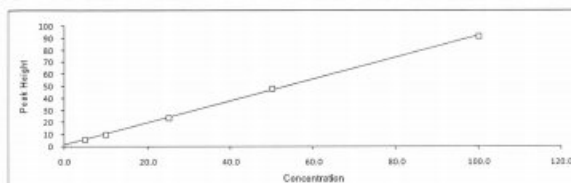
OVERALL TEST RESULT: PASS



Field Service Rep	
Date	

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DETECTOR LINEARITY (CD)

ThermoFisher
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Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromleonLocal/Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ

Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	5.872	4.82
Detector Linearity 02	10	10.299	9.68
Detector Linearity 03	25	23.794	24.52
Detector Linearity 04	50	48.473	51.65
Detector Linearity 05	100	91.855	99.34

Linearity

Test	Observed	OQ Limit	Result
r ²	0.999	≥ 0.999	PASS

OVERALL TEST RESULT: PASS



Field Service Rep	
Date	

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ELUENT GENERATOR TEST



EG Current Test

Set Point (mM)	Expected (mA)	Reading (mA)	Deviation (mA)	OQ Limit (mA)	Result
1.00	1.6082	1.604	0.00	± 0.01	PASS
5.00	8.041	8.019	0.02	± 0.05	PASS
10.00	16.082	16.037	0.05	± 0.10	PASS
50.00	80.41	80.17	0.24	± 0.50	PASS
100.00	160.82	160.32	0.50	± 1.00	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
Date:	

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IC PUMP FLOW RATE ACCURACY



IC Pump Flow Rate

Set Point (mL)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4995	0.100	± 2.0	PASS
1.0	0.999	0.10	± 2.0	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
Date:	

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TEMPERATURE ACCURACY



Column Compartment

Set Point (°C)	Reading (°C)	Deviation (°C)	OQ Limit (°C)	Result
30.0	30.5	0.5	± 2.0	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
Date:	

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OQ EXCEPTIONS AND COMMENTS



N/A

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Field Service Representative Signature:	Customer Signature:
Date:	

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OQ REVIEW AND COMPLETION

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These Operational Qualification Results should be reviewed by the Customer. If the qualification is accepted, both the Customer and the Service Representative should sign the Operational Qualification Results, below.

OPERATIONAL QUALIFICATION RESULTS

Based upon the actual results obtained, this Operational Qualification **PASSED** the acceptance criteria described in the Operational Qualification in the Installation Checklist procedure.

Service Representative

A Field Service Representative signature below confirms the completion of all aspects of the Operational Qualification and have concluded that the system has been successfully verified to be operating as required.

Customer

A Customer signature below confirms the completion of all aspects of the Operational Qualification have been completed and that the system has been successfully verified to be operating as required.



Field Service Representative Signature	Customer Signature
Date	

RPO Reports v2.053
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PinAAcle 900F Preventive Maintenance Report

Company Name: UNITED ANALYST AND ENGINEERING

Instrument Location: BANGCHAK, PRAKHANONG

BANGKOK, 10260

Instrument Serial No.: PFBS20031902

Date: 26-Jun-2023

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PinAAcle 900F Preventive Maintenance (PM)

Company Name:	UNITED ANALYST AND ENGINEERING		
Address (Instrument Location):	BANGCHAK, PRAKHANONG, BANGKOK, 10260		
Serial Number:	PFBS20031902	PM Number:	2/2
Customer Name (if applicable):	K. SATIDA	Telephone Number:	095-558-0049
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-02273773
Date PM Performed: (DD-MMM-YYYY)	Jun 26, 2023	Next PM Due Date: (DD-MMM-YYYY)	Dec 30, 2023
Standard Labor Hours to Complete PM :		5 hours	

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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

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

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

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

Additional Reagents and Standards Required for PM

Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024

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

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

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Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MGO-252
N1013002	1.0A Neutral density filter	1	MGO-358
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

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Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

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7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9890	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1975	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0009	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

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8.4 D₂ Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	-0.0062	Passed

8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0002	Passed

8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0014	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3467	Passed

10. Review:

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

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Additional Comments

Additional Comments Regarding the PM

Review

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

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

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Jun-2023

(YY)

Authorized Customer Representative:

Jun-2023

(YY)

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

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

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

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Introduction

Customer Information

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

Important Customer Web Links

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

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Service Engineer's Responsibilities

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

Additional Instruction Notes

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

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System Information

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

Instrument System Name and ID	CN11021007
Instrument System Site and Location	Instrument Room

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440A	CN11021007
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

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

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
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Page 4 of 9



เอกสารไม่ควบคุม

Preventive Maintenance Procedure

Clean and inspect GC

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

Inlet and detector consumable replacement

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

Zero Sensors and Leak test

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

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
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Page 5 of 9



เอกสารไม่ควบคุม

ALS Maintenance

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

Restore Instrument

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

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

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
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Page 6 of 9



เอกสารไม่ควบคุม

Signature Page

Service Review

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

7890 GC Test Results Table

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

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
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Page 7 of 9



เอกสารไม่ควบคุม

7890 Parts List Table

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

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

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
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Page 8 of 9



เอกสารไม่ควบคุม

Service Engineer Comments

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

Service Completion

Service request number 6006748380 Date service completed 21Feb2024

Agilent signature Phuwana Yoktragul Customer signature

Total number of pages in this document 9

Revision: 2.00, Issued: December 30, 2020
 Agile Document Number: D0007063
 DE number: 44166.759722222
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Page 9 of 9



เอกสารไม่ควบคุม

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Air Quality Analysis									
1	Analytical Balance (Readability 0.1 mg)	TSP	Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19 Apr 24	18 Apr 25	-
2	Ion Chromatrography Anion (IC)	Hydrochloric acid Phosphoric acid	Dionex	DionexAquionRFIC / 220380031	Archemica Lab Co.Ltd.	Qualification Report Anion (ID#1047)	23 Apr 24	22 Apr 25	-
3	Atomic Absorption Spectrophotometer (AAS)	Chromium	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC.ACL.No 358/67	11 Mar 24	10 Mar 25	-
4	UV-VIS Spectrophotometer	Chromium Hexavalent, Oxide of Nitrogen Chromium Trivalent, Sodium Hydroxide	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	SP24-018	9 May 24	8 May 25	-
Equipment for Water Quality Analysis									
5	pH Meter	pH Temp	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
6	pH Meter		Mettler-Toledo	Seven Easy S20 / 1230525212	DKSH (Thailand) Ltd.	C07240167	9 Apr 24	8 Apr 25	-
7	Conductivity Meter	Conductivity	SI Analytics	Lab955 / 16300356	DKSH (Thailand) Ltd.	C24240057	11 Mar 24	10 Mar 25	-
8	Analytical Balance (Readability 0.1 mg)	Oil & Grease	Mettler-Toledo	XSR204 / C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
9	Analytical Balance (Readability 0.01 mg)	TDS TSS	Mettler-Toledo	XSR205DU / C210685394	National Food Institute, Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25	-

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
10	Hot Air Oven	SS	Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	<u>2400141-001-01</u>	11 Oct 23	10 Oct 24	-
11	BOD Incubator	BOD	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	<u>24TM303</u>	10 Feb 24	9 Feb 25	-
12	COD Reactor (Heating Block)	COD	Hanna	HI839800 / 1147807	Hanna Instruments (Thailand) Ltd.	<u>HIT-2417-0568</u>	25 Apr 24	24 Apr 25	-
13	UV-VIS Spectrophotometer	Chromium Hexavalent, COD Chromium Trivalent	Agilent Technologies	Cary60 G6860A / MY15410009	DQE Services Co.,Ltd.	<u>SP24-018</u>	9 May 24	8 May 25	-
14	Atomic Absorption Spectrophotometer (AAS)	Zinc, Hg, Pb, Ni, Cu, As, Cr	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	<u>MTC.ACL.No 358/67</u>	11 Mar 24	10 Mar 25	-
15	Inductively Coupled Plasma (ICP)		Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	<u>Preventive Maintenance Checklist</u>	13 Nov 23	12 Nov 24	-
16	Incubator	Colifor Bacteria	Binder	KB400 / 20200000015535	Technology Promotion Association (Thailand-Japan)	<u>24TM647</u>	1 Apr 24	31 Mar 25	-
17	Incubator		Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	<u>24TM650</u>	2 Apr 24	1 Apr 25	-
18	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	<u>24TM29</u>	10 Feb 24	8 Feb 25	-
19	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	<u>24TM30</u>	10 Feb 24	8 Feb 25	-
20	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	<u>2304203-001-01</u>	10 Aug 23	9 Aug 24	-

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
21	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	<u>2402281-001-01</u>	2 Apr 24	1 Apr 25	-
22	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	<u>C01234158</u>	7 Dec 23	6 Dec 24	-

Calibration Certificate

Certificate No.: 2402420-003-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS204TS/00
Serial No.: C252436235
ID No.: UAE.AIR.023/2566
Order No.: 2402420
Operation No.: 2402420-003
Date of Receipt: 19 April 2024
Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit
 Scientist

Approved by

Vice President

Date of Issue: 23 April 2024

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

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



Calibration Report

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

Page 2 of 3

Date of Calibration: 19 April 2024

Environment Condition: Ambient Temperature: 21.7 ± 1.5 °C Relative Humidity: 65 ± 6.7 %

Place of Calibration: Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2311181S	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 019/23	Quality Reborn	QR24-0492	4 March 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:

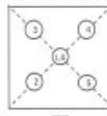
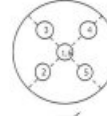
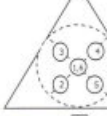
1. Repeatability of Reading:

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

2. Off-Center Error:

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

The balance reading obtained is given in the table.

		
☐	☒	☐
1	2	3
(g)	(g)	(g)
100.0005	100.0006	100.0003
4	5	6
(g)	(g)	(g)
100.0006	100.0003	100.0005
(Maximum Difference)		
0.0002		

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



Calibration Report

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

Date of Calibration: 19 April 2024

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000094	2.00
0.1	0.10000	0.1000	0.0000	0.000094	2.00
1	0.99998	1.0000	0.0000	0.000097	2.00
5	4.99997	5.0000	0.0000	0.000096	2.00
10	10.00002	10.0000	0.0000	0.00012	2.00
20	20.00003	20.0001	-0.0001	0.00014	2.00
50	49.99998	50.0003	-0.0003	0.00012	2.00
70	70.00000	70.0005	-0.0005	0.00017	2.00
100	99.99997	100.0006	-0.0006	0.00017	2.00
150	149.99994	150.0012	-0.0013	0.00022	2.00
200	200.00001	200.0015	-0.0015	0.00028	2.00

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

----- End -----

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





Certificate of Calibration
AquionRFIC : Anion (ID#1047)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

AquionRFIC S/N : 220380031
AS-DV S/N : 220360045

for
United Analyst and Engineering Consultant Co.,Ltd.

