

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือ

เอกสารสอบเทียบเครื่องมือ

ประจำเดือนมกราคม พ.ศ. 2567

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental, Inc.	05072022	5 Jul 22	4 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1401	9 May 23	8 May 24	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 159822	Innovative Instrument Co., Ltd.	23-AFM-203	27 Sep 23	26 Sep 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1856	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-70971-367	UAE Consultant Co., Ltd.	16032023	16 Mar 23	15 Mar 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-78933-390	UAE Consultant Co., Ltd.	09022023	9 Feb 23	8 Feb 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 1182920014	UAE Consultant Co., Ltd.	01042023	1 Mar 23	28 Feb 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920015	UAE Consultant Co., Ltd.	14022023	14 Feb 23	13 Feb 24	-
11	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

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Ambient									
12	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201497733	UAE Consultant Co.,Ltd.	20032023	20 Mar 23	19 Mar 24	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1201778117	UAE Consultant Co.,Ltd.	21022023	21 Feb 23	20 Feb 24	-
14	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
15	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 T4FG19AN	UAE Consultant Co.,Ltd.	20022023	20 Feb 23	19 Feb 24	-
16	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 HAMEHU5M	UAE Consultant Co.,Ltd.	25012023	25 Jan 23	24 Jan 24	-
17	Standard Gas	Total Hydrocarbons	Air Liquide	CC143232	Air Liquide	E03A199E15A006C	16 Oct 20	16 Oct 28	-
18	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12393	Calibration Laboratory Co.Ltd	Q23019601	22 Feb 23	21 Feb 24	-
19	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co.,Ltd.	23-ACT-111	27 Jun 23	26 Jun 24	-
20	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} เสียงรบกวน	Larson Davis	LxT1 0007311	Larson Davis-A PCB Piezotronics Div.	2023003675	24 Mar 23	23 Mar 25	-
21	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} เสียงรบกวน	Larson Davis	LXT1 0007312	Larson Davis-A PCB Piezotronics Div.	2023003676	24 Mar 23	23 Mar 25	-

Certificate of Calibration

Calibration Certification Information				
Cal. Date:	July 5, 2022	Roots meter S/N:	438320	Ta: 297 °K
Operator:	Jim Tisch	Pa:	750.1	mm Hg
Calibration Model #:	G25A	Calibrator S/N:	1901	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3540	3.3	2.00
2	3	4	1	0.9650	6.4	4.00
3	5	6	1	0.8640	8.0	5.00
4	7	8	1	0.8200	8.9	5.50
5	9	10	1	0.6780	12.9	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9859	0.7281	1.4073	0.9956	0.7353	0.8899
0.9818	1.0174	1.9902	0.9915	1.0274	1.2585
0.9797	1.1339	2.2251	0.9893	1.1451	1.4071
0.9785	1.1933	2.3337	0.9881	1.2050	1.4757
0.9732	1.4354	2.8146	0.9828	1.4496	1.7798
QSTD		m= 1.98897	QA		m= 1.24546
		b= -0.03691			b= -0.02334
		r= 0.99996			r= 0.99996

Calculations			
Vstd=	$\Delta Vol / (Pa \cdot \Delta P / Pstd) (Tstd / Ta)$	Va=	$\Delta Vol / (Pa \cdot \Delta P / Pa)$
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime
For subsequent flow rate calculations:			
Qstd=	$1/m \left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$	Qa=	$1/m \left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmeter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION	
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30	

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

www.tisch-env.com
TOLL FREE: (877)263-7610
7-9009

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK, 10250
TEL. 0-2717-3080-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No.: 23P1401
Page: 1 of 2

Equipment: U-Tube Manometer
Manufacturer: Dwyer
Model: 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.022/2560

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 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
81 Soi Udomsak 41, Sukhumvit Road, Bangkok, 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 and oil 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 Aussaroon
Issue Date: 11 May 2023

Approved Signatory:

Signature of Suwit Aussaroon
Signature of Sura Suwannasri
Signature of Attapol Panurach

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B 0314241

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7109 MID 17, 18B SUWANNAPHUM 11 TAMBON BANG KAELE,
AMPHOE BANG PHU SANGU T PRAKAN PROVINCE 10540 THAI AND
TEL: 0669-2110-5969-1 FAX: 0669-2110-7140



Certificate of Calibration

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

Certificate No.: 23-AFM-203
Request No.: Req-2023-1919

Unit Under Calibration Details

Measurement Item: Air Flow Meter
Manufacturer: BGI
Model: Delta Cal DC1
Serial Number: 159022
ID: UAE.EFM.039/2561

Sensor Model: -
Sensor Serial Number: -

Location of Calibration: LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature: 23 °C ± 3 °C
Humidity: 55 %RH ± 20 %RH
Barometric Pressure: 1013 kPa ± 10 hPa
Received Date: 7 September 2023
Calibration Date: 27 September 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	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU1651882	TPA	7 November 2023

Traceability:

This Certificate is traceable to SI Unit through Sensidyne A21A 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: Mr. Nopphadol Chongkiet
Service Calibration Engineer

Approved By: Mr. Parat Manthorn
Calibration Engineer Supervisor
Issue Date: 27 September 2023

Attapol P.

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a 1160340

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.
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FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-APM-203
Request No : Req-2023-1919

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.90	100.64	14.58	14.50	-0.08	0.20
24.90	100.64	15.06	15.00	-0.06	0.21
25.00	100.63	15.90	15.80	-0.10	0.22
24.90	100.63	16.78	16.67	-0.11	0.23
24.90	100.63	18.46	18.30	-0.16	0.26

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

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

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

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
FM-708-APM-01 Rev.00 Issue date 01/07/19

Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 23-TPM-461
Request No : Req-2023-1919
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
Tx	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.1	-0.1	0.13
	40.040	40.0	0.0	0.13
	45.039	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
TT	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.2	-0.2	0.13
	40.040	40.2	-0.2	0.13
	45.039	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13

End of Certificate

Calibrated By : 
Mr. Suttachak Prapakornchai

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
FM-708-TPM-01 Rev.01 Issue date 15/03/20

Certificate of Calibration

Certificate No : 23-TPM-461
Request No : Req-2023-1919
Customer : UNITED ANALYST AND ENGINEERING
Name : CONSULTANT CO., LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Page : 1/2

Unit Under Calibration Details


Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 159822
Resolution : 0.1 °C
ID Number : UAE.EFM.039/2561
Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 September 2023
Calibrated Date : 27 September 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.
Reference Standard : Digital Thermometer with Sensor, 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., NISC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By : 
Mr. Noppadon Luangart
Technical Manager
Issue Date : 27 September 2023

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3. EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No. : 23P1856
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE.EMA2.110/2555
Condition As-Received: Used Item
Received Date : 26 May 2023
Calibration Date : 02 June 2023
Reference : 2305-0919WSC
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Atmospheric Pressure : 1006 mbar
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260.

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


Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	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 : 
[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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Cert.No.: 23P1856
Page: 2 of 2

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

Range: 720 mmHg to 800 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	720.43	730.67	740.34	751.52	758.56	761.83	773.53	788.76
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	755.0	760.0	770.0	790.0
Error (mmHg)	-0.43	-0.67	-0.34	-1.52	-1.56	-1.83	-3.53	-8.76

Decreasing Pressure

Applied Pressure (mmHg)	788.76	773.50	761.89	756.65	751.59	740.72	730.68	720.59
UUC* Indication (mmHg)	790.0	770.0	760.0	755.0	750.0	740.0	730.0	720.0
Error (mmHg)	-8.76	-3.50	-1.89	-1.65	-1.59	-0.72	-0.68	-0.59

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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TEL. 0-2717-3000-34 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023

Reference: 2305-0919WSC

Ambient Temperature: (25 \pm 3) °C

Relative Humidity: (50 \pm 20) %

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

81 Soi Udonsuk 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	23105	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:

[] Chakrit Waewwanjua
[] Pornthippa Tameyakul
[] Viporn Tantiyawutti

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Cert. No.: 23H1200
Page: 2 of 2

Result of Calibration:- Before Adjustment
Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (\pm %R.H.)
25.0	40.1	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:- After Adjustment
Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (\pm %R.H.)
25.0	40.1	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:- Without Adjustment
Function: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (\pm °C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

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

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United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udonsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Tel. 0 2763 2828 Fax 0 2763 2800 www.uaconsultant.com E-mail: ua@uaconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: Mar 16, 2023

Equipment: Gas Analyzer (NO₂) Model: 42C
Manufacturer: Thermo Environmental Instruments Serial Number: 42C-70971-367

Standard Gas Concentration

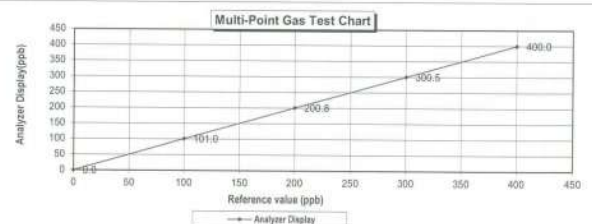
Gas	Concentration	Unit	Manufacturer
Sulphur Dioxide (SO ₂)	44.68	PPM	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	1461
Methane (CH ₄)	-	PPM	1180540071
Carbon Monoxide (CO)	984.8	PPM	
Cylinder No.:	EB0143262		
Expiration Date:	Jun 21, 2024		

Dilutor Detail

Manufacturer	Thermo Scientific
Model	1461
Serial Number	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	1.00	0.99	0.99
Level 3	40.00%	200.8	0.80	0.40	0.40
Level 4	60.00%	300.5	0.50	0.17	0.17
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark: Measuring Range	500.0 ppb		Average Difference (%)	0.31	
Acceptable Limit \pm 5%					



Calibration by: [Signature]
16, 3, 2023

Calibration by: [Signature]
16, Mar, 2023

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MULTI-POINT GAS TEST REPORT

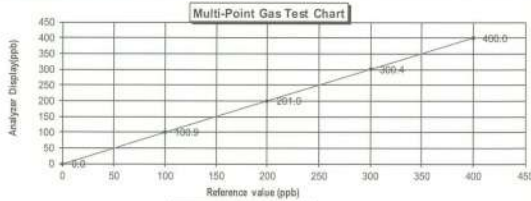
Test Date : Feb 9, 2023

Equipment : Gas Analyzer (NO₂) Model : 42C
Manufacturer : Thermo Environmental Instruments Serial Number : 42C-78933-390

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68 PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94 PPM	Model :	1461
Methane (CH ₄)	- PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8 PPM		
Cylinder No. :	EB0143262		
Expiration Date :	Jun 21, 2024		

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]	
Level 1	Zero	0.0	0.0	0.00	0.00	0.00	
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89	
Level 3	40.00%	200.0	201.0	1.00	0.50	0.50	
Level 4	60.00%	300.0	300.4	0.40	0.13	0.13	
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00	
Remark : Measuring Range			500.0 ppb		Average Difference (%)		0.30



Calculate by

4 2 16
9 Feb 2023

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เอกสารไม่ควบคุม

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,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

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

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708068	49.92 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D88025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	40142383102	CC505981	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



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

Approved for Release



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

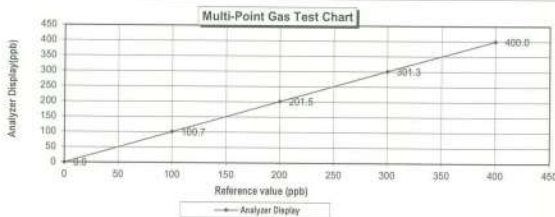
Test Date : Apr 4, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1201778116

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	201.5	1.50	0.74	0.74
Level 4	60.00%	300.0	301.3	1.30	0.43	0.43
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.37



Calculate by

4 3 16
4 Apr 2023

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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

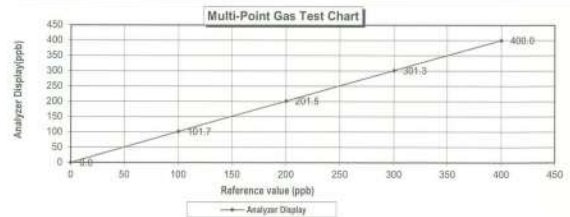
Test Date : Mar 1, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : JCL606001757

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.7	1.70	1.67	1.67
Level 3	40.00%	200.0	201.5	1.50	0.74	0.74
Level 4	60.00%	300.0	301.3	1.30	0.43	0.43
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.57



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1 3 16
1 Mar 2023

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เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 molar basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release

เอกสารไมควนคณ

MULTI-POINT GAS TEST REPORT

Test Date : Mar 20, 2023

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1201497733

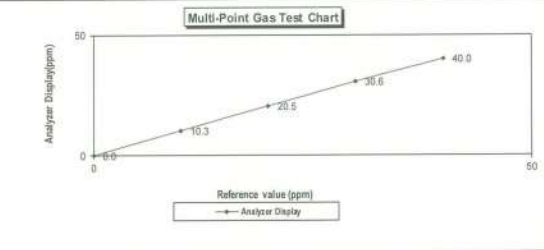
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.68 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.94 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 984.8 PPM	
Cylinder No. : EB0143262	
Expiration Date : Jun 20, 2024	

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	0.3	2.9	2.9
Level 3	40.00%	20.0	0.5	2.4	2.4
Level 4	60.00%	30.0	0.6	2.0	2.0
Level 5	80.00%	40.0	0.0	0.0	0.0

Remark : Measuring Range 50.0 ppm

Average Difference (%) 1.46



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21 / Mar / 2023

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เอกสารไมควนคณ

MULTI-POINT GAS TEST REPORT

Test Date : Feb 21, 2023

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1201778117

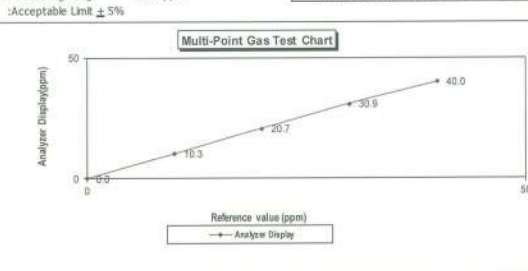
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂) 44.68 PPM	Manufacturer : Thermo Scientific
Nitric Oxide (NO) 45.94 PPM	Model : 146i
Methane (CH ₄) - PPM	Serial Number : 1180540071
Carbon Monoxide (CO) 984.8 PPM	
Cylinder No. : EB0143262	
Expiration Date : Jun 20, 2024	

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	0.3	2.9	2.9
Level 3	40.00%	20.0	0.7	3.4	3.4
Level 4	60.00%	30.0	0.9	2.9	2.9
Level 5	80.00%	40.0	0.0	0.0	0.0

Remark : Measuring Range 50.0 ppm

Average Difference (%) 1.54



Calculate by
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22 Feb 2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 molar basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



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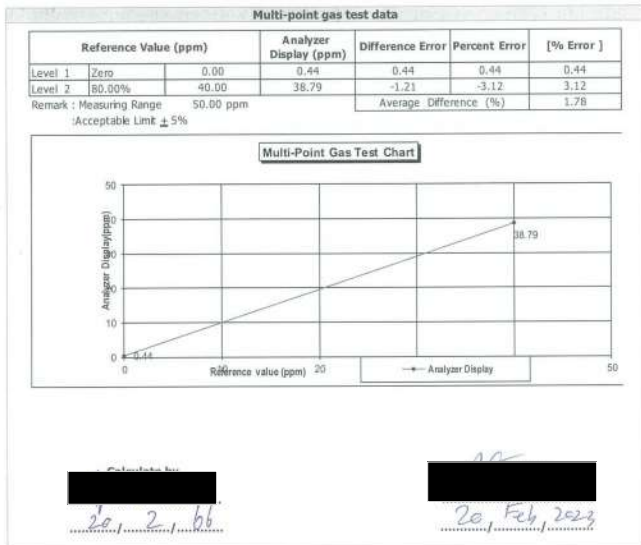
เอกสารไมควนคณ

MULTI-POINT GAS TEST REPORT

Test Date : Feb 20, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : T4FG19AN

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	-	PPM	Manufacturer :
Nitric Oxide (NO)	-	PPM	Model :
Methane (CH ₄)	39.8	PPM	Serial Number :
Carbon Monoxide (CO)	-	PPM	
Cylinder No. :	D824432		
Expiration Date :	Aug 4, 2028		



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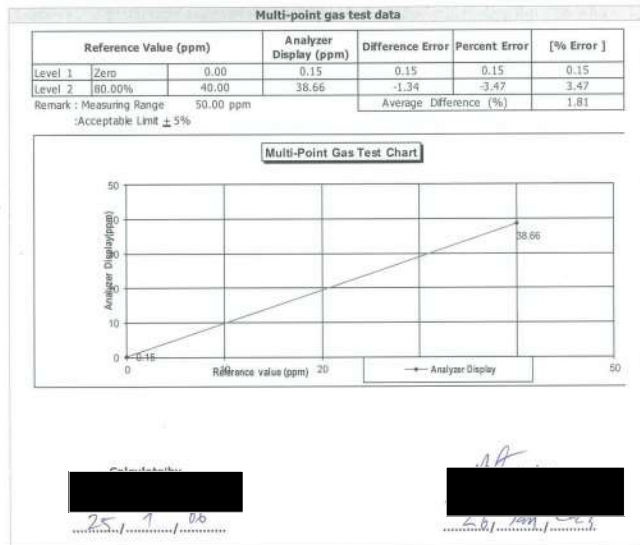
เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Jan 25, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : HAMEJUSM

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	-	PPM	Manufacturer :
Nitric Oxide (NO)	-	PPM	Model :
Methane (CH ₄)	39.8	PPM	Serial Number :
Carbon Monoxide (CO)	-	PPM	
Cylinder No. :	D824432		
Expiration Date :	Aug 4, 2028		



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เอกสารไม่ควบคุม



Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 1
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03A199E15A006C Reference Number: 160-401908379-1
Cylinder Number: CC143232 Cylinder Volume: 144.0 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2018 PSIG
PGVP Number: A12020 Valve Outlet: 590
Gas Code: CH4,PPN,BALA Certification Date: Oct 16, 2020

Expiration Date: Oct 16, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/531, 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 mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig. i.e. 0.7 megapascals

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
METHANE	4000 PPM	4019 PPM	G1	+/- 1.0% NIST Traceable	10/16/2020
PROPANE	4000 PPM	4008 PPM	G1	+/- 0.7% NIST Traceable	10/09/2020
AIR	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	02010405	K010090	4976 PPM PROPANE/NITROGEN	+/- 0.5%	Dec 02, 2021
NTRM	170608	CC160290	0.967 % METHANE/NITROGEN	+/- 0.4%	Aug 22, 2023

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CH4 - 000928781	FTIR	Oct 14, 2020
Nicolet 6700 APW1100391 C3H8	FTIR	Sep 18, 2020

Triad Data Available Upon Request

NOTES: NET WEIGHTS: 4.865kg
GROSS WEIGHTS: 27.385kg
PO#: 5220003825



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CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2572 www.calibrationlab.com E-mail: sale@calibrationlab.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12393/UM12393
CLID. NO. : 251801351
JOB CONTROL NO. : 230221019601

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 21 February 2023

DATE OF ISSUED : 24 February 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

Approved By : Mongkol Yotsontorn
Authorized Signatory
24 February 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23019601

F3-011-04-01-12

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เอกสารไม่ควบคุม



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12393/UM12393
DATE OF CALIBRATION : 22 February 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.

The calibration was performed by using Digital Multimeter, High Resolution Programmable Timer/Counter,

Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Digital Multimeter, Wavetek Model 1281 S/N. 29320.
- High Resolution Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
- Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0001/22, Due Date 22 February 2023.
- The measurements are traceable to International Systems of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23019601

F3-011-04/01-12

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เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	\pm (% of rdg.)
0.3	50 Hz	peak	0.300	0.305	-0.005	1.9
0.4	50 Hz		0.400	0.408	-0.008	1.9
0.5	50 Hz		0.500	0.511	-0.011	1.3
0.6	50 Hz		0.600	0.618	-0.018	1.3
0.7	50 Hz		0.700	0.721	-0.021	1.3
0.3	100 Hz	peak	0.300	0.304	-0.004	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.509	-0.009	1.3
0.6	100 Hz		0.600	0.613	-0.013	1.3
0.7	100 Hz		0.700	0.719	-0.019	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	\pm (% of rdg.)
3	50 Hz	peak	3.000	3.041	-0.041	1.8
4	50 Hz		4.000	4.055	-0.055	1.8
5	50 Hz		5.000	5.067	-0.067	1.8
6	50 Hz		6.000	6.079	-0.079	1.8
7	50 Hz		7.000	7.089	-0.089	1.8
3	100 Hz	peak	3.000	3.039	-0.039	1.8
4	100 Hz		4.000	4.048	-0.048	1.8
5	100 Hz		5.000	5.055	-0.055	1.8
6	100 Hz		6.000	6.068	-0.068	1.8
7	100 Hz		7.000	7.080	-0.080	1.8

Certificate No. Q23019601

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CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	\pm (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.061	-0.001	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

Note: * means Calibrations marked "Not ANAB Accredited" in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23019601

F3-011-04/01-12

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MED U.S. SOI SENTINAKORN 11 TAMBON BANG KHAO,
AMPHIB RANG PHU SAMUT PRAKAN PROVINCE 10940 THAILAND
TEL: 0668-2116-3900-1 FAX: 0668-2116-7140



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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-111
Request No : Req-2023-1408

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35A
Serial Number : 73249
ID : UAE.EPM.105/2561

Class : 1
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : $(23 \pm 2 ^\circ\text{C})$
Humidity : $(50 \pm 20 \% \text{RH})$
Barometric Pressure : $(1013 \pm 10.0 \text{ hPa})$
Received Date : 26 June 2023
Calibration Date : 27 June 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 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 :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 27 June 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.