Operator Signature [Redacted] Date : Apr 23, 2024

เอกสารไม่ควบคุม

Qualification Report

PM Check list,CM_OQ and PQ
AquionRFIC : Anion (ID#1047)
Aquion : Cation (ID#1048)

For
United Analyst Engineering Consuland Co.,Ltd.
(Validate System 2024)

เอกสารไม่ควบคุม

PM Anion ID#1047

Preventive Maintenance Check List

เอกสารไม่ควบคุม



Checklist ICS Preventive Maintenance

Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co.,Ltd.	Khun.Suwan Kongthong / Lab
Engineer	Date
Mr.Channarong Khiao-Un	23-24/Apr/2024

Instrument Detail

Instrument Model	Application
AquionRFIC	Anion
Instrument components	Serial Number
AquionRFIC	220380031
AS-DV	220360045

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS-600	-	EGC III KOH
				CR-ATC

Remark: 1. Guard Column, Guard Column use Suppressor & peak shift use tail

Perform By Archemica



Arch
Date

เอกสารไม่ควบคุม



General ICS Maintenance Checklist

No.	Description	Result			
Power on & Connection		Checked	Cleaned	Replaced	N.A.
1	Instrument power on	☒	-	-	☐
2	Instrument connection	☒	-	-	☐
Injection Valve Rebuild		Checked	Cleaned	Replaced	N.A.
3	Rebuild injection valve 6 port	☐	☒	☐	☐
4	- Rotor seal	☐	☒	☐	☐
5	- Stator face	☐	☒	☐	☐
(Optional) Auxiliary Valve Rebuild		Checked	Cleaned	Replaced	N.A.
6	Rebuild auxiliary valve - port	☐	☐	☐	☒
7	- Rotor seal	☐	☐	☐	☒
8	- Stator face	☐	☐	☐	☒
Check Valve Cartridge		Checked	Cleaned	Replaced	N.A.
9	Inlet check valve assembly	☐	☒	☐	☐
10	Outlet check valve assembly	☐	☒	☐	☐
11	Verified correct flow orientation	☒	-	-	☐
Pump Piston Rinse Seal, Piston Seal and Piston		Checked	Cleaned	Replaced	N.A.
12	Piston rinse seal in primary pump head	☐	☒	☐	☐
13	Piston seal in primary pump head	☐	☒	☐	☐
14	Piston in primary pump head	☐	☒	☐	☐
15	Piston rinse seal in secondary pump head	☐	☒	☐	☐
16	Piston seal in secondary pump head	☐	☒	☐	☐
17	Piston in secondary pump head	☐	☒	☐	☐
Waste Valve and Priming Valve		Checked	Cleaned	Replaced	N.A.
18	Waste valve	☒	☐	☐	☐
19	Priming valve	☒	☐	☐	☐
Cell Detector		Checked	Cleaned	Replaced	N.A.
20	Check conductivity cell	☒	☐	☐	☐
21	Check electrochemical cell	☐	☐	☐	☒
22	- Working electrode	☐	☐	☐	☒
23	- Reference electrode	☐	☐	☐	☒
24	- Gasket	☐	☐	☐	☒
25	- Cell body	☐	☐	☐	☒
Other		Checked	Cleaned	Replaced	N.A.
26	Sample Loop Size 25 uL	☐	☒	☐	☐
27	End-line filter	☒	☐	☐	☐
28	Leak sensor	☒	☐	☐	☐
29	Lubricate pump mechanic	☐	Lubricated	-	☐
30	Reconnected liquid lines to the valve	☒	-	-	☐
31	Reconnected liquid lines to pump heads	☒	-	-	☐
32	Primed pump	☒	-	-	☐
33	Checked pump for leaks	☒	-	-	☐
34	Checked gas for leaks	☒	-	-	☐

เอกสารไม่ควบคุม

PM Cation ID#1048

Preventive Maintenance Check List

เอกสารไม่ควบคุม



AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial number	Firmware Version
AS-DV	220360045	1.6.0

No.	Description	Result			
Power on & Connection		Checked	Cleaned	Replaced	N.A.
1.	AS-DV power on	☒	-	-	☐
2.	AS-DV connection	☒	-	-	☐
Sampling Tip		Checked	Cleaned	Replaced	N.A.
3.	Sampling needle	☐	☒	☐	☐
4.	Sampling tubing (Transfer line)	☐	☒	☐	☐
5.	Reconnect sampling needle & tubing	☒	-	-	☐
Other		Checked	Cleaned	Replaced	N.A.
6.	Check carousel movement	☒	-	-	☐
7.	Check needle movement	☒	-	-	☐
8.	Lubricate needle drive	☐	☒	-	☐
9.	AS-DV cover	☒	☐	☐	☐
(Optional) High Pressure Valve		Checked	Cleaned	Replaced	N.A.
10.	High pressure valve - Port	☐	☐	☐	☒
11.	- Rotor seal	☐	☐	☐	☒
12.	- Stator face	☐	☐	☐	☒
13.	- Reconnected liquid line to the valve	☐	☐	☐	☒

Others / comments

เอกสารไม่ควบคุม



Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co.,Ltd.	Khun Suwan Kongthong / Lab
Engineer	Date
Mr Channarong Khiao-Un	23-24/Apr/2024

Instrument Detail

Instrument Model	Application
Aquion	Cation
Instrument components	Serial Number
Aquion	220340349

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
CS12A	CG12A	CDER-800	-	-

Remark: อะไหล่ที่เปลี่ยนไปใช้ใหม่, System ยังใช้เดิม

Perform By Archemica

Arch

Date

เอกสารไม่ควบคุม



General ICS Maintenance Checklist

No.	Description		Result			
Power on & Connection			Checked	Cleaned	Replaced	N.A.
1	Instrument power on		☒	-	-	☐
2	Instrument connection		☒	-	-	☐
Injection Valve Rebuild			Checked	Cleaned	Replaced	N.A.
3	Rebuilt injection valve - port		☒	☐	☐	☐
4	-	Rotor seal	☒	☐	☐	☐
5	-	Stator face	☒	☐	☐	☐
(Optional) Auxiliary Valve Rebuild			Checked	Cleaned	Replaced	N.A.
6	Rebuilt auxiliary valve - port		☐	☐	☐	☒
7	-	Rotor seal	☐	☐	☐	☒
8	-	Stator face	☐	☐	☐	☒
Check Valve Cartridge			Checked	Cleaned	Replaced	N.A.
9	Inlet check valve assembly		☒	☐	☐	☐
10	Outlet check valve assembly		☒	☐	☐	☐
11	Verified correct flow orientation		☒	-	-	☐
Pump Piston Rinse Seal, Piston Seal and Piston			Checked	Cleaned	Replaced	N.A.
12	Piston rinse seal in primary pump head		☐	☒	☐	☐
13	Piston seal in primary pump head		☐	☒	☐	☐
14	Piston in primary pump head		☐	☒	☐	☐
15	Piston rinse seal in secondary pump head		☐	☒	☐	☐
16	Piston seal in secondary pump head		☐	☒	☐	☐
17	Piston in secondary pump head		☐	☒	☐	☐
Waste Valve and Priming Valve			Checked	Cleaned	Replaced	N.A.
18	Waste valve		☒	☐	☐	☐
19	Priming valve		☒	☐	☐	☐
Cell Detector			Checked	Cleaned	Replaced	N.A.
20	Check conductivity cell		☒	☐	☐	☐
21	Check electrochemical cell		☐	☐	☐	☒
22	-	Working electrode	☐	☐	☐	☒
23	-	Reference electrode	☐	☐	☐	☒
24	-	Gasket	☐	☐	☐	☒
25	-	Cell body	☐	☐	☐	☒
Other			Checked	Cleaned	Replaced	N.A.
26	Sample Loop	Size 25 uL	☒	☐	☐	☐
27	End-line filter		☒	☐	☐	☐
28	Leak sensor		☒	☐	☐	☐
29	Lubricate pump mechanic		☐	Lubricated	-	☐
30	Reconnected liquid lines to the valve		☒	-	-	☐
31	Reconnected liquid lines to pump heads		☒	-	-	☐
32	Primed pump		☒	-	-	☐
33	Checked pump for leaks		☒	-	-	☐
34	Checked gas for leaks		☒	-	-	☐

เอกสารไม่ควบคุม

CM OQ

Chromeleon
Operation QualificationThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification

General Information

Computer Name Version Number:
Instrument Controller: DESKTOP-C4FS3L7 7.3.1 Build 6535
Client: DESKTOP-C4FS3L7 7.3.1.6535
Operator: Mr.Channarong Khiao-Un

Overall Test Result: **Passed**

Comparison Format:

All Parameters:	Significant Digits:	10
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Reviewer's Signature / Date

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Detection Algorithm: Cobra
Calibration Type: Lin, With Offset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

Report Variable	Peak Name	Status
Offset (c0)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Slope (c1)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Correlation Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Std. Deviation	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Rel. Std. Dev.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Calibration Point Y	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Amount [ng]	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Resolution (EP)	Acetanilide	ok
	Acetophenone	ok
Resolution (USP)	Acetanilide	ok
	Acetophenone	ok
Peak Asymmetry (EP/USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Peak Asymmetry (AIA)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (JP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

Test Result: Passed

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 2
Most Frequently Used Parameters: Comparison with Expected Results

Detection Algorithm: Cobra
Calibration Type: Lin, With Offset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

Variable Category	Report Variable	Peak Name	Status
Injection	No.		ok
	Name		ok
	Type		ok
	Position		ok
	Status		ok
	Volume		ok
	Dilution Factor		ok
	Weight		ok
	IntStd		ok
	InstrumentMethod		ok
	ProcessingMethod		ok
Chromatogram	Channel		ok
	No. of Peaks		ok
	Chromatogram Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Unit		ok
	Noise		ok
Peak Results	No.	Acetanilide	ok
	No.	Acetophenone	ok
	No.	Propiophenone	ok
	Peak Name	Acetanilide	ok
	Peak Name	Acetophenone	ok
	Peak Name	Propiophenone	ok
	Ret.Time	Acetanilide	ok
	Ret.Time	Acetophenone	ok
	Ret.Time	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 2
Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Abs.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(abs)	Acetophenone	ok
	Ret.Dev.(abs)	Propiophenone	ok
	Rel.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(rel)	Acetophenone	ok
	Ret.Dev.(rel)	Propiophenone	ok
	Area	Acetanilide	ok
	Area	Acetophenone	ok
	Area	Propiophenone	ok
	Rel.Area	Acetanilide	ok
	Rel.Area (Total)	Acetophenone	ok
	Rel.Area (Total)	Propiophenone	ok
	Height	Acetanilide	ok
	Height	Acetophenone	ok
	Height	Propiophenone	ok
	Rel.Height (Total)	Acetanilide	ok
	Rel.Height (Total)	Acetophenone	ok
	Rel.Height (Total)	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Concentration	Acetanilide	ok
	Concentration	Acetophenone	ok
	Concentration	Propiophenone	ok
	Rel.Amount	Acetanilide	ok
	Rel.Amount	Acetophenone	ok
	Rel.Amount	Propiophenone	ok
	Peak Width (0%)	Acetanilide	ok
	Peak Width (0%)	Acetophenone	ok
	Peak Width (0%)	Propiophenone	ok
	Peak Width (5%)	Acetanilide	ok
	Peak Width (5%)	Acetophenone	ok
	Peak Width (5%)	Propiophenone	ok
	Peak Width (10%)	Acetanilide	ok
	Peak Width (10%)	Acetophenone	ok
	Peak Width (10%)	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Acetanilide	ok
	Peak Width (50%)	Acetophenone	ok
	Peak Width (50%)	Propiophenone	ok
	Left Width (0%)	Acetanilide	ok
	Left Width (0%)	Acetophenone	ok
	Left Width (0%)	Propiophenone	ok
	Right Width (0%)	Acetanilide	ok
	Right Width (0%)	Acetophenone	ok
	Right Width (0%)	Propiophenone	ok
	Peak Start	Acetanilide	ok
	Peak Start	Acetophenone	ok
	Peak Start	Propiophenone	ok
	Peak Stop	Acetanilide	ok
	Peak Stop	Acetophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Start Value	Acetanilide	ok
	Peak Start Value	Acetophenone	ok
	Peak Start Value	Propiophenone	ok
	Peak Stop Value	Acetanilide	ok
	Peak Stop Value	Acetophenone	ok
	Peak Stop Value	Propiophenone	ok
	BL-Value Peak Start	Acetanilide	ok
	BL-Value Peak Start	Acetophenone	ok
	BL-Value Peak Start	Propiophenone	ok
	BL-Value Peak Stop	Acetanilide	ok
	BL-Value Peak Stop	Acetophenone	ok
	BL-Value Peak Stop	Propiophenone	ok
	Type	Acetanilide	ok
	Type	Acetophenone	ok
	Type	Propiophenone	ok
	Resolution (EP)	Acetanilide	ok
	Resolution (EP)	Acetophenone	ok
	Resolution (USP)	Acetanilide	ok
	Resolution (USP)	Acetophenone	ok
	Asymmetry (EP)	Acetanilide	ok
	Asymmetry (EP)	Acetophenone	ok
	Asymmetry (EP)	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Acetanilide	ok
	Asymmetry(AIA)	Acetophenone	ok
	Asymmetry(AIA)	Propiophenone	ok
	Theor. Plates(EP)	Acetanilide	ok
	Theor. Plates(EP)	Acetophenone	ok
	Theor. Plates(EP)	Propiophenone	ok
	Theor. Plates(USP)	Acetanilide	ok
	Theor. Plates(USP)	Acetophenone	ok
	Theor. Plates(USP)	Propiophenone	ok
	Theor. Plates(JP)	Acetanilide	ok
	Theor. Plates(JP)	Acetophenone	ok
	Theor. Plates(JP)	Propiophenone	ok
Peak Calibration	Cal.Mode	Acetanilide	ok
	Cal.Mode	Acetophenone	ok
	Cal.Mode	Propiophenone	ok
	Cal.Type	Acetanilide	ok
	Cal.Type	Acetophenone	ok
	Cal.Type	Propiophenone	ok
	Weights	Acetanilide	ok
	Weights	Acetophenone	ok
	Weights	Propiophenone	ok
	Calibr. Coefficient C0	Acetanilide	ok
	Calibr. Coefficient C0	Acetophenone	ok
	Calibr. Coefficient C0	Propiophenone	ok
	Calibr. Coefficient C1	Acetanilide	ok
	Calibr. Coefficient C1	Acetophenone	ok
	Calibr. Coefficient C1	Propiophenone	ok
	RF-Value	Acetanilide	ok
	RF-Value	Acetophenone	ok
	RF-Value	Propiophenone	ok
	No. of Points	Acetanilide	ok
	No. of Points	Acetophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propiophenone	ok
	No. of Points(disabled)	Acetanilide	ok
	No. of Points(disabled)	Acetophenone	ok
	No. of Points(disabled)	Propiophenone	ok
	Variance	Acetanilide	ok
	Variance	Acetophenone	ok
	Variance	Propiophenone	ok
	Var.Coeff	Acetanilide	ok
	Var.Coeff	Acetophenone	ok
	Var.Coeff	Propiophenone	ok
	Std.Dev.	Acetanilide	ok
	Std.Dev.	Acetophenone	ok
	Std.Dev.	Propiophenone	ok
	Rel.Std.Dev.	Acetanilide	ok
	Rel.Std.Dev.	Acetophenone	ok
	Rel.Std.Dev.	Propiophenone	ok
	Corr.Coeff.	Acetanilide	ok
	Corr.Coeff.	Acetophenone	ok
	Corr.Coeff.	Propiophenone	ok
	R-Square	Acetanilide	ok
	R-Square	Acetophenone	ok
	R-Square	Propiophenone	ok
	Adj. R-Square	Acetanilide	ok
	Adj. R-Square	Acetophenone	ok
	Adj. R-Square	Propiophenone	ok
	X	Acetanilide	ok
	X	Acetophenone	ok
	X	Propiophenone	ok
	Y	Acetanilide	ok
	Y	Acetophenone	ok
	Y	Propiophenone	ok
	W	Acetanilide	ok
	W	Acetophenone	ok
	W	Propiophenone	ok
	F(X)	Acetanilide	ok
	F(X)	Acetophenone	ok
	F(X)	Propiophenone	ok

เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC

Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Acetanilide	ok
	Residual for Cal.Point X	Acetophenone	ok
	Residual for Cal.Point X	Propiophenone	ok
	Calibration Point Status	Acetanilide	ok
	Calibration Point Status	Acetophenone	ok
	Calibration Point Status	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Amount	Propiophenone	ok
Component	Cal.Type	Acetanilide	ok
	Peak Type	Acetanilide	ok
	Left Limit	Acetophenone	ok
	Right Limit	Acetanilide	ok
	Group	Acetanilide	ok
	Factor	Acetophenone	ok
	Amount	Acetanilide	ok
	Conc.Unit	Acetophenone	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Acetanilide	ok
	PPI	Acetophenone	ok
	PPI	Propiophenone	ok
	RSD PPI	Acetanilide	ok
	RSD PPI	Acetophenone	ok
	RSD PPI	Propiophenone	ok
	Match	Acetanilide	ok
	Match	Acetophenone	ok
	Match	Propiophenone	ok
	RSD Match	Acetanilide	ok
	RSD Match	Acetophenone	ok
	RSD Match	Propiophenone	ok
	Rel.Max at	Acetanilide	ok
	Rel.Max at	Acetophenone	ok

Test Result: Passed

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Chromeleon Operational Qualification, Part 3 System Suitability Test: Comparison with Expected Results

Variable Category	Report Variable	Status
System Suitability Test Case	Number	ok
	Name	ok
	Inj. Condition	ok
	Eval. Formula	ok
	Operator	ok
	Statistics	ok
	Rounding	ok
	MinimumNumberOfInjections	ok
	MaximumNumberOfInjections	ok
	Channel	ok
	Peak	ok
	Ref. Value Formula 1	ok
	Ref. Value Formula 2	ok
	N.A.	ok
System Suitability Test Case Result	Inj. Eval. Result	ok
	Eval. Result	ok
	Peak Result	ok
	Injection Condition Result	ok
	Ref. Value 1	ok
	Ref. Value 2	ok
	Result	ok
	Message	ok
	Average	ok
	Count	ok
	Maximum	ok
	Minimum	ok
	Range	ok
	Rel. Range	ok

Test Result: Passed

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SOFTWARE OQ



Chromeleon

Part 1 - Verification of Selected Results	PASS
Part 2 - Most Frequently Used Parameters: Comparison with Expected Results	PASS
Part 3 - System Suitability Test: comparison with Expected Results	PASS

PQ Anion ID#1047

Performance Qualification

OVERALL TEST RESULTS

Field Service	

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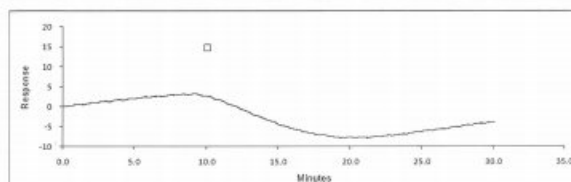
เอกสารไม่ควบคุม

Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	27970244	N/A	N/A
Thermocouple	Fluke	K-Type	27970244	N/A	N/A
Balance	Mettler Toledo	AB204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	21379153	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

Standards/Chemicals

Description	Manufacturer	Concentration	Part Number	Lot Number	Expiration Date
Nitrate	Thermo Scientific	5 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	10 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	25 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	50 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	100 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	1000 ppm	060254	231226	Dec-2024
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A



Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	chrom://desktop-c4fs37/ChromeleonLocal/Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ.seq/278.smp/ECD_1.channel

Noise and Drift

Test	Measured (nS)	OQ Limit (nS)	Result	Conversion Factor
Noise	1.1 nS	≤ 2.0 nS	PASS	1000
Drift	16.1 nS/hr	≤ 20.0 nS/hr	PASS	1000