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Certificate No : 23-ACT-111

Request No : Req-2023-1408

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	93.84	-0.16	-	-	0.14	0.25
114 dB / 1000 Hz	113.79	-0.21	-	-	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 (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.17	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.04	-	-	-	0.40	2.5

Note :

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

End of Calibration

Calibration Certificate

Certificate Number 2023003675

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT1

Serial Number

0007311

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number

D0001.8384

Technician

Jacob Cannon

Calibration Date

24 Mar 2023

Calibration Due

23.56 °C

Humidity

± 0.25 °C

Static Pressure

49.9 %RH ± 2.0 %RH

85.69 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis CAL291, S/N 0108
Larson Davis CAL200, S/N 9079
PCB 377B02, S/N 345817
Larson Davis PRMLxT1, S/N 077846

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61260:2001 Class 1
IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (P2006) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (P2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-03-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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Certificate Number 2023003675

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014 Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1.

Description	Standards Used		
	Cal Date	Cal Doc	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007025
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB00604783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.73	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.23	Pass
1000	0.15	0.00	-0.70	0.70	0.23	Pass
8000	-3.69	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

— End of Report—

Signature

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Calibration Certificate

Certificate Number 2023003651

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1

Serial Number 0007311

Test Results Pass

Initial Condition As Manufactured

Description
SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378

Technician Jacob Cannon

Calibration Date 23 Mar 2023

Calibration Due

Temperature 23.6 °C ± 0.25 °C

Humidity 50.3 %RH ± 2.0 %RH

Static Pressure 86.08 kPa ± 0.13 kPa

Evaluation Method
Tested electrically using Larson Davis PRMLxT1 S/N 077646 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards
Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61672:2013 Class 1
IEC 61260:2001 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1
ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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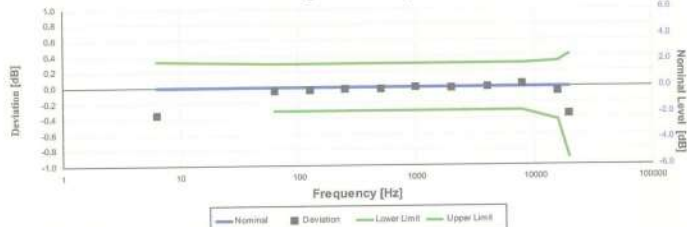
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Certificate Number 2023003651

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4:1993 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.36	-0.35	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.01	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.26	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.52	-0.35	-0.35	-0.91	0.41	0.15	Pass

– End of measurement results –

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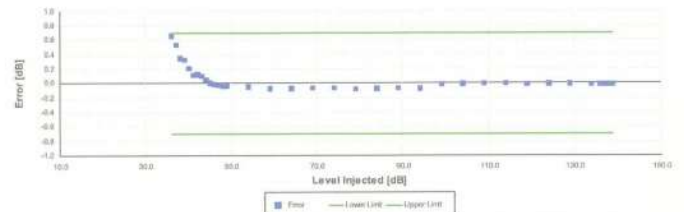
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Certificate Number 2023003651

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.66	-0.70	0.70	0.16	Pass
37.00	0.53	-0.70	0.70	0.16	Pass
38.00	0.35	-0.70	0.70	0.16	Pass
39.00	0.32	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.12	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.17	Pass
44.00	0.05	-0.70	0.70	0.17	Pass
45.00	0.00	-0.70	0.70	0.16	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	-0.03	-0.70	0.70	0.16	Pass
48.00	-0.04	-0.70	0.70	0.16	Pass
49.00	-0.04	-0.70	0.70	0.16	Pass
50.00	-0.05	-0.70	0.70	0.16	Pass
51.00	-0.07	-0.70	0.70	0.16	Pass
52.00	-0.07	-0.70	0.70	0.16	Pass
53.00	-0.07	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
55.00	-0.07	-0.70	0.70	0.16	Pass
56.00	-0.07	-0.70	0.70	0.16	Pass
57.00	-0.07	-0.70	0.70	0.16	Pass
58.00	-0.07	-0.70	0.70	0.16	Pass
59.00	-0.07	-0.70	0.70	0.16	Pass
60.00	-0.07	-0.70	0.70	0.16	Pass
61.00	-0.07	-0.70	0.70	0.16	Pass
62.00	-0.07	-0.70	0.70	0.16	Pass
63.00	-0.07	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
65.00	-0.07	-0.70	0.70	0.16	Pass
66.00	-0.07	-0.70	0.70	0.16	Pass
67.00	-0.07	-0.70	0.70	0.16	Pass
68.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.07	-0.70	0.70	0.16	Pass
70.00	-0.07	-0.70	0.70	0.16	Pass
71.00	-0.07	-0.70	0.70	0.16	Pass
72.00	-0.07	-0.70	0.70	0.16	Pass
73.00	-0.07	-0.70	0.70	0.16	Pass
74.00	-0.07	-0.70	0.70	0.16	Pass
75.00	-0.07	-0.70	0.70	0.16	Pass
76.00	-0.07	-0.70	0.70	0.16	Pass
77.00	-0.07	-0.70	0.70	0.16	Pass
78.00	-0.07	-0.70	0.70	0.16	Pass
79.00	-0.07	-0.70	0.70	0.16	Pass
80.00	-0.07	-0.70	0.70	0.16	Pass
81.00	-0.07	-0.70	0.70	0.16	Pass
82.00	-0.07	-0.70	0.70	0.16	Pass
83.00	-0.07	-0.70	0.70	0.16	Pass
84.00	-0.07	-0.70	0.70	0.16	Pass
85.00	-0.07	-0.70	0.70	0.16	Pass
86.00	-0.07	-0.70	0.70	0.16	Pass
87.00	-0.07	-0.70	0.70	0.16	Pass
88.00	-0.07	-0.70	0.70	0.16	Pass
89.00	-0.07	-0.70	0.70	0.16	Pass
90.00	-0.07	-0.70	0.70	0.16	Pass
91.00	-0.07	-0.70	0.70	0.16	Pass
92.00	-0.07	-0.70	0.70	0.16	Pass
93.00	-0.07	-0.70	0.70	0.16	Pass
94.00	-0.07	-0.70	0.70	0.16	Pass
95.00	-0.07	-0.70	0.70	0.16	Pass
96.00	-0.07	-0.70	0.70	0.16	Pass
97.00	-0.07	-0.70	0.70	0.16	Pass
98.00	-0.07	-0.70	0.70	0.16	Pass
99.00	-0.07	-0.70	0.70	0.16	Pass
100.00	-0.07	-0.70	0.70	0.16	Pass
101.00	-0.07	-0.70	0.70	0.16	Pass
102.00	-0.07	-0.70	0.70	0.16	Pass
103.00	-0.07	-0.70	0.70	0.16	Pass
104.00	-0.07	-0.70	0.70	0.16	Pass
105.00	-0.07	-0.70	0.70	0.16	Pass
106.00	-0.07	-0.70	0.70	0.16	Pass
107.00	-0.07	-0.70	0.70	0.16	Pass
108.00	-0.07	-0.70	0.70	0.16	Pass
109.00	-0.07	-0.70	0.70	0.16	Pass
110.00	-0.07	-0.70	0.70	0.16	Pass
111.00	-0.07	-0.70	0.70	0.16	Pass
112.00	-0.07	-0.70	0.70	0.16	Pass
113.00	-0.07	-0.70	0.70	0.16	Pass
114.00	-0.07	-0.70	0.70	0.16	Pass
115.00	-0.07	-0.70	0.70	0.16	Pass
116.00	-0.07	-0.70	0.70	0.16	Pass
117.00	-0.07	-0.70	0.70	0.16	Pass
118.00	-0.07	-0.70	0.70	0.16	Pass
119.00	-0.07	-0.70	0.70	0.16	Pass
120.00	-0.07	-0.70	0.70	0.16	Pass
121.00	-0.07	-0.70	0.70	0.16	Pass
122.00	-0.07	-0.70	0.70	0.16	Pass
123.00	-0.07	-0.70	0.70	0.16	Pass
124.00	-0.07	-0.70	0.70	0.16	Pass
125.00	-0.07	-0.70	0.70	0.16	Pass
126.00	-0.07	-0.70	0.70	0.16	Pass
127.00	-0.07	-0.70	0.70	0.16	Pass
128.00	-0.07	-0.70	0.70	0.16	Pass
129.00	-0.07	-0.70	0.70	0.16	Pass
130.00	-0.07	-0.70	0.70	0.16	Pass
131.00	-0.07	-0.70	0.70	0.16	Pass
132.00	-0.07	-0.70	0.70	0.16	Pass
133.00	-0.07	-0.70	0.70	0.16	Pass
134.00	-0.07	-0.70	0.70	0.16	Pass
135.00	-0.07	-0.70	0.70	0.16	Pass
136.00	-0.07	-0.70	0.70	0.16	Pass
137.00	-0.07	-0.70	0.70	0.16	Pass
138.00	-0.07	-0.70	0.70	0.16	Pass
139.00	-0.07	-0.70	0.70	0.16	Pass

– End of measurement results –

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Peak Rise Time

Peak rise time performed according to IEC 60851:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.26	133.80	0.15	Pass
		Positive Pulse	135.25	133.80	0.15	Pass
		Negative Pulse	134.32	133.80	0.15	Pass
126.85	30	Negative Pulse	134.32	133.80	0.15	Pass
		Positive Pulse	134.32	133.80	0.15	Pass
		Negative Pulse	134.32	133.80	0.15	Pass

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.16 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	0.01	± 1.50	0.15 ±	Pass

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.25	± 1.50	0.15 ±	Pass
106.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	0.01	± 1.50	0.15 ±	Pass

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Gain

Gain measured according to IEC 61672-3:2013 17.3 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.14	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.01	36.00	Pass
C-weight Noise Floor	27.02	35.00	Pass
Z-weight Noise Floor	33.41	39.00	Pass

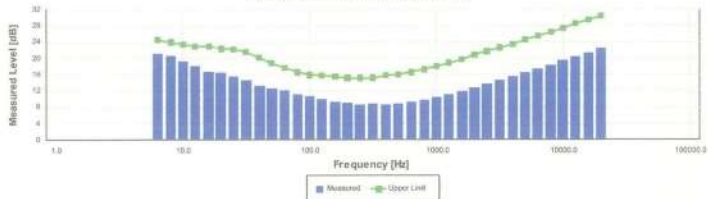
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.84	135.05	136.65	0.15	Pass
THD	-67.26	-58.00	-56.00	0.01 ±	Pass
THD+N	-63.27	-58.00	-56.00	0.01 ±	Pass

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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	21.01	24.60	Pass
8.00	20.60	24.00	Pass
10.00	19.19	23.50	Pass
12.50	18.13	23.00	Pass
16.00	16.66	22.50	Pass
20.00	16.47	22.40	Pass
25.00	15.54	22.30	Pass
31.50	14.59	21.50	Pass
40.00	13.14	20.20	Pass
50.00	12.53	18.80	Pass
63.00	12.05	17.60	Pass
80.00	11.24	16.60	Pass
100.00	10.61	15.90	Pass
125.00	10.01	15.70	Pass
160.00	9.34	15.50	Pass
200.00	9.01	15.20	Pass
250.00	8.52	15.20	Pass
315.00	8.71	15.20	Pass
400.00	8.61	15.70	Pass
500.00	8.80	16.00	Pass
630.00	9.26	16.60	Pass
800.00	9.76	17.30	Pass
1,000.00	10.40	18.10	Pass
1,250.00	11.15	18.90	Pass
1,600.00	11.94	19.80	Pass
2,000.00	12.75	20.80	Pass
2,500.00	13.68	21.70	Pass
3,150.00	14.64	22.60	Pass
4,000.00	15.55	23.50	Pass
5,000.00	16.47	24.50	Pass
6,300.00	17.47	25.50	Pass
8,000.00	18.44	26.50	Pass
10,000.00	19.44	27.40	Pass
12,500.00	20.45	28.50	Pass
16,000.00	21.42	29.50	Pass
20,000.00	22.41	30.40	Pass

— End of measurement results—

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— End of Report—

Signatory:

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Calibration Certificate

Certificate Number 2023003676

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonok 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8384
Serial Number	0007312	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	24 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	23.58 °C ± 0.25 °C
		Humidity	49.3 %RH ± 2.0 %RH
		Static Pressure	85.71 kPa ± 0.13 kPa

Evaluation Method	Tested with: Larson Davis CAL200, S/N 9079 PCB 377B02, S/N 345618 Larson Davis PRMLxT1, S/N 07647 Larson Davis CAL291, S/N 0106	Data reported in dB re 20 µPa.
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Compliance Standards	Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:
IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

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Certificate Number 2023003676

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-08 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-11 Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 Inch Polarized Pressure Microphone	2023-04-06	2024-04-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.85	-52.44	-48.33	0.14	Pass

– End of measurement results –

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.72	-3.00	-5.50	-1.50	0.32	Pass

– End of measurement results –

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Certificate Number 2023003676

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1	Test Result [dB]
Measurement	40.51
A-weighted	

– End of measurement results –

– End of Report –

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Calibration Certificate

Certificate Number 2023003652

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonok 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8378
Serial Number	0007312	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	23 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	23.62 °C ± 0.25 °C
		Humidity	49.5 %RH ± 2.0 %RH
		Static Pressure	86.98 kPa ± 0.13 kPa

Evaluation Method: Tested electrically using Larson Davis PRMLxT1 S/N 077647 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards: Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

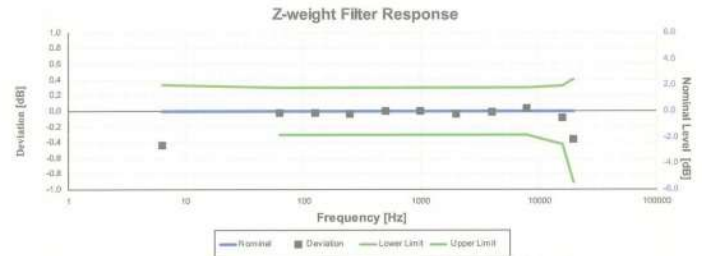
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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-25	806798
SRS DS360 Ultra Low Distortion Generator	2022-05-04	2023-05-04	807117

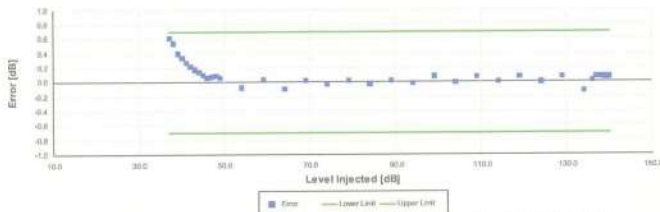


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4-1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.44	-0.44	-1.11	0.33	0.15	Pass
63.10	-0.03	-0.03	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.01	-0.01	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass
— End of measurement results—						

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A-weighted Broadband Log Linearity: 8,000.00 Hz

Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6; IEC 60804:2000 6.2; IEC 61252:2002 8; ANSI S1.4 (R2006) 6.9; ANSI S1.4-2014 Part 1: 5.6; ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
37.00	0.61	-0.70	0.70	0.16	Pass
38.00	0.54	-0.70	0.70	0.16	Pass
39.00	0.40	-0.70	0.70	0.16	Pass
40.00	0.33	-0.70	0.70	0.16	Pass
41.00	0.27	-0.70	0.70	0.16	Pass
42.00	0.22	-0.70	0.70	0.16	Pass
43.00	0.18	-0.70	0.70	0.17	Pass
44.00	0.15	-0.70	0.70	0.17	Pass
45.00	0.10	-0.70	0.70	0.16	Pass
46.00	0.07	-0.70	0.70	0.16	Pass
47.00	0.07	-0.70	0.70	0.16	Pass
48.00	0.09	-0.70	0.70	0.16	Pass
49.00	0.06	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
59.00	0.03	-0.70	0.70	0.16	Pass
64.00	-0.09	-0.70	0.70	0.16	Pass
69.00	0.03	-0.70	0.70	0.16	Pass
74.00	-0.03	-0.70	0.70	0.16	Pass
79.00	0.02	-0.70	0.70	0.16	Pass
84.00	-0.02	-0.70	0.70	0.16	Pass
89.00	0.03	-0.70	0.70	0.16	Pass
94.00	-0.02	-0.70	0.70	0.15	Pass
99.00	0.08	-0.70	0.70	0.15	Pass
104.00	0.00	-0.70	0.70	0.15	Pass
109.00	0.08	-0.70	0.70	0.15	Pass
114.00	0.01	-0.70	0.70	0.15	Pass
119.00	0.07	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.08	-0.70	0.70	0.15	Pass
134.00	-0.12	-0.70	0.70	0.15	Pass
136.00	0.02	-0.70	0.70	0.15	Pass
137.00	0.07	-0.70	0.70	0.15	Pass
138.00	0.07	-0.70	0.70	0.15	Pass
139.00	0.07	-0.70	0.70	0.15	Pass
140.00	0.07	-0.70	0.70	0.15	Pass
— End of measurement results—					

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Table 1: Test results according to EN 60335-1:2013 and EN 60335-2-1:2013 (category 0)							
Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	134.73	133.30	135.30	0.15	Pass
		Positive Pulse	134.72	133.28	135.28	0.15	Pass
30	30	Negative Pulse	133.79	133.30	135.30	0.15	Pass
		Positive Pulse	133.78	133.28	135.28	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.07	± 1.00	0.16 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.16	± 0.50	0.15 ±	Pass
	5	-0.05	± 1.00	0.15 ±	Pass
	10	-0.24	± 1.50	0.15 ±	Pass
106.85	3	-0.19	± 0.50	0.15 ±	Pass
	5	-0.09	± 1.00	0.15 ±	Pass
	10	-0.30	± 1.50	0.15 ±	Pass
— End of measurement results—					

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.08	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.10	± 0.50	0.15 ±	Pass
	5	-0.06	± 1.00	0.15 ±	Pass
	10	-0.23	± 1.50	0.15 ±	Pass
106.85	3	-0.18	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.28	± 1.50	0.15 ±	Pass
— End of measurement results—					

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Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.92	93.86	94.06	0.15	Pass
0 dB Gain, Linearity	41.16	40.26	41.66	0.16	Pass
OBA Low Range	93.97	93.86	94.06	0.15	Pass
OBA Normal Range	93.96	93.20	94.80	0.15	Pass

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.86	36.00	Pass
C-weight Noise Floor	26.56	36.00	Pass
Z-weight Noise Floor	32.28	38.00	Pass

-- End of measurement results--

Total Harmonic Distortion

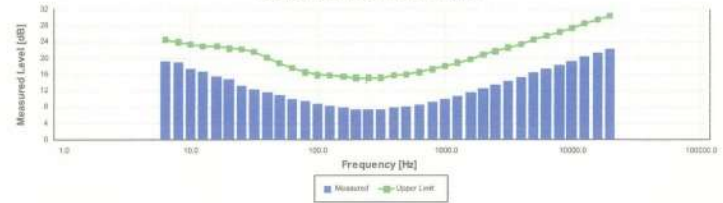
Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.35	135.05	136.65	0.15	Pass
THD	-64.53	-58.00	-58.00	0.01 %	Pass
THD+N	-61.30	-58.00	-58.00	0.01 %	Pass

-- End of measurement results--

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1/3-Octave Self-Generated Noise