Field

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OVERALL TEST RESULT: PASS



Field

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Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal/Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Repeatability 01	25	0.265	2.825
Repeatability 02	25	0.265	2.822
Repeatability 03	25	0.265	2.831
Repeatability 04	25	0.265	2.835
Repeatability 05	25	0.265	2.834
Repeatability 06	25	0.265	2.836

Repeatability

Test	Measured (% RSD)	OQ Limit (% RSD)	Result
Retention Time	0.0	≤ 5.0	PASS
Area	0.2	≤ 1.0	PASS



OVERALL TEST RESULT: PASS

Field Service

เอกสารไม่ควบคุม

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal/Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.265	0.053
High Standard	25	0.265	49.734
Carryover	25	0.265	0.051

Results

Test	Observed (%)	OQ Limit (%)	Result
AREA	0.00	≤ 0.10	PASS

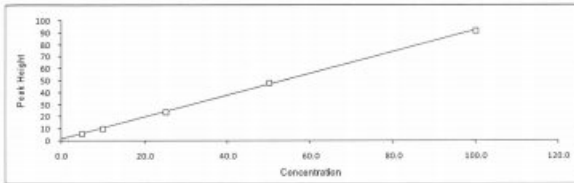


OVERALL TEST RESULT: PASS

Field

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DETECTOR LINEARITY (CD)

ThermoFisher
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Information

System Name	Aquion RFIG
Detector SN	220360045
Data Path	ChromleonLocal://Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/AnionIC OQ

Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	5.872	4.82
Detector Linearity 02	10	10.299	9.68
Detector Linearity 03	25	23.794	24.52
Detector Linearity 04	50	48.473	51.65
Detector Linearity 05	100	91.855	99.34

Linearity

Test	Observed	OQ Limit	Result
r ²	0.999	≥ 0.999	PASS



OVERALL TEST

Field Service	
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ELUENT GENERATOR TEST

ThermoFisher
SCIENTIFIC

EG Current Test

Set Point (mM)	Expected (mA)	Reading (mA)	Deviation (mA)	OQ Limit (mA)	Result
1.00	1.6082	1.604	0.00	± 0.01	PASS
5.00	8.041	8.019	0.02	± 0.05	PASS
10.00	16.082	16.037	0.05	± 0.10	PASS
50.00	80.41	80.17	0.24	± 0.50	PASS
100.00	160.82	160.32	0.50	± 1.00	PASS



OVERALL TEST RESULT: PASS

Field Service	
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IC PUMP FLOW RATE ACCURACY

ThermoFisher
SCIENTIFIC

IC Pump Flow Rate

Set Point (mL/min)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4995	0.100	± 2.0	PASS
1.0	0.999	0.10	± 2.0	PASS



OVERALL TEST RESULT: PASS

Field Service	
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TEMPERATURE ACCURACY

ThermoFisher
SCIENTIFIC

Column Compartment

Set Point (°C)	Reading (°C)	Deviation (°C)	OQ Limit (°C)	Result
30.0	30.5	0.5	± 2.0	PASS



OVERALL TEST RESULT: PASS

Field Service	
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N/A

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Field

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These Operational Qualification Results should be reviewed by the Customer. If the qualification is accepted, both the Customer and the Service Representative should sign the Operational Qualification Results, below.

OPERATIONAL QUALIFICATION RESULTS

Based upon the actual results obtained, this Operational Qualification **PASSED** the acceptance criteria described in the Operational Qualification in the Installation Checklist procedure.

Service Representative

A Field Service Representative signature below confirms the completion of all aspects of the Operational Qualification and have concluded that the system has been successfully verified to be operating as required.

Customer

A Customer signature below confirms the completion of all aspects of the Operational Qualification have been completed and that the system has been successfully verified to be operating as required.



Field Service Representative Signature:	Customer Signature:

เอกสารไม่ควบคุม



Request No. 25-67 / 0275

MTC. ACL.No. 358 / 67

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

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

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

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

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

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

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

CALIBRATION DATE : 2 February 2024

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

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

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

AMBIENT CONDITIONS : Temperature $25 \pm 5^\circ\text{C}$ Relative humidity $50 \pm 20\%$

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

Calibrated by

Director of Analytical Chemistry Laboratory

Ref. 2015267020100454001

Issued Date : 11 March 2024

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

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

FM.BLMTC.002 Rev.4

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Request No. 25-67 / 0275

1 / 5

MTC. ACL. No. 358 / 67

CALIBRATION DATA

1. Noise Level

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

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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Request No. 25-67 / 0275

2 / 5

MTC. ACL. No. 358 / 67

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0078	0.0076	0.0069	0.0075	0.0071	0.0070	0.0076	0.0074	0.0077	0.0067	0.007	0.0004	5.15
	0.30	0.1008	0.1007	0.0999	0.0997	0.1000	0.0996	0.1008	0.1002	0.1005	0.0999	0.100	0.0005	0.46
	0.70	0.2301	0.2306	0.2277	0.2305	0.2310	0.2295	0.2290	0.2293	0.2305	0.2296	0.230	0.0010	0.42
Cr	0.10	0.0094	0.0093	0.0093	0.0098	0.0094	0.0095	0.0090	0.0090	0.0094	0.0090	0.009	0.0003	2.75
	0.30	0.0241	0.0236	0.0221	0.0238	0.0231	0.0226	0.0231	0.0223	0.0230	0.0231	0.023	0.0006	2.75
	0.70	0.0500	0.0500	0.0500	0.0524	0.0499	0.0511	0.0509	0.0512	0.0515	0.0504	0.051	0.0008	1.63
Cu	0.05	0.0061	0.0062	0.0064	0.0061	0.0069	0.0069	0.0061	0.0062	0.0064	0.0061	0.006	0.0003	5.00
	0.30	0.0419	0.0411	0.0402	0.0407	0.0405	0.0404	0.0399	0.0400	0.0399	0.0400	0.040	0.0006	1.58
	0.70	0.0960	0.0960	0.0960	0.0959	0.0947	0.0955	0.0952	0.0952	0.0951	0.0955	0.096	0.0005	0.48
Fe	0.10	0.0096	0.0101	0.0103	0.0100	0.0099	0.0096	0.0106	0.0099	0.0105	0.0102	0.010	0.0003	3.38
	0.50	0.0424	0.0415	0.0428	0.0427	0.0421	0.0426	0.0413	0.0430	0.0421	0.0419	0.042	0.0006	1.33
	1.00	0.0830	0.0839	0.0847	0.0834	0.0832	0.0820	0.0839	0.0838	0.0837	0.0845	0.084	0.0008	0.92
Pb	0.20	0.0078	0.0074	0.0078	0.0078	0.0076	0.0078	0.0077	0.0078	0.0078	0.0077	0.008	0.0001	1.71
	0.70	0.0278	0.0273	0.0271	0.0267	0.0270	0.0264	0.0274	0.0273	0.0269	0.0269	0.027	0.0004	1.45
	1.50	0.0551	0.0548	0.0552	0.0555	0.0547	0.0546	0.0544	0.0544	0.0549	0.0547	0.055	0.0004	0.64
Mn	0.05	0.0116	0.0107	0.0110	0.0103	0.0108	0.0108	0.0112	0.0107	0.0109	0.0108	0.011	0.0003	3.15
	0.30	0.0650	0.0649	0.0649	0.0651	0.0646	0.0646	0.0649	0.0646	0.0640	0.0648	0.065	0.0003	0.48
	0.70	0.1463	0.1465	0.1459	0.1471	0.1475	0.1474	0.1487	0.1473	0.1462	0.1468	0.147	0.0008	0.56
Ni	0.10	0.0095	0.0100	0.0096	0.0103	0.0102	0.0096	0.0100	0.0095	0.0097	0.0096	0.010	0.0003	3.04
	0.50	0.0443	0.0433	0.0438	0.0444	0.0430	0.0437	0.0444	0.0437	0.0438	0.0434	0.044	0.0005	1.09
	1.00	0.0812	0.0820	0.0834	0.0829	0.0818	0.0829	0.0831	0.0835	0.0816	0.0819	0.082	0.0008	0.99
Zn	0.05	0.0374	0.0377	0.0373	0.0377	0.0374	0.0377	0.0373	0.0371	0.0371	0.0374	0.037	0.0002	0.61
	0.30	0.1985	0.1993	0.1975	0.1992	0.1979	0.1988	0.1995	0.1985	0.1974	0.2004	0.199	0.0006	0.87
	0.70	0.4027	0.4031	0.4019	0.4021	0.4023	0.3981	0.4042	0.4025	0.3993	0.3997	0.402	0.001	0.87

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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FM.BLMTC.002 Rev.4

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Request No. 25-67 / 0275

3 / 5

MTC. ACL. No. 358 / 67

3. Trueness

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

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

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

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

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.051	0.047	-0.004	7.58	± 0.003
	0.303	0.296	-0.007	2.19	± 0.009
	0.704	0.698	-0.005	0.74	± 0.020

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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Request No. 25-67 / 0275

4 / 5

MTC. ACL. No. 358 / 67

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

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

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

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

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

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

Continue 5 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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เอกสารไม่ควบคุม 5225, 5217



Request No. 25-67 / 0275

5 / 5

MTC. ACL. No. 358 / 67

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

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

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

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

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 ($k = 2$)

which gives a level of confidence of approximately 95%

Calibrated by .

Director of Analytical Chemistry Laboratory

Issued Date : 11 March 2024

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

End of Certificate

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

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

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เอกสารไม่ควบคุม 5225, 5217

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018 Page 1 of 5

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

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

Location of calibration : Laboratory 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 : 

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

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

เอกสารไม่ควบคุม
2021

REPORT OF CALIBRATION

Certificate No. : SP24-018 Page 2 of 5

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

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

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	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.

เอกสารไม่ควบคุม

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



ISO 9001

ISO 14001

ISO 45001

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	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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NSC-TIS-17025
CALIBRATION 0004

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
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

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
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 result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม
PM-008-02 R01 1/11/2021

Calibration Certificate

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

Page 1 of 5

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

Calibrated by Mr.Manas Somsak Specialist
Approved by [Redacted]
 Manager, Division of Calibration Laboratory
Date of Issue: 12 March 2024
 Responsible for the Technical Management Team

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its 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.: 2401718-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553

Page 2 of 5

Date of Calibration: 11 March 2024
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (51 ± 3) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration

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

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	23E2003	14 June 2024
2.2 Digital Thermometer	2709007	Fluke	CC 660570-01	30 October 2024
2.3 Thermo-Hygro Meter	NFLBTH 014/23	Iesio	CC 660353-01	3 April 2024
Certified Reference Material	Lot No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	888842	CPAchem	PH216 L5	13 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	888843	CPAchem	PH217 L5	13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	888844	CPAchem	PH220 L5	13 April 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	C03109	HACH LANGE GmbH	S11M004	16 October 2025

3. This certification is traceable to The International System of Unit (SI Unit)
 3.1 Instruments No.2.1 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
 3.2 Instruments No.2.2 and 2.3 through NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
 3.3 Certified Reference Material No.2.4 to 2.6 traceable to Primary measurement method- Hamed oil using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
 3.4 Certified Reference Material No.2.7 traceable to PTB Certificate Nr. PTB-PHQA-563/30504/23 and Certificate Nr. PTB-PHOB-555/30620/22 (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.

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



Calibration Report

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

Calibration Results:

(Manual Temperature Compensation at 25 °C)

(offset value before adjust: -0.4 mV)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty ($\pm$ mV)	Coverage Factor (k)
		mV	pH		
0	414.121	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-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 Solids
Serial No.:	3065701	ID.No.	N/A

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

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	188	-	0.0071	2.00
7.001	7.00	13	98.9	0.0086	2.00
10.010	10.01	-160	97.2	0.0085	2.00
6.865	6.87	21	-	0.0074	2.00



Calibration Report

Certificate No.:	2401718-001-01		
Equipment:	Digital Thermometer with RTD (pH Meter)		
Resolution:	0.1 °C	Model:	SevenEasy pH
Serial No.:	1231155210	ID No.:	UAE.WAT.010/2553
Manufacturer:	METTLER TOLEDO		

Date of Calibration:

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

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

Relative Humidity 51 % $\pm$ 2 %

Condition of this results of Calibration:

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

2. Reference Standard Instrument

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2118154	PSL-T 0877/66	06-Jun-24	T1STR
Platinum Resistance Thermometer (PRT)	5627A	877332			

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

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated item :	Good	
7. Result of Calibration :	X Without adjustment	After adjustment



Calibration Report

Certificate No.: 2401718-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1231155210 ID No.: UAE.WAT.010/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 11 March 2024

Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

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

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.998	0.1	0.099
25.1	24.998	0.1	0.099
35.1	34.997	0.1	0.099

Note

- UUC* : Unit Under Calibration

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

----- End -----

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





Certificate No.: C07240167 Page 2 of 3

Certificate of Calibration

Equipment: pH METER Certificate No.: C07240167
Model: SevenEasy Issued Date: 9 April 2024
Serial No. (or ID.): 1230525212 (UAE.WAS.003/2553) Job No.: WO-00024208
Manufacturer: METTLER TOLEDO Page: 1 of 3
Electrode Serial No.: 1156883 Model: InLab Solids Brand: METTLER TOLEDO
Condition: In Condition

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

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

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

Calibration By: 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
meaurement 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

Calibration Results:

pH Scale

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

Person in charge

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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CAL-FM-C07-14: 9 Apr 2024

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CAL-FM-C07-14: 9 Apr 2024



Certificate No.: C07240167 Page 3 of 3

Practical slope and zero point*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 9.997

-During calibration, display of pH meter reading; pH 4.00 , pH 7.00 and pH 10.01

The practical slope of the pH electrode; 57.01 (mV/pH), 96.37%

The zero point of the pH electrode; 6.88 (pH)

Sample Test Results

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

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

The End of Certificate

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CAL-FM-C07-14: 9 Apr 2024



Certificate of Calibration

Equipment:	Digital Thermometer with Probe	Certificate No.:	C15240373
Model:	SevenEasy pH	Issued Date:	09 April 2024
Serial No.:	1230525212	Job No.:	WO-00024208
Manufacturer:	METTLER TOLEDO	Page:	1 of 2
ID No.:	UAE.WAS.003/2553	Condition:	In Condition

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

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

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

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

Person in charge

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).

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CAL-FM-C15-14: 06 Dec 2022



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



Certificate of Calibration

Certificate No.: C24240057

Page: 2 of 2

Calibration Results:

Before Adjustment

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

After Adjustment ; at 1413 $\mu\text{S/cm}$

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

Equipment: CONDUCTIVITY METER Certificate No.: C24240057
 Model: Lab 955 Issued Date: 11 March 2024
 Serial No. (or ID.): 16300356 Job No.: WO-00020309
 Manufacturer: SI Analytic Page: 1 of 2
 Electrode Serial No. 16070067 Model : LF413T Brand : SI Analytic
 Condition: In Condition

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

Environment Condition: Temperature 23 $^{\circ}\text{C}$ $\pm$ 2 $^{\circ}\text{C}$
 Humidity 50 %RH $\pm$ 15 %RH

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

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

The End of Certificate



Person in Charge: _____

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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CAL-FM-C24-09: 12 Sep 2022

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CAL-FM-C24-09: 12 Sep 2022

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

Manager,
 Responsible

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
Model: XSR204
Serial No.: C117635043
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.WAS.012/2564

Date of Calibration: 10 May 2023

Page 2 of 4

Environment Condition: Ambient Temperature: 21.4 ± 0.2 °C Relative Humidity: 43.4 ± 0.9 %

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-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 016/23	Quality Reborn	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:

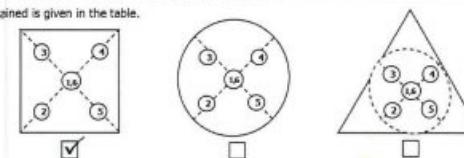
1. Repeatability of Reading:

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	100.0003	100.0002	0.0001

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



Calibration Report

Certificate No.: 2302827-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

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
Unload	0.00000	0.0000	0.0000	0.000085	2.00
0.01	0.01000	0.0100	0.0000	0.000085	2.00
0.02	0.02001	0.0200	0.0000	0.000085	2.00
0.05	0.05000	0.0500	0.0000	0.000085	2.00
0.1	0.10001	0.1000	0.0000	0.000085	2.00
0.2	0.20001	0.2000	0.0000	0.000085	2.00
0.5	0.50002	0.5000	0.0000	0.000085	2.00
1	1.00000	1.0000	0.0000	0.000086	2.00
2	2.00002	2.0000	0.0000	0.000086	2.00
3	3.00003	3.0000	0.0000	0.000087	2.00
5	5.00002	5.0000	0.0000	0.000087	2.00
10	10.00001	10.0000	0.0000	0.000088	2.00
20	20.00003	20.0000	0.0000	0.000092	2.00
30	30.00004	30.0000	0.0000	0.000098	2.00
40	40.00007	40.0000	0.0000	0.00011	2.00
45	45.00009	45.0001	0.0000	0.00013	2.00

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

Calibration Report

Certificate No.: 2302827-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

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	50.00003	50.0000	0.0000	0.00011	2.00
55	55.00005	55.0000	0.0000	0.00012	2.00
60	60.00004	60.0000	0.0000	0.00012	2.00
65	65.00005	65.0000	0.0000	0.00013	2.00
70	70.00006	70.0001	-0.0001	0.00013	2.00
75	75.00008	75.0002	-0.0001	0.00013	2.00
80	80.00007	80.0002	-0.0001	0.00014	2.00
85	85.00009	85.0002	-0.0001	0.00014	2.00
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0002	-0.0001	0.00016	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
200	200.00016	200.0003	-0.0001	0.00028	2.00

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

----- End -----

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



Calibration Certificate

Certificate No.: 2400141-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
 Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Hot Air Oven)
Manufacturer: MEMMERT
Model: UF 55
Serial No.: B216.1666
ID No.: UAE.WAO.027/2559
Order No.: 2400141
Operation No.: 2400141-001
Date of Receipt: 11 October 2023
Date of Calibration: 11 October 2023

Calibrated by Mr.Worapob Sooktong
 Scientist

Approved by

(M...)
 Manager, Division...
 Responsible for...

Date of Issue: 16 October 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.: 2400141-001-01
Equipment: CHAMBER (Hot Air Oven)
 Model: UF 55 Serial No.: B216.1666
 Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
 Manufacturer: MEMMERT

Date of Calibration: 11 October 2023

Page 2 of 3

Location: Laboratory, Floor 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition: Ambient Temperature (28 ± 1) °C
 Relative Humidity (63 ± 2) %
 Line Voltage (228 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
 - 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./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY49016894	TE 660380-01	22 April 2024	NATIONAL FOOD INSTITUTE
	RTD	CH#201-209/ RTD#201-209			

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

UUC Description :

Time of Record 1 Hour 9 Minute At 104.0, 140.0 and 180.0 °C
 Fresh air Damper ☐ Open Position ☐
☒ Close
☐ Not Available

- Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

Calibration Report

Certificate No.: 2400141-001-01
Equipment: CHAMBER (Hot Air Oven)
 Model: UF 55 Serial No.: B216.1666
 Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
 Manufacturer: MEMMERT

Date of Calibration: 11 October 2023

Page 3 of 3

Calibration point: 104.0, 140.0 and 180.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	28.2	61.4	227.4
MAX	28.3	65.1	229.3

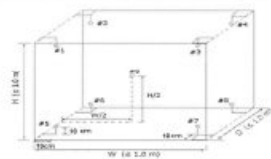


Table 1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	104.05	103.98	104.02	104.08	104.00	104.05	103.99	104.17	104.00	0.53
140.0	140.09	139.99	139.91	140.05	139.99	139.91	139.97	140.26	139.97	0.73
180.0	180.46	180.33	180.25	180.28	180.33	179.96	180.31	180.64	180.16	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.090	0.18	0.38
140.0	140.0	140.1	140.0	0.075	0.28	0.47
180.0	180.0	180.1	180.0	0.13	0.48	0.88

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

UUC* = Unit Under Calibration

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

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

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

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 -----





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.: 24TM303
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator
Manufacturer : Arco
Model : UC4-1320
Serial No. : 13JRC4S013201
ID No. : UAE.WAO.015/2561
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : [Redacted]
Approved by : [Redacted]
() Pornthippa Tameyakul
(✓) 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 : 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)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.873	19.803	20.322	19.690	19.615	19.585	19.612	19.558	19.645	0.58

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

เอกสารไม่ควบคุม



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

Cert. No.: 24TM303
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	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.