The SLIM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.36	24.60	Pass
8.00	18.96	24.00	Pass
10.00	17.32	23.50	Pass
12.50	16.60	23.00	Pass
16.00	15.47	22.90	Pass
20.00	14.87	22.40	Pass
25.00	13.12	22.30	Pass
31.50	12.38	21.50	Pass
40.00	11.67	20.20	Pass
50.00	10.95	18.80	Pass
63.00	10.08	17.60	Pass
80.00	9.46	16.60	Pass
100.00	8.73	15.90	Pass
125.00	8.30	15.70	Pass
160.00	7.83	15.50	Pass
200.00	7.53	15.20	Pass
250.00	7.40	15.20	Pass
315.00	7.44	15.20	Pass
400.00	7.80	15.70	Pass
500.00	8.11	16.00	Pass
630.00	8.69	16.60	Pass
800.00	9.34	17.30	Pass
1,000.00	10.05	18.10	Pass
1,250.00	10.74	18.90	Pass
1,600.00	11.61	19.60	Pass
2,000.00	12.58	20.90	Pass
2,500.00	13.49	21.70	Pass
3,150.00	14.42	22.60	Pass
4,000.00	15.39	23.50	Pass
5,000.00	16.38	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.33	26.50	Pass
10,000.00	19.35	27.40	Pass
12,500.00	20.35	28.50	Pass
16,000.00	21.34	29.50	Pass
20,000.00	22.35	30.40	Pass

-- End of measurement results--

เอกสารไม่ควบคุม

-- End of Report--

Signature: _____

เอกสารไม่ควบคุม

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2303074-001-01	27 May 23	25 May 24
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	25 Apr 24
3	Analytical Balance	SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	23MM112	26 Apr 23	25 Apr 24
4	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Harikul Science	HSU012C	1 Mar 23	29 Feb 24
5	Digestion Units	TOTAL KJELDAHL NITROGEN	VELP/VELP Scientifica	DKL20 / 213517	National Food Institute Ministry of Industry, Thailand	2304455-001-01	28 Aug 23	27 Aug 24
6	Hot Air Oven	TOTAL DISSOLVED SOLIDS SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	23TM373	11 Apr 23	10 Apr 24
7	Incubator	FECAL COLIFORM BACTERIA TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000022476	DKSH Technology	C31231678	7 Aug 23	6 Aug 24
8	Kjeltrec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjeltrec 8100 / 91889052	FOSS South East Asia	8411	29 May 23	28 May 24
9	pH Meter	pH	Horiba	LAQUA-PH210 / HA0E0009	technology promotion association (thailand-japan)	23CH420	29 Mar 23	28 Mar 24
10	Water Bath	FECAL COLIFORM BACTERIA	Memmert	WNE14 / L421.0121	Technology Promotion Association (Thailand-Japan)	23TM764	27 Apr 23	26 Apr 24

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



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

Cert.No.: 23MM113
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

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

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

Range capacity : 0 g to 81 g **Resolution** 0.00001 g
81 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	79.99992	+0.00008	0.15	2.00
200	199.9995	+0.0005	0.29	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00004

เอกสาร



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

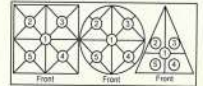
Cert.No.: 23MM113
Page: 3 of 3

Result of calibration

2. Effect of off center loading

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

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



Maximum difference between
off-center and central loading
(g)
0.0001

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.11
0.05	0.04999	+0.00001	0.015	2.09
0.1	0.09999	+0.00001	0.015	2.07
1	1.00000	0.00000	0.018	2.04
5	5.00000	0.00000	0.026	2.00
20	20.00002	-0.00002	0.045	2.00
50	50.00002	-0.00002	0.080	2.00
80	80.00002	-0.00002	0.15	2.00
100	100.00000	0.00000	0.17	2.00
150	150.00000	0.00000	0.29	2.00
200	199.99999	+0.00001	0.29	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 %.

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เอกสาร



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.: 23MM112
Page: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C009071872
ID No. : UAE.WAO.012/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai
Issue Date : 2 May 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



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

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

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

Range capacity : 0 g to 81 g **Resolution** 0.00001 g
81 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	80.00005	-0.00005	0.15	2.00
200	199.9999	+0.0001	0.29	2.00

After Adjustment :

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

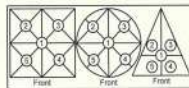
Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00000

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 3 of 3



Maximum difference between
off-center and central loading
(g)
0.0001

2. Effect of off center loading

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

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

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.13
0.05	0.05001	-0.00001	0.015	2.09
0.1	0.10001	-0.00001	0.015	2.09
1	1.00001	-0.00001	0.018	2.04
5	5.00003	-0.00003	0.026	2.00
20	20.00006	-0.00006	0.045	2.00
50	50.00006	-0.00006	0.080	2.00
80	80.00004	-0.00004	0.15	2.00
100	100.00000	0.00000	0.16	2.00
150	150.00000	0.00000	0.29	2.00
200	200.00000	0.00000	0.29	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 %.

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- 1150000



CERT.No.: HS-U012C

Harikul Science Co.,Ltd.
694 Soi Ratchadaniwet 24, Pracharatbamphen,
Samsenok, HuaiKhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com
Certificate of Calibration

Calibration Date : 1 Mar 23

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

Model : YSI 5100

S/N : 11B101863

Probe : YSI 5010

S/N : 22B100125

ID NO. : -

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Air Temp ref : S/N. E00522

Barometric ref : S/N. E00522

Water Temp ref : S/N. 11431

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.09	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.09	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.09	mg/l	-	-
Inaccuracy	0.00	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- This certificate is issued based on the result that are found as shown on date and place of test only.
- The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- This result shall not be used for advertising purpose.

Technician Signature
(Kittipong Maekwong)

เอกสารในควบคุม
(Supreecha Sumartiam)



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

Verification Certificate

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

Page 1 of 4

Equipment: Digestion Unit (Heating Block)

Manufacturer: VELP SCIENTIFICA

Model: DKL20

Serial No.: 213517

ID No.: UAE.WAS.005/2555

Order No.: 2304455

Operation No.: 2304455-001

Date of Receipt: 28 August 2023

Date of Calibration: 28-29 August 2023

Calibrated by Mr.Manas Somsak
Specialist

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

Date of Issue: 1 September 2023

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

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

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

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nfi.com



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

Verification Report

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

Date of Calibration: 28-29 August 2023

Page 2 of 4

Location: Dry Laboratory (312), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Environment Condition:
Ambient Temperature (28 ± 1) °C
Relative Humidity (56 ± 3) %
Line Voltage (224 ± 2) Volt

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	MY4045576/MY41194453	TC23/0048	2-Jun-2024	N.M. Technical Center Laboratory

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

UUC* Description
Time of Record 1 Hour 6 Minute At 380 °C

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

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

เอกสารในควบคุม

nfi.com

Verification Report

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

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

Calibration point: 380 °C

Calibration result:

Table 1 : Reporting of Temperature

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

Note:

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

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

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

2008 อาคารพาณิชย์ 36 หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10710
2008 หมู่ 36, หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10710
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Verification Report

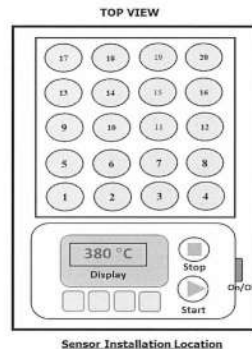
Certificate No.: 2304455-001-01
Equipment: Digestion Unit (Heating Block)
Model: DKL20 Serial No.: 213517
Resolution: 1 °C ID No.: UAE.WAS.005/2555
Manufacturer: VLP SCIENTIFICA

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

Calibration point: 380 °C

Calibration result: Continued

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

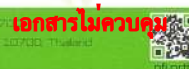


Sensor Installation Location

----- End -----

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

2008 อาคารพาณิชย์ 36 หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10710
2008 หมู่ 36, หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10710
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3008-29 FAX: 0-2719-9484



Cert. No.: 23TM373
Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven
Manufacturer: Memmert
Model: UF 55
Serial No.: B212.0411
ID No.: UAE.WAO.005/2556
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location: Lab Floor 2
Received Order: 11 April 2023
Calibration Date: 11 - 12 April 2023
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %

Calibrated by: Krisda Malee

Approved by:
() Pornthippa Tameyakul
(x) Malee Butkruea
() Suwit Imjai

Issue Date: 24 April 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 & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0053359



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2304-01560C-1

Cert. No.: 23TM373
Page: 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

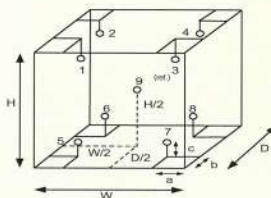
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :
a = 5.0 cm D = 0.50 m
b = 5.0 cm W = 0.80 m
c = 5.0 cm H = 0.75 m
Capacity = 0.30 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	45	44
AC Supply (Volt)	221	220

Ref. Std. ID No. : @ Calibration Point		
Position :	(120 to 180) °C	(104) °C
1	18-20TC-01	20RTD-2/1
2	18-20TC-02	20RTD-2/2
3	18-20TC-03	20RTD-2/3
4	18-20TC-04	20RTD-2/4
5	18-20TC-05	20RTD-2/5
6	18-20TC-06	20RTD-2/6
7	18-20TC-07	20RTD-2/7
8	18-20TC-08	20RTD-2/8
9 (ref.)	18-20TC-09	20RTD-2/9

เอกสารไม่ควบคุม

a 1158261



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2304-0156OC-1
 Result of Calibration :- (°) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 23TM373
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
104.0	104.0	104.0	0.054	0.59	0.95	2
120.0	120.0	120.0	0.12	0.89	1.5	2
180.0	180.0	180.0	0.12	1.5	2.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.512	104.016	104.542	104.407	103.704	103.729	104.167	104.158	104.001	0.42
120.0	120.317	119.768	120.524	120.232	119.363	119.209	119.888	119.797	119.735	1.1
180.0	180.878	179.819	181.357	180.871	179.303	179.139	180.230	180.055	179.960	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม

a 1158260



Certificate of Calibration

Equipment: Cooled Incubator
 Model: KB 400
 Serial No.(or ID): 2022000022479
 Manufacturer: Binder
 Condition: New
 Shelves(pc.): 5

Certificate No.: C31231678
 Issued Date: 10 August 2023
 Job No.: WO-00002652
 Page: 1 of 3
 Ventilation Valve: None

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

Environment Condition: Temperature: 25 °C ± 1.9 °C
 Humidity: 49 %RH ± 5.3 %RH
 Voltage: 232 VAC ± 1.2 VAC

Calibration Place: United Analyst and Engineering Consultant Company Limited. (Control Area)
 3 Soi Udomsuk 41 Sukhumvit Road,
 Bangkok, Prakanong, Bangkok 10260 Thailand.

Calibration By: Mr. Thanakrit Raksapol
 Calibration Date: 07 August 2023
 The Method used: In house method, CAL-WI-16, base on TLAS-G20
 Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
 Certificate No. C10230019

(Mr. Thanakrit Raksapol)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท เทคโนโลยี จำกัด
 DKSH Technology Limited
 2533 หมู่ 4 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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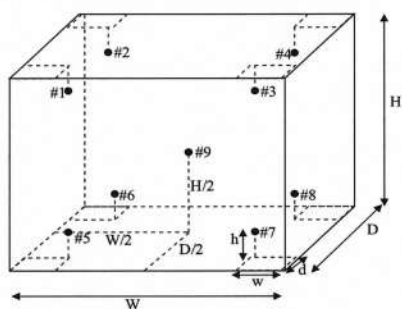
เอกสารไม่ควบคุม

CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31231678

Page: 2 of 3



Standard Installation Locations

Volume (Calibration Zone)= 193 (Liters)

Inside chamber: W = 65 (cm) D = 49 (cm) H = 127 (cm)

Standard Locations (#1, #2, #3, #4): w = 7 (cm) d = 5 (cm) h = 15 (cm)

Standard Locations (#5, #6, #7, #8): w = 7 (cm) d = 5 (cm) h = 15 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	301	302	303	304	305	306	307	308	309

Definitions

Indicating Temperature: The average reading of Indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

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CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31231678

Page: 3 of 3

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	35.11	0.11	0.23
#2	35.04	0.04	0.23
#3	35.03	0.03	0.23
#4	35.13	0.13	0.23
#5	35.02	0.02	0.23
#6	35.07	0.07	0.23
#7	34.97	-0.03	0.23
#8	34.97	-0.03	0.23
#9	35.10	0.10	0.23

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	35.0	35.0	35.11	35.04	35.03	35.13	35.02	35.07	34.97	34.97	35.10	0.23

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
35.0	0.16	0.04	0.22

Note: * Maximum uncertainty of the each position

The End of Certificate

บริษัท เทคโนโลยี จำกัด
 DKSH Technology Limited
 2533 หมู่ 4 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
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CAL-FM-C31-10: 12 Sep 2022

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 correction 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, TLAS-G20. 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

(Mr. Udon Srichana)
Authorized signatory

Without adjustment

Desired Temperature : 35.0°C Tolerances : 0.5 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured (°C)	Correction* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	35.11	0.11	0.23	0.5	Pass
#2	35.04	0.04	0.23	0.5	Pass
#3	35.03	0.03	0.23	0.5	Pass
#4	35.13	0.13	0.23	0.5	Pass
#5	35.02	0.02	0.23	0.5	Pass
#6	35.07	0.07	0.23	0.5	Pass
#7	34.97	-0.03	0.23	0.5	Pass
#8	34.97	-0.03	0.23	0.5	Pass
#9	35.10	0.10	0.23	0.5	Pass

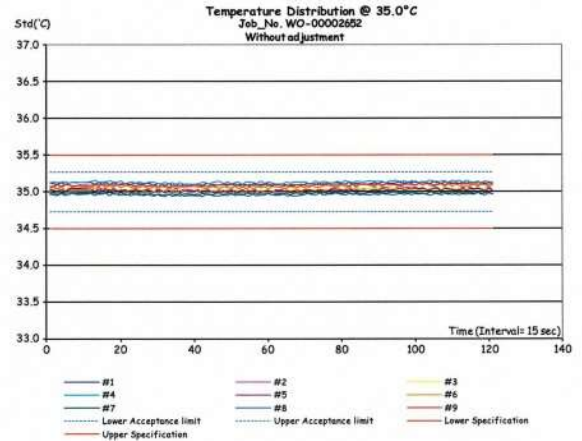
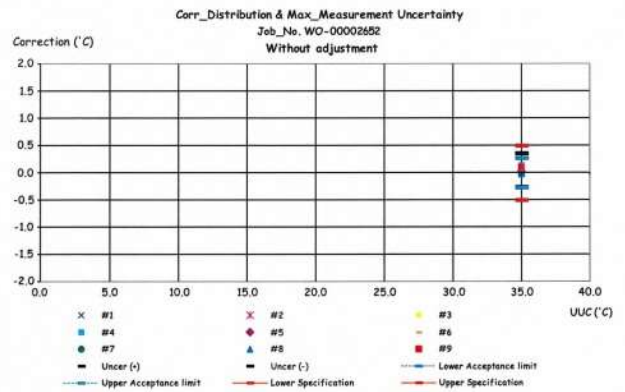
Correction* = Measured Temperature - Desired Temperature

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

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand
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เอกสารไม่ควบคุม
CAL-FM-C31-10: 12 Sep 2022



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00002652

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: KB 400

หมายเลขเครื่อง: 20220000022479.000

ตรวจสอบ (รับ)	รายการตรวจสอบ	ตรวจสอบ (ส่ง)	หมายเหตุ
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ
General			
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ชื่อเจ้าหน้าที่:

Mr. Thanakrit Raksapol
Service Engineer

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand
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เอกสารไม่ควบคุม

FOSS

Customer Service Report

FOSS South East Asia
3388 Siriraj Building, 25th - 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110

Report No: 8411

Date: 29/05/23
Customer: UAE
Instrument: KT8100
Address: Bangkok, Thailand
Serial: 91829052

Hours: Start 07:00, Finish 08:30
Travel To Customer: 1.5 hr
Labour: 04:00, 15:00, 6 hr.
Travel From Customer: 16:30, 18:30, 2 hr

Application	Special	Standard
Normal	Courtesy Visit	Installation
Distributor	PMA Onboarding	Quote
Internal	Warranty	Repair
Digital Service	Sales Support	Remote
		Other

PO/Quote Number: If applicable

PMA Type: If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
- ตรวจสอบ Function Lat ก่อนเข้า PM	OK
- ทำการปรับ Part On site PM - kit 800/800 12 hr	OK
- ตรวจสอบอุณหภูมิ Heatin Coil = 32.3 °C	OK
- ตรวจสอบอุณหภูมิ Splash head Steam generator	OK
- ตรวจสอบอุณหภูมิ Steam valve = 54.8 °C	OK
- ตรวจสอบอุณหภูมิ Condenser Water Cooling Valve A/B = 54.2 °C	OK
- ตรวจสอบอุณหภูมิ Hot water coil → 100 ml / 10 ml / 10 ml → 51 ml	OK
- ตรวจสอบอุณหภูมิ Hot water coil → 170 ml	OK
- ทำการปิดระบบ 0.12 Recovery = 100%	OK

Instrument Ready for Use: ☒ OK ☐ Not OK If not OK - Comment

Part No	Batch	Description	Qty
50031807	18.07.2022	Fung PM kit KT8100/8100 12 hr	1

I confirm this report is accurate and complete
Signed FOSS: [Signature] Signed Customer: [Signature]
Name: [Name] Name: [Name]

Would you be willing to participate in a brief survey in order to tell us how we performed? [Signature]

เอกสารไม่ควบคุม



Cert.No.: 23CH420
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Honiba
Model : LAQUA-PH210
Serial No. : HA0E0009
ID No. : UAE.EFM.071/2564(EFM pH.04/64)
Condition As-Received: Used Item
Received Date : 28 March 2023
Calibration Date : 29-30 March 2023
Reference : 2303-1001WSC-3
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udumsuk 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 Lerngagtrakul

Approved by :

(/) Malee Butkruea
() Saitip Meangmai
() Warakorn Lerngagtrakul

Issue Date : 31 March 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



Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	2211306	27 Oct 2023

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

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	863832	28 Dec 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter S/N.: HA0E0009	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.0	6.99	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

เอกสารไม่ควบคุม



Cert.No.: 23CH420
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: Q92M0159	4.008	4.01	183.1	0.0085	2.05
	6.987	6.99	9.5	0.011	2.00
	6.987	6.99	9.0	0.011	2.00
	10.010	10.01	-165.7	0.011	2.07

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q92M0159

Dimension of probe;

- Length : 107 mm

- Diameter : 16 mm

- Immersion Depth : 100 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	30.003	30.0	-0.003	0.13	2.00
35.0	35.001	35.0	-0.001	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-

เอกสารไม่ควบคุม



Cert. No.: 23TM764
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Mammert
Model : WNE 14
Serial No. : L421.0121
ID No. : UAE.MIC.015/2565
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udumsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 27 April 2023
Calibration Date : 27 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib
Approved by :
() Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai
Issue Date : 11 May 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



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-04610C-3
Cert. No.: 23TM764
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

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

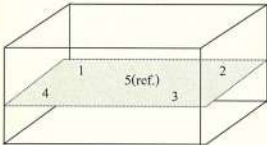
3. This certification is traceable to the International System of Unit.

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	23	69	220
Finished of Calibration	22	73	221



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005

เอกสารไม่คว



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-04610C-3
Cert. No.: 23TM764
Page : 3 of 3

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.370	44.339	44.379	44.413	44.372	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.097	0.030	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 %.