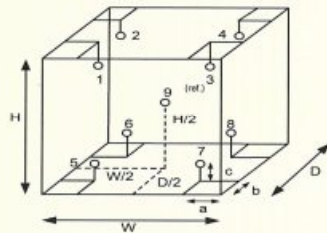
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	28	31
REL Humid. (%)	70	65
AC Supply (Volt)	233	234



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

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

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater
Meter Model : HI839800-02 **Serial No. :** 1147807
Tube Heater : 25 Vial Capacity **Resolution :** 0.1°C
Temperature Range : (-10 to 160)°C **Temperature of Reaction :** 150°C
Manufacturer : Hanna Instruments **Made in :** Romania
Condition As-Received : Used Product **Reference :** RE240681
Ambient Temperature : (25 ± 2)°C **Relative Humidity :** (50 ± 15)%RH
Customer name : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260
Received date : 22 April 2024
Calibrate date : 23 April 2024
Issue date : 25 April 2024
Calibrated Location : Hanna Instruments (Thailand) Ltd.
Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-04 by using certified reference standard instruments.

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Channarong Soinak

Approved by :

Mr.

Authorized Signatory

Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AI.07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	149.8	0.49

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
148.901	149.249	149.950	150.042	149.186
(1B)	(2B)	(3B)	(4B)	(5B)
149.724	149.578	149.852	150.100	150.117
(1C)	(2C)	(3C)	(4C)	(5C)
149.863	149.799	150.233	149.847	149.977
(1D)	(2D)	(3D)	(4D)	(5D)
149.550	149.666	149.958	149.744	149.819
(1E)	(2E)	(3E)	(4E)	(5E)
150.044	149.869	149.361	149.973	149.654

Figure: Shows the location of the temperature source.

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

** End of certificate **

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018 Page 1 of 5

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

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

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : 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 : 

Technical Manager

Quality Manager

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

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

REPORT OF CALIBRATION

Certificate No. : SP24-018 Page 2 of 5

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

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

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	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.

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



ISO 9001

ISO 14001

ISO 45001

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
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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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



NSC-TIS-715 17025
CALIBRATION 0004

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
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. : SP24-018

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
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 result expanded uncertainty of measurement *U* is stated as the standard uncertainty of measurement multiplied by the coverage factor *k*,

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

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม
PM-008-02_R01 1/11/2021



Request No. 25-67 / 0275

MTC. ACL.No. 358 / 67

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

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

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

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

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

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

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

CALIBRATION DATE : 2 February 2024

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

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

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

AMBIENT CONDITIONS : Temperature $25 \pm 5^\circ\text{C}$ Relative humidity $50 \pm 20\%$

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

Calibrated by

()

Ref. 2015267020100454001

Issued Date : 11 March 2024

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

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FM.BLMTC.002 Rev.4

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Request No. 25-67 / 0275

1 / 5

MTC. ACL. No. 358 / 67

CALIBRATION DATA

1. Noise Level

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

Continue 2 / 5

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Request No. 25-67 / 0275

2 / 5

MTC. ACL. No. 358 / 67

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%RSD
Cd	0.02	0.0078	0.0076	0.0069	0.0075	0.0071	0.0070	0.0076	0.0074	0.0077	0.0067	0.007	0.0004	5.15
	0.30	0.1008	0.1007	0.0999	0.0997	0.1000	0.0996	0.1008	0.1002	0.1005	0.0999	0.100	0.0005	0.46
	0.70	0.2301	0.2306	0.2277	0.2305	0.2310	0.2295	0.2290	0.2293	0.2305	0.2296	0.230	0.0010	0.42
Cr	0.10	0.0094	0.0093	0.0093	0.0098	0.0094	0.0095	0.0090	0.0090	0.0094	0.0090	0.009	0.0003	2.75
	0.30	0.0241	0.0236	0.0221	0.0238	0.0231	0.0226	0.0231	0.0223	0.0230	0.0231	0.023	0.0006	2.75
	0.70	0.0500	0.0500	0.0500	0.0524	0.0499	0.0511	0.0509	0.0512	0.0515	0.0504	0.051	0.0008	1.63
Cu	0.05	0.0061	0.0062	0.0064	0.0061	0.0069	0.0069	0.0061	0.0062	0.0064	0.0061	0.006	0.0003	5.00
	0.30	0.0419	0.0411	0.0402	0.0407	0.0405	0.0404	0.0399	0.0400	0.0399	0.0400	0.040	0.0006	1.58
	0.70	0.0960	0.0960	0.0960	0.0959	0.0947	0.0955	0.0952	0.0952	0.0951	0.0955	0.096	0.0005	0.48
Fe	0.10	0.0096	0.0101	0.0103	0.0100	0.0099	0.0096	0.0106	0.0099	0.0105	0.0102	0.010	0.0003	3.38
	0.50	0.0424	0.0415	0.0428	0.0427	0.0421	0.0426	0.0413	0.0430	0.0421	0.0419	0.042	0.0006	1.33
	1.00	0.0830	0.0839	0.0847	0.0834	0.0832	0.0820	0.0839	0.0838	0.0837	0.0845	0.084	0.0008	0.92
Pb	0.20	0.0078	0.0074	0.0078	0.0078	0.0076	0.0078	0.0077	0.0078	0.0078	0.0077	0.008	0.0001	1.71
	0.70	0.0278	0.0273	0.0271	0.0267	0.0270	0.0264	0.0274	0.0273	0.0269	0.0269	0.027	0.0004	1.45
	1.50	0.0551	0.0548	0.0552	0.0555	0.0547	0.0546	0.0544	0.0544	0.0549	0.0547	0.055	0.0004	0.64
Mn	0.05	0.0116	0.0107	0.0110	0.0103	0.0108	0.0108	0.0112	0.0107	0.0109	0.0108	0.011	0.0003	3.15
	0.30	0.0650	0.0649	0.0649	0.0651	0.0646	0.0646	0.0649	0.0646	0.0640	0.0648	0.065	0.0003	0.48
	0.70	0.1463	0.1465	0.1459	0.1471	0.1475	0.1474	0.1487	0.1473	0.1462	0.1468	0.147	0.0008	0.56
Ni	0.10	0.0095	0.0100	0.0096	0.0103	0.0102	0.0096	0.0100	0.0095	0.0097	0.0096	0.010	0.0003	3.04
	0.50	0.0443	0.0433	0.0438	0.0444	0.0430	0.0437	0.0444	0.0437	0.0438	0.0434	0.044	0.0005	1.09
	1.00	0.0812	0.0820	0.0834	0.0829	0.0818	0.0829	0.0831	0.0835	0.0816	0.0819	0.082	0.0008	0.99
Zn	0.05	0.0374	0.0377	0.0373	0.0377	0.0374	0.0377	0.0373	0.0371	0.0371	0.0374	0.037	0.0002	0.61
	0.30	0.1985	0.1993	0.1975	0.1992	0.1979	0.1988	0.1995	0.1985	0.1974	0.2004	0.199	0.0009	0.47
	0.70	0.4027	0.4031	0.4019	0.4021	0.4023	0.3981	0.4042	0.4025	0.3993	0.3997	0.402	0.0019	

Continue 3 / 5

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Request No. 25-67 / 0275

3 / 5

MTC. ACL. No. 358 / 67

3. Trueness

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

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

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

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

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

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.051	0.047	-0.004	7.58	± 0.003
	0.303	0.296	-0.007	2.19	± 0.009
	0.704	0.698	-0.005	0.74	± 0.020

Continue 4 / 5

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Request No. 25-67 / 0275

4 / 5

MTC. ACL. No. 358 / 67

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

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

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

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

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

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

Continue 5 / 5

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5 / 5

MTC. ACL. No. 358 / 67

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

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

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

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

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 ($k = 2$)

which gives a level of confidence of approximately 95%

Calibrated by

Director of Analytical Chemistry Laboratory

Issued Date : 11 March 2024

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

End of Certificate

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Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES Preventive Maintenance

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

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

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

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Introduction

Customer Information

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

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Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** Flexible Repair Options | Agilent

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Service Engineer's Responsibilities

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

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Instrument Maintenance

System Information

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

Instrument System Name and ID	3110 VDV ICP-OES
Instrument System Site and Location	URE

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 3019A	M 13030001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

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

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Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. **N/A**
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

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Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

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

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SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

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ICP-OES adjustment

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

Record Post-PM instrument performance

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

- ☒ Record the result in the Instrument Test Results Table

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Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. ^{21A}
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☒ Complete the Signature Page with both Service Engineer and Customer signatures.

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Test Results

Instrument Performance Test Results Table

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

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial*	Radial	Axial*
Zn 213.857 nm SRBR	4190.5	6649.9	4700.6	7564.2
Mn 257.610 nm SRBR	13691.0	27295.3	14569.1	29992.5
Al 396.152 nm SBR	12.1	14.6	11.5	15.6
K 766.491 nm SBR	8.0	31.2	7.4	39.7

* 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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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	225.153 VAC	225.613 VAC
Mains Current	0.090 A	0.219 A
Instrument Temperature	24.0 °C	25.1 °C
RF Air Flow (sensor speed)	15.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	39.2 °C
Water Flow Oscillator	No measurement	1.57 L/min
Water Flow Detector	0.94 L/min	0.91 L/min
Water Inlet Temperature	13.3 °C	13.8 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-39.8 °C	-39.8 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	659.52 kPa	609.43 kPa
Purge Gas Supply Pressure*1	656.41 kPa	627.71 kPa
Option Gas Supply Pressure*1	- kPa	- kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	166.30 kPa
Plasma Gas Flow	No measurement	11.98 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	199.5 W
RF Supply Current	No measurement	5.223 A
RF Supply Voltage	No measurement	194.461 V

*1 If option installed

เอกสารไม่ควบคุม

Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	GB010-68014	GB010A, GB011A, GB014A/GB015A	1
Radial Pre-Optic Window	GB010-68016	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	-
Purge Gas Filter	GB010-60136	All	1
Air Inlet filter	GB000-68002	All	1
High Capacity Air Filter	GB010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	GB494-60002	GB494A/GB495	-
Rotor seal for 4 port valve for AVS4	GB493-60002	GB493A	-
Rinse solution to rinse station 2.5mm id x 1m	GB410-GB0123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	GB410-GB0124	SPS 4	-
PVC waste tubing 8mm od x 5mm id, 2m	GB410-GB0122	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC Solvaflex, 3 braided	3710049000	SPS 4	-

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

☐ Section Not Applicable[illegible]

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Document Number: G8014-90075
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Page 13 of 14



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Signature Page

Service Engineer Comments (optional)

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

Service Verification

Service Request Number:

6006 331120

Date Service Completed

16 Nov 2023

Service Engineer Name:

Customer Name:

Customer Name: Abayn Okano

Customer Signature: _____

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14

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



เอกสารไม่ควบคุม

Report Summary

Instrument Model	Agilent 51005110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Kanyakorn S.
Test Completed On	11/13/2023 9:18:24 AM

Result Summary

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

Page 1 of 4

Resolution Test

Pass

Element	Wavelength	Specification	Width
N	(174.213 nm)	≤ 9.40	5.92
As	(188.980 nm)	≤ 8.20	6.12
C	(193.027 nm)	≤ 11.50	8.31
Mo	(202.032 nm)	≤ 8.20	6.35
Cr	(206.158 nm)	≤ 13.40	8.99
Zn	(213.857 nm)	≤ 8.70	6.64
Pb	(220.355 nm)	≤ 9.50	7.05
Co	(226.615 nm)	≤ 17.20	11.68
Ba	(230.424 nm)	≤ 9.40	7.27
Mn	(257.810 nm)	≤ 13.30	9.46
Mn	(280.568 nm)	≤ 20.30	14.18
Cr	(267.716 nm)	≤ 11.00	8.01
Cu	(324.754 nm)	≤ 25.00	18.89
Cu	(327.395 nm)	≤ 14.20	11.29
Br	(353.071 nm)	≤ 33.50	24.46
Sr	(455.403 nm)	≤ 44.00	33.62
Sr	(460.733 nm)	≤ 36.00	17.37
Ba	(483.408 nm)	≤ 36.00	25.47
Ba	(614.171 nm)	≤ 42.00	25.43
K	(675.283 nm)	≤ 74.00	60.50
K	(766.491 nm)	≤ 80.00	65.33

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test				Fail		
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	142.0	958.5	41.7	
Se (196.026 nm)	≥ 41.0	SRBR	105.9	937.4	67.5	
Zn (213.857 nm)	≥ 1421.0	SRBR	4190.3	44372.5	111.6	
Pb (220.353 nm)	≥ 46.0	SRBR	213.9	2521.3	125.4	
Mn (257.610 nm)	≥ 3518.0	SRBR	13681.0	279651.7	416.6	
Al (396.152 nm)	≥ 3.4	SBR	12.1	52269.7	3994.3	
Ba (493.408 nm)	≥ 34.0	SBR	185.8	2294372.8	12280.0	
K (766.491 nm)	≥ 1.8	SBR	8.0	107401.4	11878.7	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	189.4	2285.0	129.5	
Se (196.026 nm)	≥ 159.0	SRBR	168.7	2613.7	233.8	
Zn (213.857 nm)	≥ 234.0	SRBR	905.0	10158.4	123.0	
Zn (213.857 nm)	≥ 1743.0	SRBR	6849.9	135760.6	390.5	
Cd (214.439 nm)	≥ 4227.0	SRBR	5597.6	82921.3	273.9	
Pb (220.353 nm)	≥ 320.0	SRBR	454.8	10111.2	451.1	
Mn (257.610 nm)	≥ 10625.0	SRBR	27295.3	1126118.1	1687.0	
Cr (267.716 nm)	≥ 1048.0	SRBR	3948.2	144875.3	1322.0	
Cu (324.754 nm)	≥ 19.0	SBR	49.2	341489.7	6798.2	
Al (396.152 nm)	≥ 6.0	SBR	14.6	235321.6	15043.9	
Ba (493.408 nm)	≥ 60.0	SBR	183.3	8393101.3	45538.3	
K (766.491 nm)	≥ 24.0	SBR	31.2	1447045.2	44917.1	

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.22	
Se (196.026 nm)	≤ 2.60	0.76	
Zn (213.857 nm)	≤ 1.50	0.33	
Pb (220.353 nm)	≤ 2.60	0.86	
Mn (257.610 nm)	≤ 1.50	0.45	
Al (396.152 nm)	≤ 1.50	0.37	
Ba (493.408 nm)	≤ 1.50	0.68	
K (766.491 nm)	≤ 1.50	0.33	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.63	
Se (196.026 nm)	≤ 1.50	0.87	
Zn (206.200 nm)	≤ 1.50	0.59	
Zn (213.857 nm)	≤ 1.50	0.46	
Cd (214.439 nm)	≤ 1.50	0.70	
Pb (220.353 nm)	≤ 1.50	0.36	
Mn (257.610 nm)	≤ 1.50	0.95	
Cr (267.716 nm)	≤ 1.50	0.56	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.63	
Ba (493.408 nm)	≤ 1.50	0.86	
K (766.491 nm)	≤ 1.50	1.13	

Page 4 of 4

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Kanyakorn S.	
Test Completed On	11/13/2023 11:10:02 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Skipped	
Water Flow Test	Skipped	
Gas Flows Test	Skipped	
RF Generator Test	Skipped	
Camera Test	Skipped	
Optics Test	Pass	
Advanced Valve System Test	Skipped	
Resolution Test	Pass	
Sensitivity Test	Pass	
Precision Test	Pass	
Subsystem Communications Test	Pass	
Optics Test		
	Radial	Axial
Intensity	3522064	4003312
Wavelength	737.212	737.212

Page 1 of 4

เอกสารไม่ควบคุม

Resolution Test			Pass		
Element Wavelength	Specification	Width			
N (174.213 nm)	≤ 9.40	6.92			
As (188.980 nm)	≤ 8.20	6.08			
C (193.027 nm)	≤ 11.50	8.33			
Mo (202.032 nm)	≤ 8.20	6.31			
Cr (206.158 nm)	≤ 13.40	8.98			
Zn (213.857 nm)	≤ 8.70	6.73			
Pb (220.353 nm)	≤ 9.50	7.02			
Co (228.615 nm)	≤ 17.20	11.65			
Ba (230.424 nm)	≤ 9.40	7.38			
Mn (257.610 nm)	≤ 13.30	9.46			
Mn (260.568 nm)	≤ 20.30	14.05			
Cr (267.716 nm)	≤ 11.00	7.92			
Cu (324.754 nm)	≤ 25.00	18.84			
Cu (327.395 nm)	≤ 14.20	11.31			
Sr (338.071 nm)	≤ 33.50	24.18			
Ba (455.403 nm)	≤ 44.00	33.28			
Sr (460.733 nm)	≤ 36.00	17.41			
Ba (493.408 nm)	≤ 36.00	25.43			
Ba (614.171 nm)	≤ 42.00	25.27			
Ar (675.283 nm)	≤ 74.00	56.87			
K (766.491 nm)	≤ 80.00	65.88			

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test		Pass				
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	168.6	1284.6	53.3	
Se (196.026 nm)	≥ 41.0	SRBR	122.4	1256.0	90.7	
Zn (213.857 nm)	≥ 1421.0	SRBR	4700.8	53870.1	130.7	
Pb (220.353 nm)	≥ 46.0	SRBR	236.0	3100.6	155.7	
Mn (257.610 nm)	≥ 3518.0	SRBR	14569.1	318398.1	478.2	
Al (396.152 nm)	≥ 3.4	SBR	11.5	59510.5	4761.6	
Ba (493.408 nm)	≥ 34.0	SBR	170.6	2490835.6	14514.2	
K (766.491 nm)	≥ 1.8	SBR	7.4	117698.7	14024.1	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	214.5	2706.2	142.8	
Se (196.026 nm)	≥ 159.0	SRBR	188.0	3262.8	255.9	
Zn (206.200 nm)	≥ 234.0	SRBR	1088.2	12794.8	135.3	
Zn (213.857 nm)	≥ 1743.0	SRBR	7564.2	156883.9	427.8	
Cd (214.439 nm)	≥ 4227.0	SRBR	6647.3	116281.7	304.4	
Pb (220.353 nm)	≥ 320.0	SRBR	519.3	12490.2	530.3	
Mn (257.610 nm)	≥ 10625.0	SRBR	29992.5	1305852.5	1890.2	
Cr (267.716 nm)	≥ 1048.0	SRBR	4366.6	173343.4	1547.9	
Cu (324.754 nm)	≥ 19.0	SBR	46.8	361093.0	7560.5	
Al (396.152 nm)	≥ 6.0	SBR	15.6	274029.5	16498.6	
Ba (493.408 nm)	≥ 60.0	SBR	203.6	9028914.5	44122.1	
K (766.491 nm)	≥ 24.0	SBR	39.7	1701521.4	41771.8	

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.85
Se (196.026 nm)	≤ 2.60	1.26
Zn (213.857 nm)	≤ 1.50	0.42
Pb (220.353 nm)	≤ 2.60	0.54
Mn (257.610 nm)	≤ 1.50	0.60
Al (396.152 nm)	≤ 1.50	0.47
Ba (493.408 nm)	≤ 1.50	0.68
K (766.491 nm)	≤ 1.50	0.50
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.42
Se (196.026 nm)	≤ 1.50	0.66
Zn (206.200 nm)	≤ 1.50	0.42
Zn (213.857 nm)	≤ 1.50	0.54
Cd (214.439 nm)	≤ 1.50	0.42
Pb (220.353 nm)	≤ 1.50	0.22
Mn (257.610 nm)	≤ 1.50	0.54
Cr (267.716 nm)	≤ 1.50	0.49
Cu (324.754 nm)	≤ 1.50	0.85
Al (396.152 nm)	≤ 1.50	0.61
Ba (493.408 nm)	≤ 1.50	0.78
K (766.491 nm)	≤ 1.50	1.00

Page 4 of 4

เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	Kanyakorn S.
Test Completed On	11/13/2023 11:15:43 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	20.00
Water Flow Test	Pass
RF Water Flow (L/min)	Camera Water Flow (L/min)
1.27	0.81
	Water Inlet Temperature (°C)
	20.37