-o0o-

เอกสารไม่คว

เอกสารสอบเทียบเครื่องมือ

ประจำเดือนกุมภาพันธ์ พ.ศ. 2567

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental, Inc.	05072022	5 Jul 22	4 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1401	9 May 23	8 May 24	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 159822	Innovative Instrument Co., Ltd.	23-AFM-203	27 Sep 23	26 Sep 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1856	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-70971-367	UAE Consultant Co., Ltd.	16032023	16 Mar 23	15 Mar 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387036	UAE Consultant Co., Ltd.	22032023	22 Mar 23	21 Mar 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 CM22387062	UAE Consultant Co., Ltd.	07032023	7 Mar 23	6 Mar 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387063	UAE Consultant Co., Ltd.	07042023	7 Apr 23	6 Apr 24	-
11	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									
12	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 24	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48CTL-65506-348	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 24	-
14	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N99E15A01D3	21 Jun 21	21 Jun 24	-
15	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 RATFJBXS	UAE Consultant Co.,Ltd.	21122023	21 Dec 23	20 Dec 24	-
16	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GY21PTED	UAE Consultant Co.,Ltd.	21122023	21 Dec 23	20 Dec 24	-
17	Standard Gas	Total Hydrocarbons	Air Liquide	CC143232	Air Liquide	E03AJ99E15A006C	16 Oct 20	16 Oct 28	-
18	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12393	Calibration Laboratory Co.Ltd	Q23019601	22 Feb 23	21 Feb 24	-
19	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co.,Ltd.	23-ACT-111	27 Jun 23	26 Jun 24	-
20	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} เสียงรบกวน	Larson Davis	LxT1 0007311	Larson Davis-A PCB Piezotronics Div.	2023003675	24 Mar 23	23 Mar 25	-
21	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} เสียงรบกวน	Larson Davis	LxT1 0007312	Larson Davis-A PCB Piezotronics Div.	2023003676	24 Mar 23	23 Mar 25	-

Certificate of Calibration

Calibration Certification Information				
Cal. Date:	July 5, 2022	Roots meter S/N:	438320	Ta: 297 °K
Operator:	Jim Tisch	Pa:	750.1	mm Hg
Calibration Model #:	G25A	Calibrator S/N:	1901	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3540	3.3	2.00
2	3	4	1	0.9650	6.4	4.00
3	5	6	1	0.8640	8.0	5.00
4	7	8	1	0.8200	8.9	5.50
5	9	10	1	0.6780	12.9	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9859	0.7281	1.4073	0.9956	0.7353	0.8899
0.9818	1.0174	1.9902	0.9915	1.0274	1.2585
0.9797	1.1339	2.2251	0.9893	1.1451	1.4071
0.9785	1.1933	2.3337	0.9881	1.2050	1.4757
0.9732	1.4354	2.8146	0.9828	1.4496	1.7798
QSTD		m= 1.98897	QA		m= 1.24546
		b= -0.03691			b= -0.02334
		r= 0.99996			r= 0.99996

Calculations			
Vstd=	$\Delta Vol / (Pa \cdot \Delta P / Pstd) (Tstd / Ta)$	Va=	$\Delta Vol / (Pa \cdot \Delta P / Pa)$
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime
For subsequent flow rate calculations:			
Qstd=	$1/m \left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$	Qa=	$1/m \left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmeter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION	
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30	

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

www.tisch-env.com
TOLL FREE: (877)263-7610
7-9009

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3080-24 FAX: 0-2719-9484

Certificate of Calibration

Certificate No.: 23P1401
Page: 1 of 2

Equipment: U-Tube Manometer
Manufacturer: Dwyer
Model: 1221-36-W/M
Serial No.: -
ID No.: UAE-EFM.022/2560

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 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
81 Soi Udomsak 41, Sukhumvit Road, Bangkok, 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 and oil 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 Aussaroon
Issue Date: 11 May 2023

Approved Signatory: [Signature]
[Signature]
[Signature]
[Signature]

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B 0314241

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7109 MID 17, 18B SUWANNAPHUM 11 TAMBON BANG KAELE,
AMPHOE BANG PHU SANU 1 PRACHIN PROVINCE 30440 THAI AND
TEL: 0669-2110-5969-1 FAX: 0669-2110-7140



Page 1/2

Certificate of Calibration

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

Certificate No.: 23-AFM-203
Request No.: Req-2023-1919

Unit Under Calibration Details

Measurement Item: Air Flow Meter
Manufacturer: BGI
Model: Delta Cal DC1
Serial Number: 159022
ID: UAE-EFM.039/2561

Sensor Model: -
Sensor Serial Number: -

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: 7 September 2023
Calibration Date: 27 September 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	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU1651882	TPA	7 November 2023

Traceability:

This Certificate is traceable to SI Unit through Sensidyne A21A 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: [Signature]
Mr. Nopphadol Luangmit
Service Calibration Engineer

Approved By: [Signature]
Mr. Pancha Anantavong
Calibration Engineer Supervisor
Issue Date: 27 September 2023

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a 1160340

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.
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FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-APM-203
Request No : Req-2023-1919

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.90	100.64	14.58	14.50	-0.08	0.20
24.90	100.64	15.06	15.00	-0.06	0.21
25.00	100.63	15.90	15.80	-0.10	0.22
24.90	100.63	16.78	16.67	-0.11	0.23
24.90	100.63	18.46	18.30	-0.16	0.26

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

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

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

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
FM-708-APM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

Certificate No : 23-TPM-461
Request No : Req-2023-1919
Customer : UNITED ANALYST AND ENGINEERING
Name : CONSULTANT CO., LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Page : 1/2

Unit Under Calibration Details


Calibration Parameter : Temperature
Instrument Name : Air Flow meter Range Calibration : 20 °C to 50 °C
Manufacturer : BGI Type of Sensor : RTD
Model : Delta Cal DC1 Sensor Diameter (mm) : 3
Serial Number : 159822 Calibration Position (mm) : 45
Resolution : 0.1 °C Instrument Status : Used
ID Number : UAE.EFM.039/2561

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 September 2023
Calibrated Date : 27 September 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.
Reference Standard : Digital Thermometer with Sensor, 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 : 
Mr. Noppadon Luangart
Technical Manager
Issue Date : 27 September 2023

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

Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 23-TPM-461
Request No : Req-2023-1919
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
Tx	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.1	-0.1	0.13
	40.040	40.0	0.0	0.13
	45.039	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
TT	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.2	-0.2	0.13
	40.040	40.2	-0.2	0.13
	45.039	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13

End of Certificate

Calibrated By : 
Mr. Sanchak Jirapakkonakul

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
FM-708-TPM-01 Rev.01 Issue date 15/03/20



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3. EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No. : 23P1856
Page : 1 of 2


Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE.EMA2.110/2555
Condition As-Received: Used Item
Received Date : 26 May 2023
Calibration Date : 02 June 2023
Reference : 2305-0919WSC
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Atmospheric Pressure : 1006 mbar
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260.

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

Condition of this result of calibration

- 1.Reference standards instruments :
- | Instrument | Model | Serial No. | Certificate No. | Due Date |
|-----------------------|--------|------------|-----------------|-------------|
| 1) Standard Barometer | 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 : 
[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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B 0316956



Cert.No.: 23P1856
Page: 2 of 2

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

Range: 720 mmHg to 800 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	720.43	730.67	740.34	751.52	758.56	761.83	773.53	788.76
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	755.0	760.0	770.0	790.0
Error (mmHg)	-0.43	-0.67	-0.34	-1.52	-1.56	-1.83	-3.53	-8.76

Decreasing Pressure

Applied Pressure (mmHg)	788.76	773.50	761.89	756.65	751.59	740.72	730.68	720.59
UUC* Indication (mmHg)	790.0	770.0	760.0	750.0	740.0	730.0	720.0	
Error (mmHg)	-8.76	-3.50	-1.89	-1.65	-1.59	-0.72	-0.68	-0.59

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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a 1165502



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-34 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023
to 06 June 2023

Reference: 2305-0919WSC

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-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	23105	15 Mar 2024

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

3. This Certificate is traceable to the International System of Unit 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:

[X] Chakrit Waewwanjua
[] Pornthippa Tameyakul
[] Viporn Tantiyawutti

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B 0316274



Cert. No.: 23H1200
Page: 2 of 2

Result of Calibration:-
Function: Humidity Measurement

Before Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (\pm %R.H.)
25.0	40.1	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:-
Function: Humidity Measurement

After Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (\pm %R.H.)
25.0	40.1	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:-
Function: Temperature Measurement

Without Adjustment

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (\pm °C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

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

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a 1165295



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.uaconsultant.com E-mail: ua@uaconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: Mar 16, 2023

Equipment: Gas Analyzer (NO₂)

Model: 42C

Manufacturer: Thermo Environmental Instruments

Serial Number: 42C-70971-367

Standard Gas Concentration

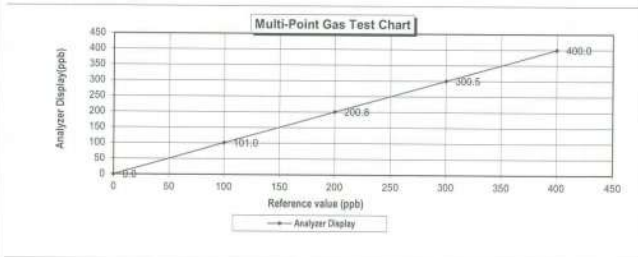
Sulphur Dioxide (SO ₂)	44.68	PPM
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	984.8	PPM
Cylinder No.:	EB0143262	
Expiration Date:	Jun 21, 2024	

Dilutor Detail

Manufacturer:	Thermo Scientific
Model:	1461
Serial Number:	1180540071

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	1.00	0.99	0.99
Level 3	40.00%	200.0	0.80	0.40	0.40
Level 4	60.00%	300.0	0.50	0.17	0.17
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark: Measuring Range	500.0 ppb		Average Difference (%)	0.31	
			Acceptable Limit $\pm 5\%$		



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MULTI-POINT GAS TEST REPORT

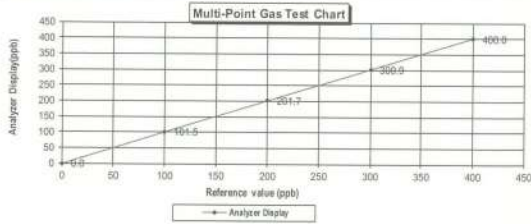
Test Date : Mar 22, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM22387036

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.5	1.50	1.48	1.48
Level 3	40.00%	200.0	201.7	1.70	0.84	0.84
Level 4	60.00%	300.0	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 (%)		0.52



Calculate by

22 / 3 / 23

22 Mar 2023

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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,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

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

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708068	49.92 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	DS85025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	40142383102	CC505981	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Jun 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



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

Approved for Release



CERT 3062.01

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MULTI-POINT GAS TEST REPORT

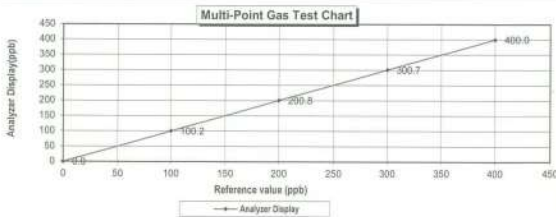
Test Date : Mar 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387062

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

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.2	0.20	0.20	0.20
Level 3	40.00%	200.0	200.8	0.80	0.40	0.40
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 (%)		0.17



7 / 3 / 23

7 Mar 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

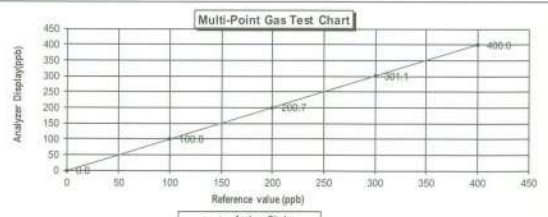
Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387063

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

Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	0.80	0.79	0.79
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	301.1	1.10	0.37
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.30



7 / 4 / 23

7 Apr 2023

เอกสารไม่ควบคุม

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 molar basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals)

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

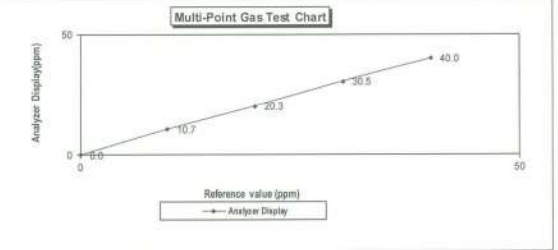
Equipment : Gas Analyzer (CO) Model : APMA-370
Manufacturer : HORIBA Serial Number : YRLHTB7G

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

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.3	0.3	1.5
Level 4	60.00%	30.0	30.5	0.5	1.6
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm				
Average Difference (%)				1.93	

Acceptable Limit $\pm 5\%$



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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

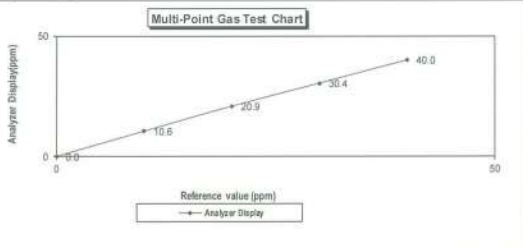
Equipment : Gas Analyzer (CO) Model : 48C
Manufacturer : Thermo Environmental Instruments Serial Number : 48C-65506-348

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

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.6	0.6	5.7
Level 3	40.00%	20.0	20.9	0.9	4.3
Level 4	60.00%	30.0	30.4	0.4	1.3
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm				
Average Difference (%)				2.26	

Acceptable Limit $\pm 5\%$



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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 molar basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals)

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



เอกสารไม่ควบคุม

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : RATFJBXS

Standard Gas Concentration

Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

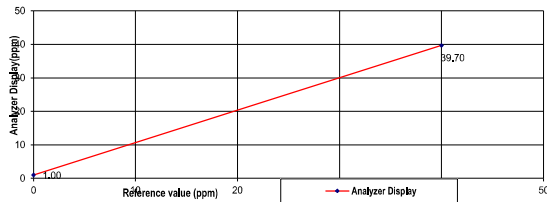
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	1.00	1.00	1.00
Level 2	80.00%	40.00	39.70	-0.30	-0.76
Remark : Measuring Range	50.00 ppm		Average Difference (%)		0.88

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Approve by

...22.../...Dec.../...2023..

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : GY21PTED

Standard Gas Concentration

Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

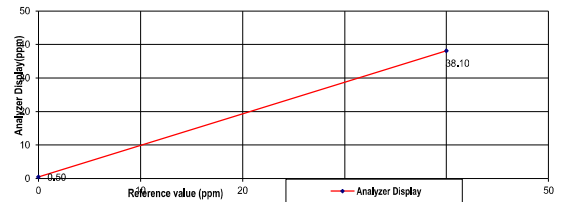
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.50	0.50	0.50	0.50
Level 2	80.00%	40.00	38.10	-1.90	-4.99
Remark : Measuring Range	50.00 ppm		Average Difference (%)		2.74

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

Approve by

...21.../...12.../...2023..

...22.../...Dec.../...2023..

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03A199E15A006C Reference Number: 160-401908379-1
Cylinder Number: CC143232 Cylinder Volume: 144.0 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2018 PSIG
PGVP Number: A12020 Valve Outlet: 590
Gas Code: CH4,PPN,BALA Certification Date: Oct 16, 2020
Expiration Date: Oct 16, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 903R-12/531, 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 mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig. i.e. 0.7 megapascals

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
METHANE	4000 PPM	4019 PPM	G1	+/- 1.0% NIST Traceable	10/16/2020
PROPANE	4000 PPM	4008 PPM	G1	+/- 0.7% NIST Traceable	10/09/2020
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	02010405	K010090	4976 PPM PROPANE/NITROGEN	+/- 0.6%	Dec 02, 2021
NTRM	170608	CC160290	0.967 % METHANE/NITROGEN	+/- 0.4%	Aug 22, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTR - CH4 - 000928781	FTR	Oct 14, 2020
Nicolet 6700 APW1100391 C3H8	FTIR	Sep 18, 2020

Triad Data Available Upon Request

NOTES: NET WEIGHTS: 4.865kg
GROSS WEIGHTS: 27.385kg
PO#: 5220003825



เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12393/UM12393
CLID. NO. : 251801351
JOB CONTROL NO. : 230221019601

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 21 February 2023

DATE OF ISSUED : 24 February 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

Approved By : Mongkol Yotsontorn
Authorized Signatory
24 February 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23019601

F3-011-04/01-12

เอกสารไม่ควบคุม



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12393/UM12393
DATE OF CALIBRATION : 22 February 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.

The calibration was performed by using Digital Multimeter, High Resolution Programmable Timer/Counter,

Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Digital Multimeter, Wavetek Model 1281 S/N. 29320.
- High Resolution Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
- Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0001/22, Due Date 22 February 2023.
- The measurements are traceable to International Systems of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23019601

F3-011-04/01-12

page 2 of 4



เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	\pm (% of rdg.)
0.3	50 Hz	peak	0.300	0.305	-0.005	1.9
0.4	50 Hz		0.400	0.408	-0.008	1.9
0.5	50 Hz		0.500	0.511	-0.011	1.3
0.6	50 Hz		0.600	0.618	-0.018	1.3
0.7	50 Hz		0.700	0.721	-0.021	1.3
0.3	100 Hz	peak	0.300	0.304	-0.004	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.509	-0.009	1.3
0.6	100 Hz		0.600	0.613	-0.013	1.3
0.7	100 Hz		0.700	0.719	-0.019	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	\pm (% of rdg.)
3	50 Hz	peak	3.000	3.041	-0.041	1.8
4	50 Hz		4.000	4.055	-0.055	1.8
5	50 Hz		5.000	5.067	-0.067	1.8
6	50 Hz		6.000	6.079	-0.079	1.8
7	50 Hz		7.000	7.089	-0.089	1.8
3	100 Hz	peak	3.000	3.039	-0.039	1.8
4	100 Hz		4.000	4.048	-0.048	1.8
5	100 Hz		5.000	5.055	-0.055	1.8
6	100 Hz		6.000	6.068	-0.068	1.8
7	100 Hz		7.000	7.080	-0.080	1.8

Certificate No. Q23019601

F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	\pm (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.061	-0.001	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

Note: * means Calibrations marked "Not ANAB Accredited" in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23019601

F3-011-04/01-12

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เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MED U.S. SOI SENTENAKORN 11 TAMBON BANG KAEO,
AMPHIB RANG PHU SAMUT PRAKAN PROVINCE 10940 THAILAND
TEL: 0668-2116-3900-1 FAX: 0668-2116-7140



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Certificate of Calibration

Customer

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

Certificate No : 23-ACT-111
Request No : Req-2023-1408

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35A
Serial Number : 73249
ID : UAE.EPM.105/2561

Class : 1
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : $(23 \pm 2) ^\circ\text{C}$
Humidity : $(50 \pm 20) \% \text{RH}$
Barometric Pressure : $(1013 \pm 10.0) \text{ hPa}$
Received Date : 26 June 2023
Calibration Date : 27 June 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 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 :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Calibration Engineer Supervisor

Issue Date : 27 June 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-ACT-111

Request No : Req-2023-1408

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	93.84	-0.16	-	-	0.14	0.25
114 dB / 1000 Hz	113.79	-0.21	-	-	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 (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.17	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.04	-	-	-	0.40	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

End of Calibration

Calibration Certificate

Certificate Number 2023003675

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT1

Serial Number

0007311

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number

D0001.8384-

Technician

Jacob Cannon

Calibration Date

24 Mar 2023

Calibration Due

Temperature

23.56 °C ± 0.25 °C

Humidity

49.9 %RH ± 2.0 %RH

Static Pressure

85.69 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis CAL291, S/N 0108
Larson Davis CAL200, S/N 9079
PCB 377B02, S/N 345817
Larson Davis PRMLxT1, S/N 077846

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61260:2001 Class 1
IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-03-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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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 Number 2023003675

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014 Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1.

Description	Standards Used		
	Cal Date	Cal Doc	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007025
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.73	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.23	Pass
1000	0.15	0.00	-0.70	0.70	0.23	Pass
8000	-3.69	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

— End of Report—

Signature



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Calibration Certificate

Certificate Number 2023003651

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1

Serial Number 0007311

Test Results Pass

Initial Condition As Manufactured

Description
SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378

Technician Jacob Cannon

Calibration Date 23 Mar 2023

Calibration Due

Temperature 23.6 °C ± 0.25 °C

Humidity 50.3 %RH ± 2.0 %RH

Static Pressure 86.08 kPa ± 0.13 kPa

Evaluation Method
Tested electrically using Larson Davis PRMLxT1 S/N 077646 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards
Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61672:2013 Class 1
IEC 61260:2001 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1
ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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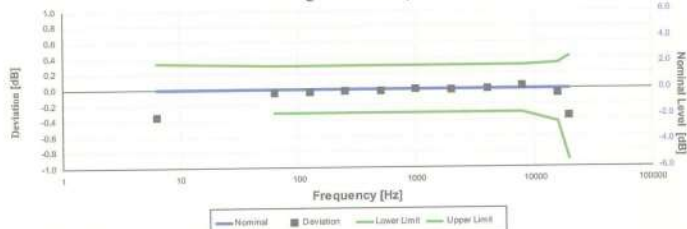
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Certificate Number 2023003651

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4:1993 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.36	-0.35	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.01	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.52	-0.35	-0.35	-0.91	0.41	0.15	Pass

– End of measurement results –

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Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-T1 Temperature Probe	2021-06-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-03-30	2023-03-30	007174

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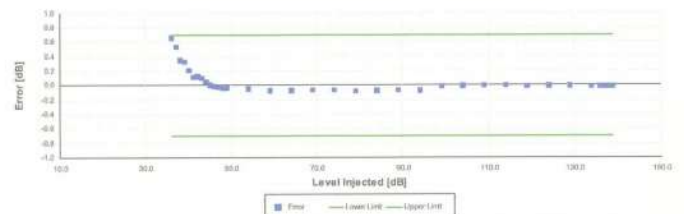
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Certificate Number 2023003651

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.66	-0.70	0.70	0.16	Pass
37.00	0.53	-0.70	0.70	0.16	Pass
38.00	0.35	-0.70	0.70	0.16	Pass
39.00	0.32	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.12	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.17	Pass
44.00	0.05	-0.70	0.70	0.17	Pass
45.00	0.00	-0.70	0.70	0.16	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	-0.03	-0.70	0.70	0.16	Pass
48.00	-0.04	-0.70	0.70	0.16	Pass
49.00	-0.04	-0.70	0.70	0.16	Pass
50.00	-0.05	-0.70	0.70	0.16	Pass
51.00	-0.07	-0.70	0.70	0.16	Pass
52.00	-0.07	-0.70	0.70	0.16	Pass
53.00	-0.07	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
55.00	-0.07	-0.70	0.70	0.16	Pass
56.00	-0.07	-0.70	0.70	0.16	Pass
57.00	-0.07	-0.70	0.70	0.16	Pass
58.00	-0.07	-0.70	0.70	0.16	Pass
59.00	-0.07	-0.70	0.70	0.16	Pass
60.00	-0.07	-0.70	0.70	0.16	Pass
61.00	-0.07	-0.70	0.70	0.16	Pass
62.00	-0.07	-0.70	0.70	0.16	Pass
63.00	-0.07	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
65.00	-0.07	-0.70	0.70	0.16	Pass
66.00	-0.07	-0.70	0.70	0.16	Pass
67.00	-0.07	-0.70	0.70	0.16	Pass
68.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.07	-0.70	0.70	0.16	Pass
70.00	-0.07	-0.70	0.70	0.16	Pass
71.00	-0.07	-0.70	0.70	0.16	Pass
72.00	-0.07	-0.70	0.70	0.16	Pass
73.00	-0.07	-0.70	0.70	0.16	Pass
74.00	-0.07	-0.70	0.70	0.16	Pass
75.00	-0.07	-0.70	0.70	0.16	Pass
76.00	-0.07	-0.70	0.70	0.16	Pass
77.00	-0.07	-0.70	0.70	0.16	Pass
78.00	-0.07	-0.70	0.70	0.16	Pass
79.00	-0.07	-0.70	0.70	0.16	Pass
80.00	-0.07	-0.70	0.70	0.16	Pass
81.00	-0.07	-0.70	0.70	0.16	Pass
82.00	-0.07	-0.70	0.70	0.16	Pass
83.00	-0.07	-0.70	0.70	0.16	Pass
84.00	-0.07	-0.70	0.70	0.16	Pass
85.00	-0.07	-0.70	0.70	0.16	Pass
86.00	-0.07	-0.70	0.70	0.16	Pass
87.00	-0.07	-0.70	0.70	0.16	Pass
88.00	-0.07	-0.70	0.70	0.16	Pass
89.00	-0.07	-0.70	0.70	0.16	Pass
90.00	-0.07	-0.70	0.70	0.16	Pass
91.00	-0.07	-0.70	0.70	0.16	Pass
92.00	-0.07	-0.70	0.70	0.16	Pass
93.00	-0.07	-0.70	0.70	0.16	Pass
94.00	-0.07	-0.70	0.70	0.16	Pass
95.00	-0.07	-0.70	0.70	0.16	Pass
96.00	-0.07	-0.70	0.70	0.16	Pass
97.00	-0.07	-0.70	0.70	0.16	Pass
98.00	-0.07	-0.70	0.70	0.16	Pass
99.00	-0.07	-0.70	0.70	0.16	Pass
100.00	-0.07	-0.70	0.70	0.16	Pass
101.00	-0.07	-0.70	0.70	0.16	Pass
102.00	-0.07	-0.70	0.70	0.16	Pass
103.00	-0.07	-0.70	0.70	0.16	Pass
104.00	-0.07	-0.70	0.70	0.16	Pass
105.00	-0.07	-0.70	0.70	0.16	Pass
106.00	-0.07	-0.70	0.70	0.16	Pass
107.00	-0.07	-0.70	0.70	0.16	Pass
108.00	-0.07	-0.70	0.70	0.16	Pass
109.00	-0.07	-0.70	0.70	0.16	Pass
110.00	-0.07	-0.70	0.70	0.16	Pass
111.00	-0.07	-0.70	0.70	0.16	Pass
112.00	-0.07	-0.70	0.70	0.16	Pass
113.00	-0.07	-0.70	0.70	0.16	Pass
114.00	-0.07	-0.70	0.70	0.16	Pass
115.00	-0.07	-0.70	0.70	0.16	Pass
116.00	-0.07	-0.70	0.70	0.16	Pass
117.00	-0.07	-0.70	0.70	0.16	Pass
118.00	-0.07	-0.70	0.70	0.16	Pass
119.00	-0.07	-0.70	0.70	0.16	Pass
120.00	-0.07	-0.70	0.70	0.16	Pass
121.00	-0.07	-0.70	0.70	0.16	Pass
122.00	-0.07	-0.70	0.70	0.16	Pass
123.00	-0.07	-0.70	0.70	0.16	Pass
124.00	-0.07	-0.70	0.70	0.16	Pass
125.00	-0.07	-0.70	0.70	0.16	Pass
126.00	-0.07	-0.70	0.70	0.16	Pass
127.00	-0.07	-0.70	0.70	0.16	Pass
128.00	-0.07	-0.70	0.70	0.16	Pass
129.00	-0.07	-0.70	0.70	0.16	Pass
130.00	-0.07	-0.70	0.70	0.16	Pass

– End of measurement results –

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Peak Rise Time

Peak rise time performed according to IEC 60851:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.26	133.80	0.15	Pass
		Positive Pulse	135.25	133.80	0.15	Pass
		Negative Pulse	134.32	133.80	0.15	Pass
126.85	30	Negative Pulse	134.32	133.80	0.15	Pass
		Positive Pulse	134.32	133.80	0.15	Pass
		Negative Pulse	134.32	133.80	0.15	Pass

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.16 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	0.01	± 1.50	0.15 ±	Pass

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.25	± 1.50	0.15 ±	Pass
106.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	0.01	± 1.50	0.15 ±	Pass

Gain

Gain measured according to IEC 61672-3:2013 17.3 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.14	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.01	36.00	Pass
C-weight Noise Floor	27.02	35.00	Pass
Z-weight Noise Floor	33.41	39.00	Pass

Total Harmonic Distortion

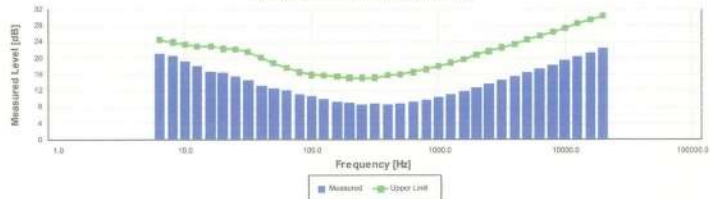
Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.84	135.05	136.65	0.15	Pass
THD	-67.26	-58.00	-56.00	0.01 ±	Pass
THD+N	-63.27	-56.00	-56.00	0.01 ±	Pass

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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	21.01	24.60	Pass
8.00	20.60	24.00	Pass
10.00	19.19	23.50	Pass
12.50	18.13	23.00	Pass
16.00	16.66	22.50	Pass
20.00	16.47	22.40	Pass
25.00	15.54	22.30	Pass
31.50	14.59	21.50	Pass
40.00	13.14	20.20	Pass
50.00	12.53	18.80	Pass
63.00	12.05	17.60	Pass
80.00	11.24	16.60	Pass
100.00	10.61	15.90	Pass
125.00	10.01	15.70	Pass
160.00	9.34	15.50	Pass
200.00	9.01	15.20	Pass
250.00	8.52	15.20	Pass
315.00	8.71	15.20	Pass
400.00	8.61	15.70	Pass
500.00	8.80	16.00	Pass
630.00	9.26	16.60	Pass
800.00	9.76	17.30	Pass
1,000.00	10.40	18.10	Pass
1,250.00	11.15	18.90	Pass
1,600.00	11.94	19.80	Pass
2,000.00	12.75	20.80	Pass
2,500.00	13.68	21.70	Pass
3,150.00	14.64	22.60	Pass
4,000.00	15.55	23.50	Pass
5,000.00	16.47	24.50	Pass
6,300.00	17.47	25.50	Pass
8,000.00	18.44	26.50	Pass
10,000.00	19.44	27.40	Pass
12,500.00	20.45	28.50	Pass
16,000.00	21.42	29.50	Pass
20,000.00	22.41	30.40	Pass

— End of measurement results—

— End of Report—

Signatory: _____

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Calibration Certificate

Certificate Number 2023003676

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonnuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8384
Serial Number	0007312	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	24 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	23.58 °C ± 0.25 °C
		Humidity	49.3 %RH ± 2.0 %RH
		Static Pressure	85.71 kPa ± 0.13 kPa

Evaluation Method	Tested with: Larson Davis CAL200, S/N 9079 PCB 377B02, S/N 345618 Larson Davis PRMLxT1, S/N 07647 Larson Davis CAL291, S/N 0106	Data reported in dB re 20 µPa.
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Compliance Standards	Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:
IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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Certificate Number 2023003676

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-08 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-11 Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 Inch Polarized Pressure Microphone	2023-04-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2023-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.85	-52.44	-48.33	0.14	Pass

– End of measurement results–

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.72	-3.00	-5.50	-1.50	0.32	Pass

– End of measurement results–

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Certificate Number 2023003676

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.51

– End of measurement results–

– End of Report–

Signature:



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เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003652

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonnuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8378
Serial Number	0007312	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	23 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	23.62 °C ± 0.25 °C
		Humidity	49.5 %RH ± 2.0 %RH
		Static Pressure	86.98 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 S/N 077647 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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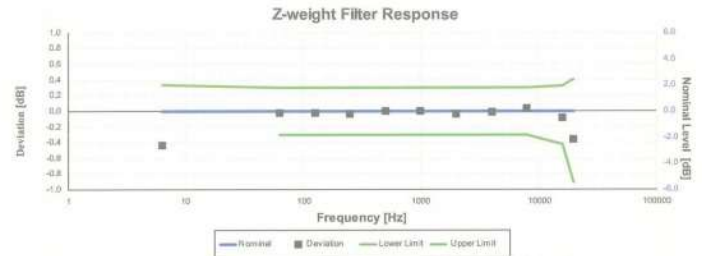
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D0001.8407 Rev G

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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-25	806798
SRS DS360 Ultra Low Distortion Generator	2022-05-04	2023-05-04	007117

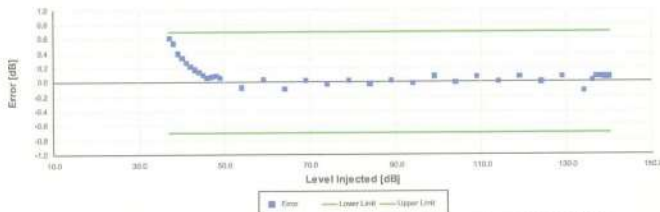


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4-1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.44	-0.44	-1.11	0.33	0.15	Pass
63.10	-0.03	-0.03	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.01	-0.01	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass
— End of measurement results—						

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A-weighted Broadband Log Linearity: 8,000.00 Hz

Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6; IEC 60804:2000 6.2; IEC 61252:2002 8; ANSI S1.4 (R2006) 6.9; ANSI S1.4-2014 Part 1: 5.6; ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
37.00	0.61	-0.70	0.70	0.16	Pass
38.00	0.54	-0.70	0.70	0.16	Pass
39.00	0.40	-0.70	0.70	0.16	Pass
40.00	0.33	-0.70	0.70	0.16	Pass
41.00	0.27	-0.70	0.70	0.16	Pass
42.00	0.22	-0.70	0.70	0.16	Pass
43.00	0.18	-0.70	0.70	0.17	Pass
44.00	0.15	-0.70	0.70	0.17	Pass
45.00	0.10	-0.70	0.70	0.16	Pass
46.00	0.07	-0.70	0.70	0.16	Pass
47.00	0.07	-0.70	0.70	0.16	Pass
48.00	0.09	-0.70	0.70	0.16	Pass
49.00	0.06	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
59.00	0.03	-0.70	0.70	0.16	Pass
64.00	-0.09	-0.70	0.70	0.16	Pass
69.00	0.03	-0.70	0.70	0.16	Pass
74.00	-0.03	-0.70	0.70	0.16	Pass
79.00	0.02	-0.70	0.70	0.16	Pass
84.00	-0.02	-0.70	0.70	0.16	Pass
89.00	0.03	-0.70	0.70	0.16	Pass
94.00	-0.02	-0.70	0.70	0.16	Pass
99.00	0.08	-0.70	0.70	0.15	Pass
104.00	0.00	-0.70	0.70	0.15	Pass
109.00	0.08	-0.70	0.70	0.15	Pass
114.00	0.01	-0.70	0.70	0.15	Pass
119.00	0.07	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.08	-0.70	0.70	0.15	Pass
134.00	-0.12	-0.70	0.70	0.15	Pass
136.00	0.02	-0.70	0.70	0.15	Pass
137.00	0.07	-0.70	0.70	0.15	Pass
138.00	0.07	-0.70	0.70	0.15	Pass
139.00	0.07	-0.70	0.70	0.15	Pass
140.00	0.07	-0.70	0.70	0.15	Pass
— End of measurement results—					

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Table 1: Test results according to EN 60601-1-2:2015 and EN 60601-1-2:2015 (continued)							
Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	134.73	133.30	135.30	0.15	Pass
		Positive Pulse	134.72	133.28	135.28	0.15	Pass
30	30	Negative Pulse	133.79	133.30	135.30	0.15	Pass
		Positive Pulse	133.78	133.28	135.28	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.07	± 1.00	0.16 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.16	± 0.50	0.15 ±	Pass
	5	-0.05	± 1.00	0.15 ±	Pass
	10	-0.24	± 1.50	0.15 ±	Pass
106.85	3	-0.19	± 0.50	0.15 ±	Pass
	5	-0.09	± 1.00	0.15 ±	Pass
	10	-0.30	± 1.50	0.15 ±	Pass
— End of measurement results—					

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.08	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.10	± 0.50	0.15 ±	Pass
	5	-0.06	± 1.00	0.15 ±	Pass
	10	-0.23	± 1.50	0.15 ±	Pass
106.85	3	-0.18	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.28	± 1.50	0.15 ±	Pass
— End of measurement results—					

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Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.92	93.86	94.06	0.15	Pass
0 dB Gain, Linearity	41.16	40.26	41.66	0.16	Pass
OBA Low Range	93.97	93.86	94.06	0.15	Pass
OBA Normal Range	93.96	93.20	94.80	0.15	Pass

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.86	36.00	Pass
C-weight Noise Floor	26.56	36.00	Pass
Z-weight Noise Floor	32.28	38.00	Pass

-- End of measurement results--

Total Harmonic Distortion

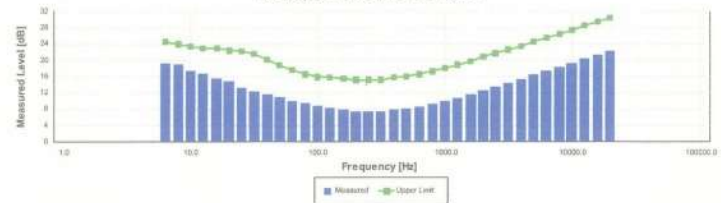
Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.35	135.05	136.65	0.15	Pass
THD	-64.53	-58.00	-58.00	0.01 %	Pass
THD+N	-61.30	-58.00	-58.00	0.01 %	Pass

-- End of measurement results--

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1/3-Octave Self-Generated Noise



The SLIM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.36	24.60	Pass
8.00	18.96	24.00	Pass
10.00	17.32	23.50	Pass
12.50	16.60	23.00	Pass
16.00	15.47	22.90	Pass
20.00	14.87	22.40	Pass
25.00	13.12	22.30	Pass
31.50	12.38	21.50	Pass
40.00	11.67	20.20	Pass
50.00	10.95	18.80	Pass
63.00	10.08	17.60	Pass
80.00	9.46	16.60	Pass
100.00	8.73	15.90	Pass
125.00	8.30	15.70	Pass
160.00	7.83	15.50	Pass
200.00	7.53	15.20	Pass
250.00	7.40	15.20	Pass
315.00	7.44	15.20	Pass
400.00	7.80	15.70	Pass
500.00	8.11	16.00	Pass
630.00	8.69	16.60	Pass
800.00	9.34	17.30	Pass
1,000.00	10.05	18.10	Pass
1,250.00	10.74	18.90	Pass
1,600.00	11.61	19.60	Pass
2,000.00	12.58	20.90	Pass
2,500.00	13.49	21.70	Pass
3,150.00	14.42	22.60	Pass
4,000.00	15.39	23.50	Pass
5,000.00	16.38	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.33	26.50	Pass
10,000.00	19.35	27.40	Pass
12,500.00	20.35	28.50	Pass
16,000.00	21.34	29.50	Pass
20,000.00	22.35	30.40	Pass

-- End of measurement results--

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-- End of Report--

Signature

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List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	National Food Institute, Ministry of Industry, Thailand	2303074-001-01	27 May 23	25 May 24
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	25 Apr 24
3	Analytical Balance	SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	23MM112	26 Apr 23	25 Apr 24
4	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Harikul Science	HSU012C	1 Mar 23	29 Feb 24
5	Digestion Units	TOTAL KJELDAHL NITROGEN	VELP/VELP Scientifica	DKL20 / 213517	National Food Institute Ministry of Industry, Thailand	2304455-001-01	28 Aug 23	27 Aug 24
6	Hot Air Oven	TOTAL DISSOLVED SOLIDS SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	23TM373	11 Apr 23	10 Apr 24
7	Incubator	FECAL COLIFORM BACTERIA TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000022476	DKSH Technology	C31231678	7 Aug 23	6 Aug 24
8	Kjeltrec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjeltrec 8100 / 91889052	FOSS South East Asia	8411	29 May 23	28 May 24
9	pH Meter	pH	Horiba	LAQUA-PH210 / HA0E0009	technology promotion association (thailand-japan)	23CH420	29 Mar 23	28 Mar 24
10	Water Bath	FECAL COLIFORM BACTERIA	Memmert	WNE14 / L421.0121	Technology Promotion Association (Thailand-Japan)	23TM764	27 Apr 23	26 Apr 24

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



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

Cert.No.: 23MM113
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

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

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

Range capacity : 0 g to 81 g **Resolution** 0.00001 g
81 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	79.99992	+0.00008	0.15	2.00
200	199.9995	+0.0005	0.29	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00004

เอกสาร



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

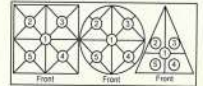
Cert.No.: 23MM113
Page: 3 of 3

Result of calibration

2. Effect of off center loading

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

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



Maximum difference between
off-center and central loading
(g)
0.0001

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.11
0.05	0.04999	+0.00001	0.015	2.09
0.1	0.09999	+0.00001	0.015	2.07
1	1.00000	0.00000	0.018	2.04
5	5.00000	0.00000	0.026	2.00
20	20.00002	-0.00002	0.045	2.00
50	50.00002	-0.00002	0.080	2.00
80	80.00002	-0.00002	0.15	2.00
100	100.00000	0.00000	0.17	2.00
150	150.00000	0.00000	0.29	2.00
200	199.99999	+0.00001	0.29	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 %.

-000-

เอกสาร



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.: 23MM112
Page: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C009071872
ID No. : UAE.WAO.012/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : [Signature]
Approved by : [Signature]
() Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai
Issue Date : 2 May 2023

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 : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

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

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

Range capacity : 0 g to 81 g **Resolution** 0.00001 g
81 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	80.00005	-0.00005	0.15	2.00
200	199.9999	+0.0001	0.29	2.00

After Adjustment :

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

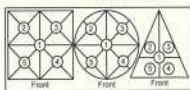
Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00000

เอกสาร



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 3 of 3



Maximum difference between
off-center and central loading
(g)
0.0001

2. Effect of off center loading

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

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

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.13
0.05	0.05001	-0.00001	0.015	2.09
0.1	0.10001	-0.00001	0.015	2.09
1	1.00001	-0.00001	0.018	2.04
5	5.00003	-0.00003	0.026	2.00
20	20.00006	-0.00006	0.045	2.00
50	50.00006	-0.00006	0.080	2.00
80	80.00004	-0.00004	0.15	2.00
100	100.00000	0.00000	0.16	2.00
150	150.00000	0.00000	0.29	2.00
200	200.00000	0.00000	0.29	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 %.

-o0o-

เอกสารไม่

23040000



CERT.No.: HS-U012C

Calibration Date : 1 Mar 23

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

Avg Room Temp : 20 °C
Avg Water Temp : 20 °C
Air Pressure : 760.00 mmHg
Salinity : 0 ppt

Model : YSI 5100
S/N : 11B101863
Probe : YSI 5010
S/N : 22B100125
ID NO. : +
Air Temp ref : S/N. E00522
Barometric ref : S/N. E00522
Water Temp ref : S/N. 11431
Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.09	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.09	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.09	mg/l	-
Inaccuracy	0.00	mg/l	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- This certificate is issued based on the result that are found as shown on date and place of test only.
- The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- This result shall not be used for advertising purpose.