Page 1 of 2

เอกสารไม่ควบคุม

Gas Flows Test		Pass	
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow
0.70	0.70	271.62	2.00
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow
2.00	2.00	116.00	18.00
			Actual Flow
			17.94
			Back Pressure
			23.11
RF Generator Test		Pass	
RF Power Supply Test	Passed		
RF Power Supply (V)	147.380		
RF Oscillator Test	Passed		
RF Oscillator Frequency (MHz)	25.843		
Work Coil Current (A)	44.410		
RF Power Supply Current (A)	1.999		
Camera Test		Pass	
	Integration Time (ms)	Standard Deviation	Status
Electronic Offset Test	1000	5.361	Passed
Dark Current Test	6000	0.779	Passed
Array Test	5	0.025	Passed
Linearity Test		0.118	Passed

Page 2 of 2

เอกสารไม่ควบคุม



Certificate of Calibration

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

Equipment : Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 2020000015535
ID No. : UAE.MIC.018/2584
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 : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
Calibrated by : Man Pattanapongpalboon
Approved by :
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat
Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



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

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

Procedure Used :-

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

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY48023532	23LM122	TPA	26 Jul 2024

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

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

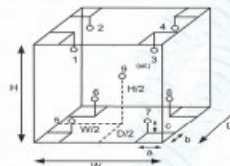
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details :

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

Dimension of Chamber :

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

เอกสารไม่ควบคุม



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

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

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

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



Certificate of Calibration

Cert. No.: 24TM850
Page : 1 of 3

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V616.0066
ID No. : UAE.MTC.032/2558
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 02 - 03 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat
Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%
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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม



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

Cert. No.: 24TM850
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	MY48023932	23LM122	TPA	26 Jul 2024

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

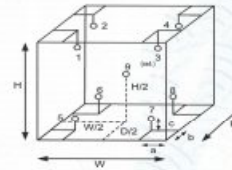
3. This certification is traceable to the international System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source
Fresh air setting : Close

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



Probe Installation Details :

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

Dimension of Chamber :

D = 0.50 m
W = 0.64 m
H = 0.80 m
Capacity = 0.26 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



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.: 24TM850
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	25.438	25.412	24.347	24.332	24.313	24.414	24.875	0.30
36.0	35.843	35.985	35.618	35.701	36.238	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



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

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Mommert
Model : WNE 14
Serial No. : L416.0505
ID No. : UAE.MIC.002/2560
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomeuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
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 : 
() Pornthipha Tameyasri
(✓) 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-2
Procedure Used :-

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

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

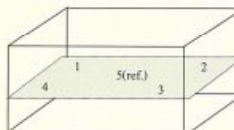
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

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



Front

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

เอกสารไม่ควบคุม



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

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

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

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
1344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Certificate of Calibration

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

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0012
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 :
() Pomsitpree Tameyakul
(✓) Umnophol 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
Procedure Used :-

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

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

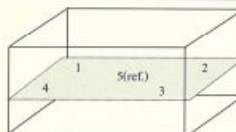
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

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



Front

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

เอกสารไม่ควบคุม



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

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

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.6	44.6	44.491	44.463	44.496	44.518	44.528	0.15

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

-000-

เอกสารไม่ควบคุม

Calibration Certificate

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

Page 1 of 3

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

Calibrated by Mr.Worapob Sooktong Approved by
Scientist

Date of Issue: 15 August 2023

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

E-ES-003 Revision: 01 Date: 20-04-88

[illegible]

Calibration Report

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

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-01B 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.

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HTemp140-2	S29901	MC-22-11-22-176	9-Nov-23	MADGETECH INC.
	HTemp140-2	S29902	MC-22-11-22-175	9-Nov-23	MADGETECH INC.
	HTemp140-2	R54918	TE 660383-01	8-Apr-24	NATIONAL FOOD

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 :

X

 Without adjustment
After adjustment

F-55-012 Revisions: 01 Date: 20-04-09

2008 โทร.09-05016133 35 โทร.09-05016133 อีเมล: info@nirakorn.com 10700 เอกสารไม่ควบคุม

Calibration Report

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

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	226.6

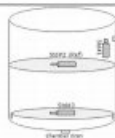


Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
121	121.68	121.20	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 %.

E-CIS-012 Revision: 01 Date: 20-09-65

2008 ๒๕๕๒-๒๕๕๓ ๒๖ ปีแห่งความสำเร็จ มาจากฝีมือของพวกเราทุกคน 10700
2008 Sp. 36, Aun Aun Road, Bang Yi Khan, Samsat, Bang Thai District, Bangkok 10700, Thailand
Tel: +662-04-62 0000 Fax: +662-7 21-22 8888



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTAKARADIN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2713-3880-29 FAX. 0-2713-9484



Cert. No.: 23TM763
Page: 1 of 3

Certificate of Calibration

Equipment : Autoclave
Manufacturer : ALP
Model : CL-40L
Serial No. : 808763
ID No. : UAE.MIC.026/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (301)
Received Order : 27 April 2023
Calibration Date : 27 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahb
Approved by :
() Pornthippa Tameyakul
(x) Mailee Butkruea
() Suwit Imjai
Issue Date : 11 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0053944



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2304-0461OC-2
Procedure Used :-

Cert. No.: 23TM763
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument :-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY50003411	22LM165	26 Nov 2023

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

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

4. This result of calibration covers laboratory autoclaves for the sterilization of goods and material which

could be infected with organisms categorized as Hazard Group 1, 2 and 3**

(** = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)

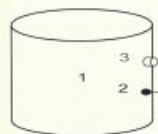
It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which

complete containment and sterilization of infected condensate is considered to be essential.

This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	27	60	220
Finished of Calibration	27	58	220

Position	Description	Ref. Std. ID No.:
1 =	Center of chamber	18-20TC-04
2 =	Temperature sensor	18-20TC-05
3 =	Exhaust port	18-20TC-06

เอกสารไม่ควบคุม

a 1159968



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2304-0461OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM763
Page: 3 of 3

Operating parameter Set : Temperature = 115.0 °C
Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
115.0	115.0	1	115.213	0.22	0.08	0.75	2
		2	115.166				
		3	115.260				

Operating parameter Set : Temperature = 121.0 °C
Sterilization period = 30 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (MPa)	Uncertainty (± °C)	Coverage Factor k
121.0	121.0	1	121.260	0.29	1.1	0.75	2
		2	121.224				
		3	121.284				

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

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 %.

-000-

เอกสารไม่ควบคุม

a 1159967



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,
Phrakhanong 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,
Phrakhanong 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



This certificate is issued for 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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เอกสารไม่ควบคุม

CAL-FM-C01-14: 12 Sep 2022



Certificate No.: C01234158

Page: 2 of 3

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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CAL-FM-C01-14: 12 Sep 2022



Certificate No.: C01234158

Page: 3 of 3

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	0.0006
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

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CAL-FM-C01-14: 12 Sep 2022



Refer to Certificate No.: C01234158

Page: 1 of 3

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



Authorized signatory

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CAL-FM-C01-14: 12 Sep 2022

Statements of conformity:

Before Adjustment

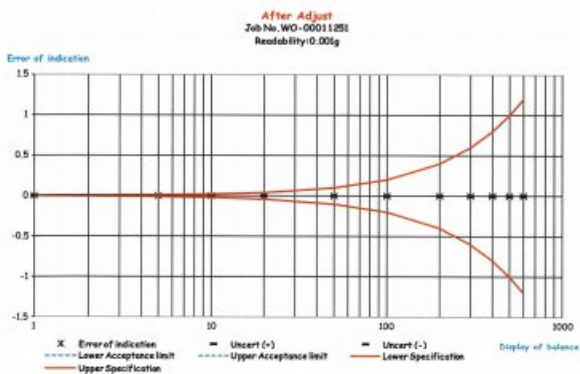
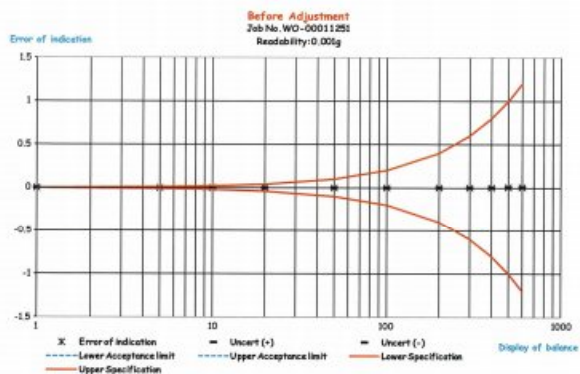
Readability: 0.001 g

Nominal Value	Error of Indication	Guard band (w)	Tolerance (z)	Conformity
g	g	g	g	
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.

เอกสารไม่ควบคุม

CAL-FM-001-14: 12 Sep 2022



เอกสารไม่ควบคุม

Statements of conformity:

After Adjustment

Readability: 0.001 g

Nominal Value	Error of indication	Guard band (w)	Tolerance (s)	Conformity
g	g	g	g	
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

เอกสารไม่ควบคุม

CAL-FM-CPI-14: 12 Sep 2023

ใบตรวจสอบสภาพเครื่องจักร

เลขที่ใบงาน: WO-00011251

ຫຼັກເຄື່ອງມື: Balance

PX623

หมายเลขเครื่อง: C236754745

ตรวจสอบ (รับ)		รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
07 Dec 2023			07 Dec 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
☒	☒	1. สายไฟ/Adapter, power supply 220/110V	☒	☒	
☒	☒	2. ความสมบูรณ์ชุดกระดกปิด (Cover)	☒	☒	
☒	☒	3. ความสมบูรณ์ชุดเครื่องวัดน้ำ	☒	☒	
☒	☒	4. การปรับระดับของขาตั้งเครื่อง	☒	☒	
☒	☒	5. การตรวจสอบของเหลวในถัง	☒	☒	
☒	☒	6. ความสมบูรณ์ของ Display	☒	☒	
☒	☒	7. การแสดงผลของ Display หลังวางน้ำน้	☒	☒	
☒	☒	8. ชุดรองจานชั่ง (Stopper) / pan support	☒	☒	
☒	☒	9. การทำงานของ Function Internal / External	☒	☒	
☒	☒	10. ความสะอาดของหัววัดปริมาณน้ำและระบบ load cell	☒	☒	
☒	☒	11. ส่วนวางตัวอย่างบน ถังน้ำที่ลิ้นชักช่อง	☒	☒	

หมายเหตุเรื่องอื่นที่น่าสนใจ :

Mr. Adisai Maknoi
Service Engineer

เอกสารไม่ควบคุม