Technician Signature

(Kittipong Maekwong)

เอกสารไม่ควบคุม

Laboratory Manager
(Supreecha Sumartiam)



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

Verification Certificate

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

Page 1 of 4

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

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

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

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

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

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

Verification Report

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

Date of Calibration: 28-29 August 2023

Page 2 of 4

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

Condition of this results of Calibration:

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

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A	MY4045576/MY41194453	TC23/0048	2-Jun-2024	N.M. Technical Center Laboratory

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

UUC* Description
Time of Record 1 Hour 6 Minute At 380 °C

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

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

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nfi.com

Verification Report

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

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

Calibration point: 380 °C

Calibration result:

Table 1 : Reporting of Temperature

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

Note:

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

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

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

2008 อาคารพาณิชย์ 36 หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10710
2008 หมู่ 36, หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10710
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Verification Report

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

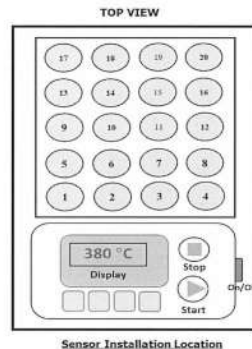
Date of Calibration: 28-29 August 2023 Page 4 of 4

Calibration point: 380 °C

Calibration result:

Continued

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



Sensor Installation Location

----- End -----

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

2008 อาคารพาณิชย์ 36 หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10710
2008 หมู่ 36, หมู่ 10 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10710
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3008-29 FAX: 0-2719-9484



Cert. No.: 23TM373
Page: 1 of 3

Certificate of Calibration

Equipment: Hot Air Oven
Manufacturer: Memmert
Model: UF 55
Serial No.: B212.0411
ID No.: UAE.WAO.005/2556
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location: Lab Floor 2
Received Order: 11 April 2023
Calibration Date: 11 - 12 April 2023
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %

Calibrated by: Krisda Malee

Approved by:
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date: 24 April 2023

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

A 0053359



Equipment: Hot Air Oven
Condition As-Received: Used Item
Reference: 2304-01560C-1
Procedure Used:-

Cert. No.: 23TM373
Page: 2 of 3

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

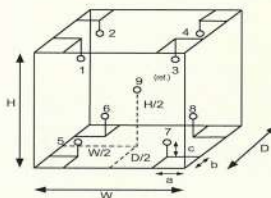
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration:- (°) Without Adjustment

Function of UUC*: Temperature Source

Fresh air setting: Close



Probe Installation Details:
a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
Dimension of Chamber:
D = 0.50 m
W = 0.80 m
H = 0.75 m
Capacity = 0.30 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	45	44
AC Supply (Volt)	221	220

Ref. Std. ID No.: @ Calibration Point		
Position:	(120 to 180) °C	(104) °C
1	18-20TC-01	20RTD-2/1
2	18-20TC-02	20RTD-2/2
3	18-20TC-03	20RTD-2/3
4	18-20TC-04	20RTD-2/4
5	18-20TC-05	20RTD-2/5
6	18-20TC-06	20RTD-2/6
7	18-20TC-07	20RTD-2/7
8	18-20TC-08	20RTD-2/8
9 (ref.)	18-20TC-09	20RTD-2/9

เอกสารไม่ควบคุม

a 1158261



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2304-0156OC-1
 Result of Calibration :- (°) Without Adjustment
 Function of UUC* : Temperature Source
 Fresh air setting : Close

Cert. No.: 23TM373
 Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor
104.0	104.0	104.0	0.054	0.59	0.95	2
120.0	120.0	120.0	0.12	0.89	1.5	2
180.0	180.0	180.0	0.12	1.5	2.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.512	104.016	104.542	104.407	103.704	103.729	104.167	104.158	104.001	0.42
120.0	120.317	119.768	120.524	120.232	119.363	119.209	119.888	119.797	119.735	1.1
180.0	180.878	179.819	181.357	180.871	179.303	179.139	180.230	180.055	179.960	1.1

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

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เอกสารไม่ควบคุม
 a 1158260



Certificate of Calibration

Equipment: Cooled Incubator
 Model: KB 400
 Serial No.(or ID): 20220000022479
 Manufacturer: Binder
 Condition: New
 Shelves(pc.): 5

Certificate No.: C31231678
 Issued Date: 10 August 2023
 Job No.: WO-00002652
 Page: 1 of 3
 Ventilation Valve: None

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

Environment Condition: Temperature: 25 °C ± 1.9 °C
 Humidity: 49 %RH ± 5.3 %RH
 Voltage: 232 VAC ± 1.2 VAC

Calibration Place: United Analyst and Engineering Consultant Company Limited. (Control Area)
 3 Soi Udomsuk 41 Sukhumvit Road,
 Bangkok, Prakanong, Bangkok 10260 Thailand.

Calibration By: Mr. Thanakrit Raksapol
 Calibration Date: 07 August 2023
 The Method used: In house method, CAL-WI-16, base on TLAS-G20
 Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
 Certificate No. C10230019

(Mr. Thanakrit Raksapol)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

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

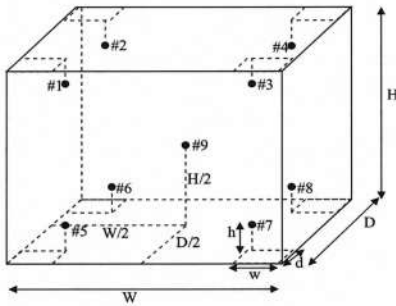
บริษัท เทคโนโลยี วิทยาศาสตร์ จำกัด
 DKSH Technology Limited
 2533 หมู่ 9 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
 Phone : +66 2639 7000 Email : info.calibration@dksh.com Website : www.dksh.com/scientific-thailand

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 CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31231678 Page: 2 of 3



Standard Installation Locations

Volume (Calibration Zone)= 193 (Liters)

Inside chamber: W = 65 (cm) D = 49 (cm) H = 127 (cm)
 Standard Locations (#1, #2, #3, #4): w = 7 (cm) d = 5 (cm) h = 15 (cm)
 Standard Locations (#5, #6, #7, #8): w = 7 (cm) d = 5 (cm) h = 15 (cm)
 #9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	301	302	303	304	305	306	307	308	309

Definitions

Indicating Temperature: The average reading of Indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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

บริษัท เทคโนโลยี วิทยาศาสตร์ จำกัด
 DKSH Technology Limited
 2533 หมู่ 9 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
 Phone : +66 2639 7000 Email : info.calibration@dksh.com Website : www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31231678 Page: 3 of 3

Calibration Results: Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 35.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	35.11	0.11	0.23
#2	35.04	0.04	0.23
#3	35.03	0.03	0.23
#4	35.13	0.13	0.23
#5	35.02	0.02	0.23
#6	35.07	0.07	0.23
#7	34.97	-0.03	0.23
#8	34.97	-0.03	0.23
#9	35.10	0.10	0.23

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
35.0	35.0	35.0	35.11	35.04	35.03	35.13	35.02	35.07	34.97	34.97	35.10	0.23

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
35.0	0.16	0.04	0.22

Note: * Maximum uncertainty of the each position

The End of Certificate

บริษัท เทคโนโลยี วิทยาศาสตร์ จำกัด
 DKSH Technology Limited
 2533 หมู่ 9 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
 Phone : +66 2639 7000 Email : info.calibration@dksh.com Website : www.dksh.com/scientific-thailand

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CAL-FM-C31-10: 12 Sep 2022



Cert.No.: 23CH420
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Honiba
Model : LAQUA-PH210
Serial No. : HA0E0009
ID No. : UAE.EFM.071/2564(EFM pH.04/64)
Condition As-Received: Used Item
Received Date : 28 March 2023
Calibration Date : 29-30 March 2023
Reference : 2303-1001WSC-3
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udumsuk 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 Lerngagtrakul

Approved by :

(/) Malee Butkruea
() Saitip Meangmai
() Warakorn Lerngagtrakul

Issue Date : 31 March 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	2211306	27 Oct 2023

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

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	863832	28 Dec 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter S/N.: HA0E0009	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.0	6.99	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

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Cert.No.: 23CH420
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: Q92M0159	4.008	4.01	183.1	0.0085	2.05
	6.987	6.99	9.5	0.011	2.00
	6.987	6.99	9.0	0.011	2.00
	10.010	10.01	-165.7	0.011	2.07

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q92M0159

Dimension of probe;

- Length : 107 mm

- Diameter : 16 mm

- Immersion Depth : 100 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	30.003	30.0	-0.003	0.13	2.00
35.0	35.001	35.0	-0.001	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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Cert. No.: 23TM764
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Mammert
Model : WNE 14
Serial No. : L421.0121
ID No. : UAE.MIC.015/2565
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udumsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 27 April 2023
Calibration Date : 27 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Preecha Hiahib
Approved by :
() Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai
Issue Date : 11 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-04610C-3
Cert. No.: 23TM764
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

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

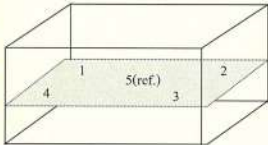
3. This certification is traceable to the International System of Unit.

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	23	69	220
Finished of Calibration	22	73	221



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005

เอกสารไม่คง



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2304-04610C-3
Cert. No.: 23TM764
Page : 3 of 3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
44.5	44.5	44.5	44.370	44.339	44.379	44.413	44.372	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.097	0.030	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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เอกสารไม่คง

เอกสารสอบเทียบเครื่องมือ

ประจำเดือนมีนาคม พ.ศ. 2567

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental, Inc.	05072022	5 Jul 22	4 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1401	9 May 23	8 May 24	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 159822	Innovative Instrument Co., Ltd.	23-AFM-203	27 Sep 23	26 Sep 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1856	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778109	UAE Consultant Co., Ltd.	21112023	21 Nov 23	20 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636463	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 1200906875	UAE Consultant Co., Ltd.	03112023	3 Nov 23	2 Nov 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co., Ltd.	09112023	9 Nov 23	8 Nov 24	-
11	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									
12	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 24	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48CTL-65506-348	UAE Consultant Co.,Ltd.	08122023	8 Dec 23	7 Dec 24	-
14	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NJ99E15A01D3	21 Jun 21	21 Jun 24	-
15	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 RATFJBXS	UAE Consultant Co.,Ltd.	21122023	21 Dec 23	20 Dec 24	-
16	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GY21PTED	UAE Consultant Co.,Ltd.	21122023	21 Dec 23	20 Dec 24	-
17	Standard Gas	Total Hydrocarbons	Air Liquide	CC143232	Air Liquide	E03AJ99E15A006C	16 Oct 20	16 Oct 28	-
18	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11356	Calibration Laboratory Co.Ltd	Q23117017	20 Oct 23	19 Oct 24	-
19	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73249	Innovative Instrument Co.,Ltd.	23-ACT-111	27 Jun 23	26 Jun 24	-
20	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} เสียงรบกวน	Larson Davis	LxT1 0007311	Larson Davis-A PCB Piezotronics Div.	2023003675	24 Mar 23	23 Mar 25	-
21	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} เสียงรบกวน	Larson Davis	LxT1 0007312	Larson Davis-A PCB Piezotronics Div.	2023003676	24 Mar 23	23 Mar 25	-

Certificate of Calibration

Calibration Certification Information				
Cal. Date:	July 5, 2022	Roots meter S/N:	438320	Ta: 297 °K
Operator:	Jim Tisch	Pa:	750.1	mm Hg
Calibration Model #:	G25A	Calibrator S/N:	1901	

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3540	3.3	2.00
2	3	4	1	0.9650	6.4	4.00
3	5	6	1	0.8640	8.0	5.00
4	7	8	1	0.8200	8.9	5.50
5	9	10	1	0.6780	12.9	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9859	0.7281	1.4073	0.9956	0.7353	0.8899
0.9818	1.0174	1.9902	0.9915	1.0274	1.2585
0.9797	1.1339	2.2251	0.9893	1.1451	1.4071
0.9785	1.1933	2.3337	0.9881	1.2050	1.4757
0.9732	1.4354	2.8146	0.9828	1.4496	1.7798
QSTD		m= 1.98897	QA		m= 1.24546
		b= -0.03691			b= -0.02334
		r= 0.99996			r= 0.99996

Calculations			
Vstd=	$\Delta Vol / ((Pa \cdot \Delta P) / (Pstd \cdot Ta))$	Va=	$\Delta Vol / ((Pa \cdot \Delta P) / Pa)$
Qstd=	Vstd/ΔTime	Qa=	Va/ΔTime
For subsequent flow rate calculations:			
Qstd=	$1/m \left(\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)} - b \right)$	Qa=	$1/m \left(\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)} - b \right)$

Standard Conditions	
Tstd:	298.15 °K
Pstd:	760 mm Hg
Key	
ΔH:	calibrator manometer reading (in H2O)
ΔP:	rootsmeter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

RECALIBRATION	
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30	

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

www.tisch-env.com
TOLL FREE: (877)263-7610
7-9009

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3080-24 FAX: 0-2719-9484

Certificate of Calibration

Certificate No.: 23P1401
Page: 1 of 2

Equipment: U-Tube Manometer
Manufacturer: Dwyer
Model: 1221-36-W/M
Serial No.: -
ID No.: UAE-EFM.022/2560

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 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
81 Soi Udomsak 41, Sukhumvit Road, Bangkok, 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 and oil 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 Aussaroon
Issue Date: 11 May 2023

Approved Signatory: [Signature]
[Signature]
[Signature]
[Signature]

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B 0314241

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7109 MID 17, 18B SUWANNAPHUM 11 TAMBON BANG KAELE,
AMPHOE BANG PHU SANG 1 PRAKARN PROVINCE 10540 THAI AND
TEL: 0669-2110-5969-1 FAX: 0669-2110-7140



Certificate of Calibration

Customer: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Certificate No.: 23-AFM-203
Request No.: Req-2023-1919

Unit Under Calibration Details

Measurement Item: Air Flow Meter
Manufacturer: BGI
Model: Delta Cal DC1
Serial Number: 159022
ID: UAE-EFM.039/2561

Sensor Model: -
Sensor Serial Number: -

Location of Calibration: LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature: 23 °C ± 3 °C
Humidity: 55 %RH ± 20 %RH
Barometric Pressure: 1013 kPa ± 10 hPa
Received Date: 7 September 2023
Calibration Date: 27 September 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	Sensodyne	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensodyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU1651882	TPA	7 November 2023

Traceability:

This Certificate is traceable to SI Unit through Sensodyne A21A 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: [Signature]
Service Calibration Engineer

Approved By: [Signature]
Calibration Engineer Supervisor
Issue Date: 27 September 2023

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a 1160340

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FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-APM-203
Request No : Req-2023-1919

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.90	100.64	14.58	14.50	-0.08	0.20
24.90	100.64	15.06	15.00	-0.06	0.21
25.00	100.63	15.90	15.80	-0.10	0.22
24.90	100.63	16.78	16.67	-0.11	0.23
24.90	100.63	18.46	18.30	-0.16	0.26

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

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

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

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
FM-708-APM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

Certificate No : 23-TPM-461
Request No : Req-2023-1919
Customer : UNITED ANALYST AND ENGINEERING
Name : CONSULTANT CO., LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Page : 1/2

Unit Under Calibration Details


Calibration Parameter : Temperature
Instrument Name : Air Flow meter Range Calibration : 20 °C to 50 °C
Manufacturer : BGI Type of Sensor : RTD
Model : Delta Cal DC1 Sensor Diameter (mm) : 3
Serial Number : 159822 Calibration Position (mm) : 45
Resolution : 0.1 °C Instrument Status : Used
ID Number : UAE.EFM.039/2561

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 September 2023
Calibrated Date : 27 September 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.
Reference Standard : Digital Thermometer with Sensor, 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 : 
Mr. Noppadon Luangart
Technical Manager
Issue Date : 27 September 2023


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

Calibration Note
UUC Adjustment : Not Adjust
Certificate No : 23-TPM-461
Request No : Req-2023-1919
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
Tx	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.1	-0.1	0.13
	40.040	40.0	0.0	0.13
	45.039	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
TT	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.2	-0.2	0.13
	40.040	40.2	-0.2	0.13
	45.039	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13

End of Certificate

Calibrated By : 
Mr. Saichok Inpakornsuat

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
FM-708-TPM-01 Rev.01 Issue date 15/03/20



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3. EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No. : 23P1856
Page : 1 of 2


Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE.EMA2.110/2555
Condition As-Received: Used Item
Received Date : 26 May 2023
Calibration Date : 02 June 2023
Reference : 2305-0919WSC
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Atmospheric Pressure : 1006 mbar
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260.

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

Condition of this result of calibration

1. Reference standards instruments :
- | Instrument | Model | Serial No. | Certificate No. | Due Date |
|-----------------------|--------|------------|-----------------|-------------|
| 1) Standard Barometer | 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 : 
[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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B 0316956



Cert.No.: 23P1856
Page: 2 of 2

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

Range: 720 mmHg to 800 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	720.43	730.67	740.34	751.52	758.56	761.83	773.53	788.76
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	755.0	760.0	770.0	790.0
Error (mmHg)	-0.43	-0.67	-0.34	-1.52	-1.56	-1.83	-3.53	-8.76

Decreasing Pressure

Applied Pressure (mmHg)	788.76	773.50	761.89	756.65	751.59	740.72	730.68	720.59
UUC* Indication (mmHg)	790.0	770.0	760.0	755.0	750.0	740.0	730.0	720.0
Error (mmHg)	-8.76	-3.50	-1.89	-1.65	-1.59	-0.72	-0.68	-0.59

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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a 1165502



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10258
TEL. 0-2717-3000-34 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023
to 06 June 2023

Reference: 2905-0919WSC

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-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	23105	15 Mar 2024

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

3. This Certificate is traceable to the International System of Unit 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:

✓ Chakrit Waeewanjua
| Ponthippa Tameyakul
| Viporn Tantiyawutti

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Cert. No.: 23H1200
Page: 2 of 2

Result of Calibration:- Before Adjustment
Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (\pm %R.H.)
25.0	40.1	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:- After Adjustment
Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (\pm %R.H.)
25.0	40.1	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:- Without Adjustment
Function: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (\pm °C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

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

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a 1165295



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.uaconsultant.com E-mail: uae@uaconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: Nov 21, 2023

Equipment: Gas Analyzer (NO₂) Model: 42i
Manufacturer: Thermo Scientific Serial Number: 1201778109

Standard Gas Concentration

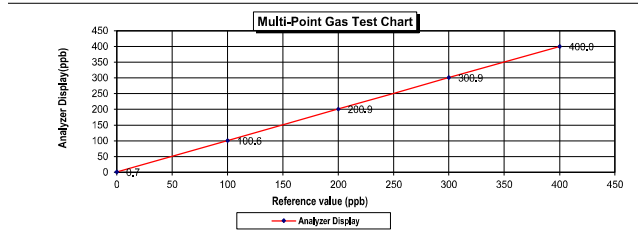
Gas	Concentration (ppm)	Manufacturer
Sulphur Dioxide (SO ₂)	44.68	Thermo Scientific
Nitric Oxide (NO)	45.94	146i
Methane (CH ₄)	-	1180540071
Carbon Monoxide (CO)	984.8	
Cylinder No.:	EB0143262	
Expiration Date:	Jun 21, 2024	

Dilutor Detail

Manufacturer	Thermo Scientific
Model	146i
Serial Number	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.70	0.70	0.70
Level 2	20.00%	100.6	0.60	0.60	0.60
Level 3	40.00%	200.9	0.90	0.45	0.45
Level 4	60.00%	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark	Measuring Range	500.0 ppb	Average Difference (%)	0.41	
	Acceptable Limit \pm 5%				



Calculated by:

21 / Nov / 2023

Checked by:

22 / Nov / 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

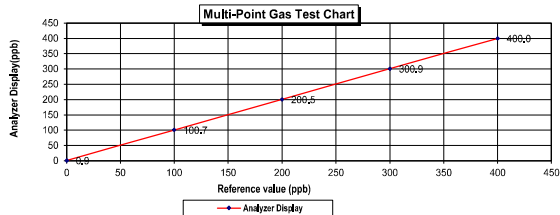
Test Date : Nov 1, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1200636463

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
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)		0.43



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01 Nov 2023

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 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,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 500/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

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

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D889025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMSI	401423836102	CC505981	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



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MULTI-POINT GAS TEST REPORT

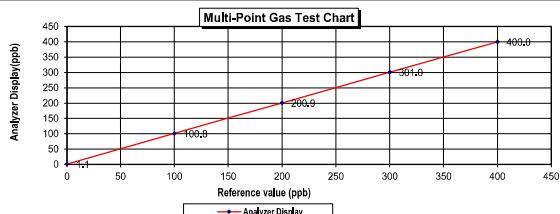
Test Date : Nov 3, 2023

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

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM	Model :	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	1.1	1.10	1.10
Level 2	20.00%	100.0	100.8	0.80	0.79
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	301.0	1.00	0.33
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)		0.53



Calculate by
03 Nov 2023

MULTI-POINT GAS TEST REPORT

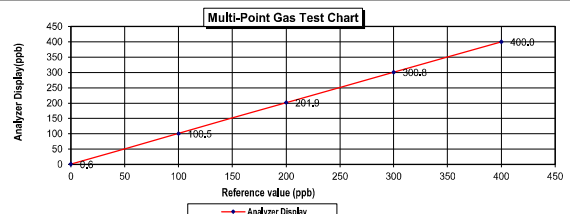
Test Date : Nov 9, 2023

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

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM	Model :	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	0.6	0.60	0.60
Level 2	20.00%	100.0	100.5	0.50	0.50
Level 3	40.00%	200.0	201.9	1.90	0.94
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)		0.46



Calculate by
9 Nov 2023

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 molar basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



เอกสารไม่ควบคุม

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

Approved for Release

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

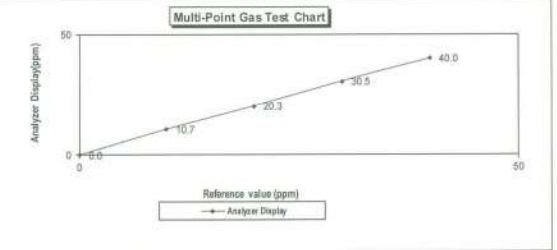
Equipment : Gas Analyzer (CO) Model : APMA-370
Manufacturer : HORIBA Serial Number : YRLHTB7G

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

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.3	0.3	1.5
Level 4	60.00%	30.0	30.5	0.5	1.6
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm				
Average Difference (%)				1.93	

Acceptable Limit $\pm 5\%$



Calculate by

8 / 02 / 23

8 / Feb 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

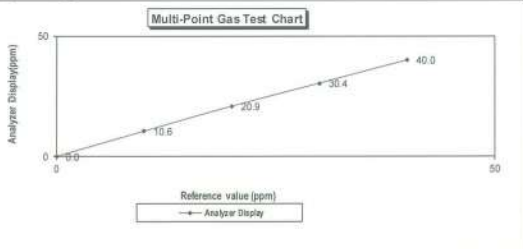
Equipment : Gas Analyzer (CO) Model : 48C
Manufacturer : Thermo Environmental Instruments Serial Number : 48C-65506-348

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

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.6	0.6	5.7
Level 3	40.00%	20.0	20.9	0.9	4.3
Level 4	60.00%	30.0	30.4	0.4	1.3
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm				
Average Difference (%)				2.26	

Acceptable Limit $\pm 5\%$



8 / 02 / 23

8 / Feb 2023

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 molar basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals).

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12388	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : RATFJBXS

Standard Gas Concentration

Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

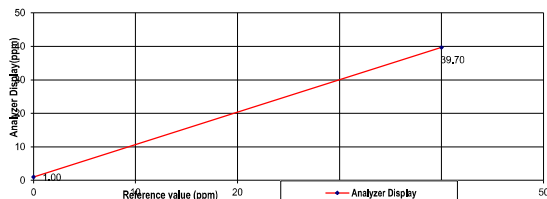
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	1.00	1.00	1.00
Level 2	80.00%	40.00	39.70	-0.30	-0.76
Remark : Measuring Range	50.00 ppm		Average Difference (%)		0.88

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



...21.../...12.../...2023

...22.../...Dec.../...2023..

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : GY21PTED

Standard Gas Concentration

Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

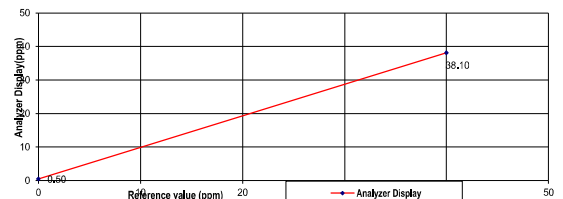
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.50	0.50	0.50	0.50
Level 2	80.00%	40.00	38.10	-1.90	-4.99
Remark : Measuring Range	50.00 ppm		Average Difference (%)		2.74

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



...21.../...12.../...2023..

...22.../...Dec.../...2023..

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03AI99E15A006C Reference Number: 160-401908379-1
Cylinder Number: CC143232 Cylinder Volume: 144.0 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2018 PSIG
PGVP Number: A12020 Valve Outlet: 590
Gas Code: CH4,PPN,BALA Certification Date: Oct 16, 2020

Expiration Date: Oct 16, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 803R-12/531, 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 mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig. Use 0.7 mmpg/psig

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
METHANE	4000 PPM	4019 PPM	G1	+/- 1.0% NIST Traceable	10/16/2020
PROPANE	4000 PPM	4008 PPM	G1	+/- 0.7% NIST Traceable	10/09/2020
AIR	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	02010405	K010090	4976 PPM PROPANE/NITROGEN	+/- 0.6%	Dec 02, 2021
NTRM	170608	CC160290	0.967 % METHANE/NITROGEN	+/- 0.4%	Aug 22, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTR - CH4 - 000928781	FTR	Oct 14, 2020
Nicolet 6700 APW1100391 C3H8	FTR	Sep 16, 2020

Triad Data Available Upon Request

NOTES: NET WEIGHTS: 4.865kg
GROSS WEIGHTS: 27.385kg
PO#: 5220003825



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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UMI11356/UM11356
CLID. NO. : 251701398
JOB CONTROL NO. : 231019117017

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 19 October 2023

DATE OF ISSUED : 25 October 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
25 October 2023

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23117017
F3-011-04/01-12

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REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UMI1356/UMI1356
DATE OF CALIBRATION : 20 October 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.
The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Vibration Calibrator Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
3. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-23, Due Date 26 June 2024.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23117017

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CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	$\pm (\% \text{ of rdg. })$
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	0.000	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.061	-0.001	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23117017

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	$\pm (\% \text{ of rdg. })$
0.3	50 Hz	peak	0.300	0.305	-0.005	1.9
0.4	50 Hz		0.400	0.406	-0.006	1.9
0.5	50 Hz		0.500	0.507	-0.007	1.9
0.6	50 Hz		0.600	0.608	-0.008	1.9
0.7	50 Hz		0.700	0.709	-0.009	1.9
0.3	100 Hz	peak	0.300	0.306	-0.006	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.507	-0.007	1.9
0.6	100 Hz		0.600	0.608	-0.008	1.9
0.7	100 Hz		0.700	0.710	-0.010	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	$\pm (\% \text{ of rdg. })$
3	50 Hz	peak	3.000	3.048	-0.048	1.9
4	50 Hz		4.000	4.059	-0.059	1.9
5	50 Hz		5.000	5.067	-0.067	1.9
6	50 Hz		6.000	6.072	-0.072	1.9
7	50 Hz		7.000	7.091	-0.091	1.9
3	100 Hz	peak	3.000	3.049	-0.049	1.9
4	100 Hz		4.000	4.051	-0.051	1.9
5	100 Hz		5.000	5.069	-0.069	1.9
6	100 Hz		6.000	6.082	-0.082	1.9
7	100 Hz		7.000	7.098	-0.098	1.9

Certificate No. Q23117017

F3-011-04/01-12

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MED U.S. SOI SUTINAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKARN PROVINCE 10940 THAILAND
TEL: 0668-2116-3900-1 FAX: 0668-2116-7140



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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-111
Request No : Req-2023-1408

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35A
Serial Number : 73249
ID : UAE.EPM.105/2561

Class : 1
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : $(23 \pm 2 ^\circ\text{C})$
Humidity : $(50 \pm 20 \% \text{RH})$
Barometric Pressure : $(1013 \pm 10.0 \text{ hPa })$
Received Date : 26 June 2023
Calibration Date : 27 June 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 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 :
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 27 June 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.

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Certificate No : 23-ACT-111

Request No : Req-2023-1408

Calibration Results : Without Adjustment

Sound pressure level

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.84	-0.16	-	-	0.14	0.25
114 dB / 1000 Hz	113.79	-0.21	-	-	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 (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.17	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.04	-	-	-	0.40	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

End of Calibration

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

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Calibration Certificate

Certificate Number 2023003675

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT1

Serial Number

0007311

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number

D0001.8384-

Technician

Jacob Cannon

Calibration Date

24 Mar 2023

Calibration Due

Temperature

23.56 °C ± 0.25 °C

Humidity

49.9 %RH ± 2.0 %RH

Static Pressure

85.69 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis CAL291, S/N 0108
Larson Davis CAL200, S/N 9079
PCB 377B02, S/N 345817
Larson Davis PRMLxT1, S/N 077846

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61260:2001 Class 1
IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.11 (R2009) Class 1
ANSI S1.25 (R2007)
ANSI S1.43 (P2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-03-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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D0001.8406 Rev G

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Certificate Number 2023003675

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014 Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1.

Description	Standards Used		
	Cal Date	Cal Doc	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007025
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.73	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.23	Pass
1000	0.15	0.00	-0.70	0.70	0.23	Pass
8000	-3.69	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

— End of Report—

Signature

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Calibration Certificate

Certificate Number 2023003651

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT1

Serial Number 0007311

Test Results Pass

Initial Condition As Manufactured

Description
SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378

Technician Jacob Cannon

Calibration Date 23 Mar 2023

Calibration Due

Temperature 23.6 °C ± 0.25 °C

Humidity 50.3 %RH ± 2.0 %RH

Static Pressure 86.08 kPa ± 0.13 kPa

Evaluation Method
Tested electrically using Larson Davis PRMLxT1 S/N 077646 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards
Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61252:2002
IEC 61672:2013 Class 1
IEC 61260:2001 Class 1

ANSI S1.4-2014 Class 1
ANSI S1.4 (R2006) Type 1
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 1
ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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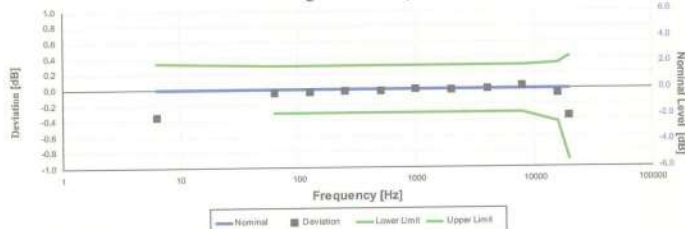
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Certificate Number 2023003651

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 6.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4:1993 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.36	-0.35	-1.11	0.33	0.15	Pass
63.10	-0.05	-0.05	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	-0.01	-0.30	0.30	0.15	Pass
1,995.26	-0.02	0.00	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.26	0.04	-0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.52	-0.35	-0.35	-0.91	0.41	0.15	Pass

– End of measurement results –

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Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-T1 Temperature Probe	2021-06-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-03-30	2023-03-30	007174

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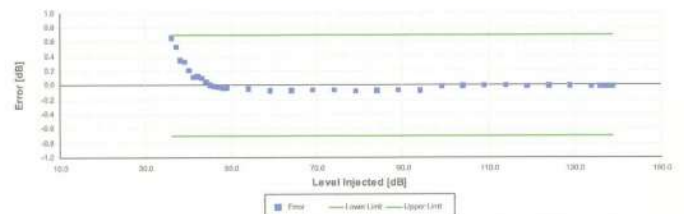
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Certificate Number 2023003651

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.66	-0.70	0.70	0.16	Pass
37.00	0.53	-0.70	0.70	0.16	Pass
38.00	0.35	-0.70	0.70	0.16	Pass
39.00	0.32	-0.70	0.70	0.16	Pass
40.00	0.21	-0.70	0.70	0.16	Pass
41.00	0.12	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.10	-0.70	0.70	0.17	Pass
44.00	0.05	-0.70	0.70	0.17	Pass
45.00	0.00	-0.70	0.70	0.16	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	-0.03	-0.70	0.70	0.16	Pass
48.00	-0.04	-0.70	0.70	0.16	Pass
49.00	-0.04	-0.70	0.70	0.16	Pass
50.00	-0.05	-0.70	0.70	0.16	Pass
51.00	-0.07	-0.70	0.70	0.16	Pass
52.00	-0.07	-0.70	0.70	0.16	Pass
53.00	-0.07	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
55.00	-0.07	-0.70	0.70	0.16	Pass
56.00	-0.07	-0.70	0.70	0.16	Pass
57.00	-0.07	-0.70	0.70	0.16	Pass
58.00	-0.07	-0.70	0.70	0.16	Pass
59.00	-0.07	-0.70	0.70	0.16	Pass
60.00	-0.07	-0.70	0.70	0.16	Pass
61.00	-0.07	-0.70	0.70	0.16	Pass
62.00	-0.07	-0.70	0.70	0.16	Pass
63.00	-0.07	-0.70	0.70	0.16	Pass
64.00	-0.07	-0.70	0.70	0.16	Pass
65.00	-0.07	-0.70	0.70	0.16	Pass
66.00	-0.07	-0.70	0.70	0.16	Pass
67.00	-0.07	-0.70	0.70	0.16	Pass
68.00	-0.07	-0.70	0.70	0.16	Pass
69.00	-0.07	-0.70	0.70	0.16	Pass
70.00	-0.07	-0.70	0.70	0.16	Pass
71.00	-0.07	-0.70	0.70	0.16	Pass
72.00	-0.07	-0.70	0.70	0.16	Pass
73.00	-0.07	-0.70	0.70	0.16	Pass
74.00	-0.07	-0.70	0.70	0.16	Pass
75.00	-0.07	-0.70	0.70	0.16	Pass
76.00	-0.07	-0.70	0.70	0.16	Pass
77.00	-0.07	-0.70	0.70	0.16	Pass
78.00	-0.07	-0.70	0.70	0.16	Pass
79.00	-0.07	-0.70	0.70	0.16	Pass
80.00	-0.07	-0.70	0.70	0.16	Pass
81.00	-0.07	-0.70	0.70	0.16	Pass
82.00	-0.07	-0.70	0.70	0.16	Pass
83.00	-0.07	-0.70	0.70	0.16	Pass
84.00	-0.07	-0.70	0.70	0.16	Pass
85.00	-0.07	-0.70	0.70	0.16	Pass
86.00	-0.07	-0.70	0.70	0.16	Pass
87.00	-0.07	-0.70	0.70	0.16	Pass
88.00	-0.07	-0.70	0.70	0.16	Pass
89.00	-0.07	-0.70	0.70	0.16	Pass
90.00	-0.07	-0.70	0.70	0.16	Pass
91.00	-0.07	-0.70	0.70	0.16	Pass
92.00	-0.07	-0.70	0.70	0.16	Pass
93.00	-0.07	-0.70	0.70	0.16	Pass
94.00	-0.07	-0.70	0.70	0.16	Pass
95.00	-0.07	-0.70	0.70	0.16	Pass
96.00	-0.07	-0.70	0.70	0.16	Pass
97.00	-0.07	-0.70	0.70	0.16	Pass
98.00	-0.07	-0.70	0.70	0.16	Pass
99.00	-0.07	-0.70	0.70	0.16	Pass
100.00	-0.07	-0.70	0.70	0.16	Pass
101.00	-0.07	-0.70	0.70	0.16	Pass
102.00	-0.07	-0.70	0.70	0.16	Pass
103.00	-0.07	-0.70	0.70	0.16	Pass
104.00	-0.07	-0.70	0.70	0.16	Pass
105.00	-0.07	-0.70	0.70	0.16	Pass
106.00	-0.07	-0.70	0.70	0.16	Pass
107.00	-0.07	-0.70	0.70	0.16	Pass
108.00	-0.07	-0.70	0.70	0.16	Pass
109.00	-0.07	-0.70	0.70	0.16	Pass
110.00	-0.07	-0.70	0.70	0.16	Pass
111.00	-0.07	-0.70	0.70	0.16	Pass
112.00	-0.07	-0.70	0.70	0.16	Pass
113.00	-0.07	-0.70	0.70	0.16	Pass
114.00	-0.07	-0.70	0.70	0.16	Pass
115.00	-0.07	-0.70	0.70	0.16	Pass
116.00	-0.07	-0.70	0.70	0.16	Pass
117.00	-0.07	-0.70	0.70	0.16	Pass
118.00	-0.07	-0.70	0.70	0.16	Pass
119.00	-0.07	-0.70	0.70	0.16	Pass
120.00	-0.07	-0.70	0.70	0.16	Pass
121.00	-0.07	-0.70	0.70	0.16	Pass
122.00	-0.07	-0.70	0.70	0.16	Pass
123.00	-0.07	-0.70	0.70	0.16	Pass
124.00	-0.07	-0.70	0.70	0.16	Pass
125.00	-0.07	-0.70	0.70	0.16	Pass
126.00	-0.07	-0.70	0.70	0.16	Pass
127.00	-0.07	-0.70	0.70	0.16	Pass
128.00	-0.07	-0.70	0.70	0.16	Pass
129.00	-0.07	-0.70	0.70	0.16	Pass
130.00	-0.07	-0.70	0.70	0.16	Pass

– End of measurement results –

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Peak Rise Time

Peak rise time performed according to IEC 60851:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.26	133.80	0.15	Pass
		Positive Pulse	135.25	133.80	0.15	Pass
		Negative Pulse	134.32	133.80	0.15	Pass
126.85	30	Negative Pulse	134.32	133.80	0.15	Pass
		Positive Pulse	134.32	133.80	0.15	Pass
		Negative Pulse	134.32	133.80	0.15	Pass

— End of measurement results—

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.16 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.26	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	0.01	± 1.50	0.15 ±	Pass

— End of measurement results—

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60851:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.10	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.25	± 1.50	0.15 ±	Pass
106.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	0.01	± 1.50	0.15 ±	Pass

— End of measurement results—

Gain

Gain measured according to IEC 61672-3:2013 17.3 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.14	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

— End of measurement results—

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.01	36.00	Pass
C-weight Noise Floor	27.02	35.00	Pass
Z-weight Noise Floor	33.41	39.00	Pass

— End of measurement results—

Total Harmonic Distortion

Measured using 1/3-Octave filters

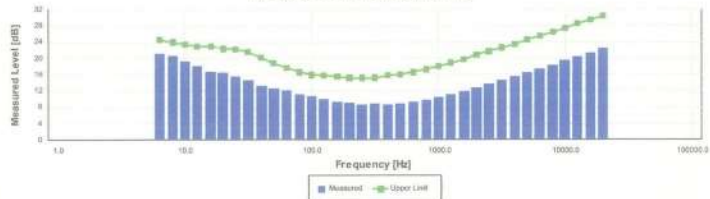
Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.84	135.05	136.65	0.15	Pass
THD	-67.26	-58.00	-56.00	0.01 ±	Pass
THD+N	-63.27	-56.00	-56.00	0.01 ±	Pass

— End of measurement results—

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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	21.01	24.60	Pass
8.00	20.60	24.00	Pass
10.00	19.19	23.50	Pass
12.50	18.13	23.00	Pass
16.00	16.66	22.50	Pass
20.00	16.47	22.40	Pass
25.00	15.54	22.30	Pass
31.50	14.59	21.50	Pass
40.00	13.14	20.20	Pass
50.00	12.53	18.80	Pass
63.00	12.05	17.60	Pass
80.00	11.24	16.60	Pass
100.00	10.61	15.90	Pass
125.00	10.01	15.70	Pass
160.00	9.34	15.50	Pass
200.00	9.01	15.20	Pass
250.00	8.52	15.20	Pass
315.00	8.71	15.20	Pass
400.00	8.61	15.70	Pass
500.00	8.80	16.00	Pass
630.00	9.26	16.60	Pass
800.00	9.76	17.30	Pass
1,000.00	10.40	18.10	Pass
1,250.00	11.15	18.90	Pass
1,600.00	11.94	19.80	Pass
2,000.00	12.75	20.80	Pass
2,500.00	13.68	21.70	Pass
3,150.00	14.64	22.60	Pass
4,000.00	15.55	23.50	Pass
5,000.00	16.47	24.50	Pass
6,300.00	17.47	25.50	Pass
8,000.00	18.44	26.50	Pass
10,000.00	19.44	27.40	Pass
12,500.00	20.45	28.50	Pass
16,000.00	21.42	29.50	Pass
20,000.00	22.41	30.40	Pass

— End of measurement results—

— End of Report—

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Calibration Certificate

Certificate Number 2023003676

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonnuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8384
Serial Number	0007312	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	24 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1	Temperature	23.58 °C ± 0.25 °C
	Class 1 Sound Level Meter	Humidity	49.3 %RH ± 2.0 %RH
	Firmware Revision: 2.404	Static Pressure	85.71 kPa ± 0.13 kPa

Evaluation Method	Tested with:	Data reported in dB re 20 µPa.
	Larson Davis CAL200, S/N 9079	
	PCB 377B02, S/N 345618	
	Larson Davis PRMLxT1, S/N 077647	
	Larson Davis CAL291, S/N 0106	

Compliance Standards	Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:		
	IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1	
	IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1	
	IEC 61252:2002	ANSI S1.11 (R2009) Class 1	
	IEC 61260:2001 Class 1	ANSI S1.25 (R2007)	
	IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1	

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

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Certificate Number 2023003676

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-08 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-11 Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 Inch Polarized Pressure Microphone	2023-04-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2023-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.85	-52.44	-48.33	0.14	Pass

– End of measurement results–

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.20	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.72	-3.00	-5.50	-1.50	0.32	Pass

– End of measurement results–

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Certificate Number 2023003676

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.51

– End of measurement results–

– End of Report–

Signature:

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Calibration Certificate

Certificate Number 2023003652

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonnuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8378
Serial Number	0007312	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	23 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 1	Temperature	23.62 °C ± 0.25 °C
	Class 1 Sound Level Meter	Humidity	49.5 %RH ± 2.0 %RH
	Firmware Revision: 2.404	Static Pressure	86.98 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 S/N 077647 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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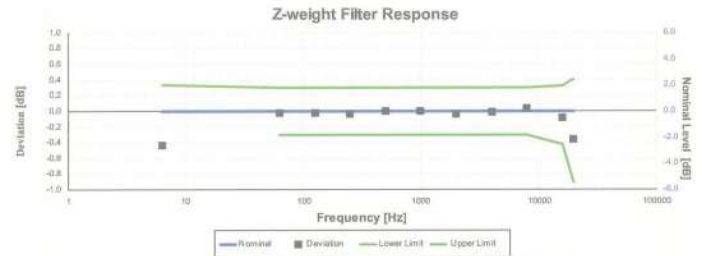
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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-25	806798
SRS DS360 Ultra Low Distortion Generator	2022-05-04	2023-05-04	807117

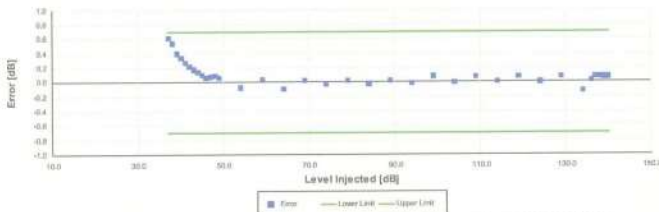


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4-1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.44	-0.44	-1.11	0.33	0.15	Pass
63.10	-0.03	-0.03	-0.30	0.30	0.15	Pass
125.89	-0.03	-0.03	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.01	-0.01	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass
— End of measurement results—						

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

A-weighted Broadband Log Linearity: 8,000.00 Hz

Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6; IEC 60804:2000 6.2; IEC 61252:2002 8; ANSI S1.4 (R2006) 6.9; ANSI S1.4-2014 Part 1: 5.6; ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
37.00	0.61	-0.70	0.70	0.16	Pass
38.00	0.54	-0.70	0.70	0.16	Pass
39.00	0.40	-0.70	0.70	0.16	Pass
40.00	0.33	-0.70	0.70	0.16	Pass
41.00	0.27	-0.70	0.70	0.16	Pass
42.00	0.22	-0.70	0.70	0.16	Pass
43.00	0.18	-0.70	0.70	0.17	Pass
44.00	0.15	-0.70	0.70	0.17	Pass
45.00	0.10	-0.70	0.70	0.16	Pass
46.00	0.07	-0.70	0.70	0.16	Pass
47.00	0.07	-0.70	0.70	0.16	Pass
48.00	0.09	-0.70	0.70	0.16	Pass
49.00	0.06	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
59.00	0.03	-0.70	0.70	0.16	Pass
64.00	-0.09	-0.70	0.70	0.16	Pass
69.00	0.03	-0.70	0.70	0.16	Pass
74.00	-0.03	-0.70	0.70	0.16	Pass
79.00	0.02	-0.70	0.70	0.16	Pass
84.00	-0.02	-0.70	0.70	0.16	Pass
89.00	0.03	-0.70	0.70	0.16	Pass
94.00	-0.02	-0.70	0.70	0.16	Pass
99.00	0.08	-0.70	0.70	0.15	Pass
104.00	0.00	-0.70	0.70	0.15	Pass
109.00	0.08	-0.70	0.70	0.15	Pass
114.00	0.01	-0.70	0.70	0.15	Pass
119.00	0.07	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.08	-0.70	0.70	0.15	Pass
134.00	-0.12	-0.70	0.70	0.15	Pass
136.00	0.02	-0.70	0.70	0.15	Pass
137.00	0.07	-0.70	0.70	0.15	Pass
138.00	0.07	-0.70	0.70	0.15	Pass
139.00	0.07	-0.70	0.70	0.15	Pass
140.00	0.07	-0.70	0.70	0.15	Pass
— End of measurement results—					

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Table 1: Test results according to EN 60747-17-1 and EN 60747-17-2 (Pass/Fail)							
Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	134.73	133.30	135.30	0.15	Pass
		Positive Pulse	134.72	133.28	135.28	0.15	Pass
	30	Negative Pulse	133.79	133.30	135.30	0.15	Pass
		Positive Pulse	133.78	133.28	135.28	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.07	± 1.00	0.16 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.16	± 0.50	0.15 ±	Pass
	5	-0.05	± 1.00	0.15 ±	Pass
	10	-0.24	± 1.50	0.15 ±	Pass
106.85	3	-0.19	± 0.50	0.15 ±	Pass
	5	-0.09	± 1.00	0.15 ±	Pass
	10	-0.30	± 1.50	0.15 ±	Pass
— End of measurement results—					

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
126.85	3	-0.11	± 0.50	0.15 ±	Pass
	5	-0.08	± 1.00	0.15 ±	Pass
	10	OVLD	± 1.50	0.15 ±	Pass
116.85	3	-0.10	± 0.50	0.15 ±	Pass
	5	-0.06	± 1.00	0.15 ±	Pass
	10	-0.23	± 1.50	0.15 ±	Pass
106.85	3	-0.18	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.28	± 1.50	0.15 ±	Pass
— End of measurement results—					

เอกสารไม่ควบคุม

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.92	93.86	94.06	0.15	Pass
0 dB Gain, Linearity	41.16	40.26	41.66	0.16	Pass
OBA Low Range	93.97	93.86	94.06	0.15	Pass
OBA Normal Range	93.96	93.20	94.80	0.15	Pass

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.86	36.00	Pass
C-weight Noise Floor	26.56	36.00	Pass
Z-weight Noise Floor	32.28	38.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.35	135.05	136.65	0.15	Pass
THD	-64.53	-58.00	-58.00	0.01 %	Pass
THD+N	-61.30	-58.00	-58.00	0.01 %	Pass

-- End of measurement results--

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1/3-Octave Self-Generated Noise



The SLIM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.36	24.60	Pass
8.00	18.96	24.00	Pass
10.00	17.32	23.50	Pass
12.50	16.60	23.00	Pass
16.00	15.47	22.90	Pass
20.00	14.87	22.40	Pass
25.00	13.12	22.30	Pass
31.50	12.38	21.50	Pass
40.00	11.67	20.20	Pass
50.00	10.95	18.80	Pass
63.00	10.08	17.60	Pass
80.00	9.46	16.60	Pass
100.00	8.73	15.90	Pass
125.00	8.30	15.70	Pass
160.00	7.83	15.50	Pass
200.00	7.53	15.20	Pass
250.00	7.40	15.20	Pass
315.00	7.44	15.20	Pass
400.00	7.80	15.70	Pass
500.00	8.11	16.00	Pass
630.00	8.69	16.60	Pass
800.00	9.34	17.30	Pass
1,000.00	10.05	18.10	Pass
1,250.00	10.74	18.90	Pass
1,600.00	11.61	19.60	Pass
2,000.00	12.58	20.90	Pass
2,500.00	13.49	21.70	Pass
3,150.00	14.42	22.60	Pass
4,000.00	15.39	23.50	Pass
5,000.00	16.38	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.33	26.50	Pass
10,000.00	19.35	27.40	Pass
12,500.00	20.35	28.50	Pass
16,000.00	21.34	29.50	Pass
20,000.00	22.35	30.40	Pass

-- End of measurement results--

เอกสารไม่ควบคุม

-- End of Report--

Signature

เอกสารไม่ควบคุม

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	National Food Institute,Ministry of Industry, Thailand	2303074-001-01	27 May 23	25 May 24
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	25 Apr 24
3	Analytical Balance	SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	Technology Promotion Association (Thailand-Japan)	23MM112	26 Apr 23	25 Apr 24
4	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
5	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	23TM726	26 Apr 23	25 Apr 24
6	Kjelttec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	9810	8 Feb 24	7 Feb 25
7	Kjelttec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjelttec 8100 / 91889052	FOSS South East Asia	8411	29 May 23	28 May 24
8	pH Meter	pH	Horiba	LAQUA-PH210 / HA0E0009	technology promotion association (thailand-japan	23CH420	29 Mar 23	28 Mar 24

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

Calibration Certificate

Certificate No.: 2303074-001-01
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:	Electronic Balance
Manufacturer:	METTLER TOLEDO
Model:	AB204-S/FACT
Serial No.:	1129361010
ID No.:	UAE.WAS.002/2552
Order No.:	2303074
Operation No.:	2303074-001
Date of Receipt:	26 May 2023
Date of Calibration:	26 May 2023

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by [Redacted]
(Miss Pheraphat Tuanjit, Scientist)

Date of Issue: 29 May 2023

Vice President, Department of Laboratory Services
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: 20-04-55

2008 182 ถนนสุขุมวิท 35 แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10710
2008 Soi 35, Aun Arun Road Bang Yi Khan Subdist. Bang Phli Dist. Bangkok 10700, Thailand
Tel: +66(0) 2422 8658 Fax: +66(0) 2422 8658

Calibration Report

Certificate No.:	2303074-001-01	
Equipment:	Electronic Balance	Manufacturer: METTLER TOLEDO
	Model: AB204-S/FACT	Resolution: 0.0001 g
	Serial No.: 1129361010	ID No.: UAE.WAS.002/2552
	Capacity: 220 g	

Page 2 of 3

Date of Calibration: 26 May 2023

Environment Condition: Ambient Temperature: 23.7 \pm 0.1 $^{\circ}$ C Relative Humidity: 61 \pm 2.2 %

Place of Calibration: Room 108 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

<u>Reference Standard</u>	<u>Model</u>	<u>Serial No.</u>	<u>Calibrated By</u>	<u>Certificate No.</u>	<u>Due Date</u>
Standard Weight Class E2	1mg to 200g	8505567572	TC5	MC23040535	8 Aug 2024

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Calibrated By</u>	<u>Certificate No.</u>	<u>Due Date</u>
Thermo-Hygro Meter	608-H1	NFLBTH 018/23	Quality Return	QR23-0491	21 Feb 2024

3. This certification is traceable to SI UNIT

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

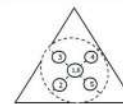
5. This result of calibration was found accurate as shown on date and place of calibration only.

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000048
200	0.000048

2. Off-Center Error:

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



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
99.9996	99.9995	99.9995	99.9999	99.9999	99.9997	0.0003

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

Calibration Report

Certificate No.:	2303074-001-01	
Equipment:	Electronic Balance	Manufacturer: METTLER TOLEDO
Model:	AB204-S/FACT	Resolution: 0.0001 g
Serial No.:	1129361010	ID No.: UAE.WAS.002/2552
Capacity:	220 g	

Date of Calibration: 26 May 2023 Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value	Standard Value	Average Reading	Correction	Uncertainty	Coverage Factor
(g)	(g)	(g)	(g)	(* g)	k
Unload	0.00000	0.0000	0.0000	0.000088	2.00
0.01	0.01000	0.0100	0.0000	0.000088	2.00
0.05	0.05000	0.0500	0.0000	0.000088	2.00
0.1	0.10001	0.0999	0.0001	0.000088	2.00
0.2	0.20001	0.1999	0.0001	0.000088	2.00
0.5	0.50002	0.5000	0.0000	0.000088	2.00
1	1.00000	1.0000	0.0000	0.000089	2.00
2	2.00002	2.0000	0.0000	0.000089	2.00
5	5.00002	5.0000	0.0000	0.000090	2.00
10	10.00001	9.9999	0.0001	0.000091	2.00
20	20.00003	20.0000	0.0000	0.000095	2.00
50	50.00003	49.9999	0.0001	0.00011	2.00
70	70.00006	69.9999	0.0002	0.00013	2.00
100	100.00006	99.9999	0.0002	0.00016	2.00
150	150.00009	149.9999	0.0002	0.00021	2.00
200	200.00016	199.9998	0.0004	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a level of confidence of approximately 95 %.

***** End *****

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

2008 โทรสารเบอร์ 36 โทรสารเบอร์ ภาษาอังกฤษ หมายเลข 10700
2008 Sat 36, Aun Aun Road, Bang Yi Khan Subdistrict, Bang Phli District, Bangkok 10700, Thailand
Tel : +662 2622 8888 Fax : +662 2622 8885



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.: 23MM113
Page.: 1 of 3

Certificate of Calibration

Equipment :	Electronic Balance
Manufacturer :	Mettler Toledo
Model :	XSR205
Serial No. :	C210685394
ID No. :	UAE.WAO.010/2565
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phakhanong, Bangkok 10260
Location :	Balance Room
Received order :	26 April 2023
Calibration Date :	26 April 2023
Ambient Temperature :	15 °C to 40 °C
Relative Humidity :	30 % to 90 %
Calibrated by :	Mani Pattanapongpaiboon
Approved by :	<div style="border: 1px solid black; width: 150px; height: 50px; margin: 0 auto;"></div>

☐ Pornthippa Tameyakul
☐ Malee Butkruea
☒ Suwit Imjai

Issue Date : 2 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

Cert.No.: 23MM113
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

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

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

Range capacity :	0 g to 81 g	Resolution	0.00001 g
	81 g to 220 g	Resolution	0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	79.99992	+0.00008	0.15	2.00
200	199.9995	+0.0005	0.29	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00004

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

Cert.No.: 23MM113
Page: 3 of 3

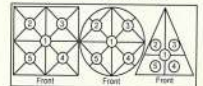
Result of calibration

2. **Effect of off center loading**

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

The weighing machine reading error obtained is given in the table

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



Maximum difference between
off-center and central loading
(g)
0.0001

3. **Departure from nominal value**

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.11
0.05	0.04999	+0.00001	0.015	2.09
0.1	0.09999	+0.00001	0.015	2.07
1	1.00000	0.00000	0.018	2.04
5	5.00000	0.00000	0.026	2.00
20	20.00002	-0.00002	0.045	2.00
50	50.00002	-0.00002	0.080	2.00
80	80.00002	-0.00002	0.15	2.00
100	100.00000	0.00000	0.17	2.00
150	150.00000	0.00000	0.29	2.00
200	199.99999	+0.00001	0.29	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 %.

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เอกสาร



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.: 23MM112
Page: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XSR205
Serial No. : C009071872
ID No. : UAE.WAO.012/2563
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phakhanong,
Bangkok 10260
Location : Balance Room
Received order : 26 April 2023
Calibration Date : 26 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Pornthippa Tameyakul
() Malee Butkruea
(✓) Suwit Imjai
Issue Date : 2 May 2023

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 : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

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

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

Range capacity :	0 g to 81 g	Resolution	0.00001 g
	81 g to 220 g	Resolution	0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	80.00005	-0.00005	0.15	2.00
200	199.9999	+0.0001	0.29	2.00

After Adjustment :

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

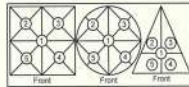
Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00000

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-1

Cert.No.: 23MM112
Page: 3 of 3



Maximum difference between off-center and central loading (g)

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

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (\pm mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.13
0.05	0.05001	-0.00001	0.015	2.09
0.1	0.10001	-0.00001	0.015	2.09
1	1.00001	-0.00001	0.018	2.04
5	5.00003	-0.00003	0.026	2.00
20	20.00006	-0.00006	0.045	2.00
50	50.00006	-0.00006	0.080	2.00
80	80.00004	-0.00004	0.15	2.00
100	100.0000	0.0000	0.16	2.00
150	150.0000	0.0000	0.29	2.00
200	200.0000	0.0000	0.29	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 %.

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เอกสารไม่



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

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

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 20 February 2024
Test Date : 21 February 2024
Reference : 2402-06290SC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirthean
Approved by : [Signature]
() Ponthippa Tameyakul
() Unnopphol Harachai
(✓) Saithip Meangmai
Issue Date : 22 February 2024

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

Condition of this result of calibration

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

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

2. Standard Material :-

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

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

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

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

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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.: 23TM726
Page : 1 of 3

Certificate of Calibration

Equipment : Cooled Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 2020000015535
ID No. : UAE.MIC.018/2564
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 27 April 2023
Calibration Date : 27 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama
Approved by : [Signature]
() Ponthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 12 May 2023

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม



Cert.No.: 23CH420
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0E0009
ID No. : UAE.EFM.071/2564(EFM pH.04/64)
Condition As-Received: Used Item
Received Date : 28 March 2023
Calibration Date : 29-30 March 2023
Reference : 2303-1001WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lernagatrakul

Approved by : 
Approved Signatory

(/) Malee Butkruea
() Saithip Meangmai
() Warakorn Lernagatrakul

Issue Date : 31 March 2023

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.



Cert.No.: 23CH420
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	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	2211306	27 Oct 2023

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT

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	863832	28 Dec 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter S/N.: HA0E0009	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.0	6.99	0.058	2.00
	7.00	0.00	0.0	7.00	0.058	2.00
	10.00	-177.48	-177.5	10.01	0.058	2.00

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เอกสารไม่ควบคุม



Cert.No.: 23CH420
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: Q92M0159	4.008	4.01	183.1	0.0085	2.05
	6.987	6.99	9.5	0.011	2.00
	6.987	6.99	9.0	0.011	2.00
	10.010	10.01	-165.7	0.011	2.07

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D
- Serial No. : Q92M0159

Dimension of probe;

- Length : 107 mm
- Diameter : 16 mm
- Immersion Depth : 100 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	30.003	30.0	-0.003	0.13	2.00
35.0	35.001	35.0	-0.001	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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เอกสารสอบเทียบเครื่องมือ

ประจำเดือนเมษายน พ.ศ. 2567

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3540	Jiranatee Associates Co., Ltd.	CL-011-65	31 Oct 22	30 Oct 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1400	9 May 23	8 May 24	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 158850	Innovative Instrument Co., Ltd.	23-AFM-187	30 Aug 23	29 Aug 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1856	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387039	UAE Consultant Co., Ltd.	07112023	7 Nov 23	6 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387040	UAE Consultant Co., Ltd.	07112023	7 Nov 23	6 Nov 24	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N099E15A01D3	21 Jun 21	21 Jun 24	-
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co., Ltd.	03112023	3 Nov 23	2 Nov 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387066	UAE Consultant Co., Ltd.	03112023	3 Nov 23	2 Nov 24	-
11	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N099E15A01D3	21 Jun 21	21 Jun 24	-
12	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636467	UAE Consultant Co., Ltd.	13112023	13 Nov 23	12 Nov 24	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200906880	UAE Consultant Co., Ltd.	13112023	13 Nov 23	12 Nov 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
15	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GAL13KSE	UAE Consultant Co.,Ltd.	21122023	21 Dec 23	20 Dec 24	-
16	Total Hydrocarbons Analyzer	Total Hydrocarbons	Thermo Scientific	55i 1182920025	UAE Consultant Co.,Ltd.	25012023	15 Dec 23	14 Dec 24	-
17	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
18	Vibration Meter	Vibration Level Acceleration Level	Instatel Inc.	Micromate UM11230	Calibration Laboratory Co.Ltd	Q23117018	20 Oct 23	19 Oct 24	-
19	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Quest Technologies, Inc	QC-20 QOF110030	Innovative Instrument Co.,Ltd.	23-ACT-116	4 Aug 23	3 Aug 24	-
20	Sound Level Meter	$L_{Aeq,1hr}$ $L_{Aeq,24hr}$ L_{Amin} L_{A90} เสียงรบกวน	Rion, Japan	NL-62 00130356	Innovative Instrument Co.,Ltd.	CP20230290EA	3 Jul 23	2 Jul 24	-
21	Sound Level Meter	$L_{Aeq,1hr}$ $L_{Aeq,24hr}$ L_{Amin} L_{A90} เสียงรบกวน	Rion, Japan	NL-62 00130357	Innovative Instrument Co.,Ltd.	CP20230291EA	3 Jul 23	2 Jul 24	-

CERTIFICATE OF CALIBRATION

Certificate No. : CL-011-65

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TSCH
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 3540
ID NUMBER : UAE.EFM.176/2561
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 25 Oct 2022
MEASUREMENT DATE : 31 Oct 2022
ISSUE DATE : 02 Nov 2022

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 24.5 °C and 61.0%RH.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/MC/W2-00. The W2-004 was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the measurement in 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: 03211801

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

Calibrated by:
Mr. Siragorn Thachud
Miss Jiragorn Lertsomphol



Approved signatory: [Signature]
Calibration Department Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION IS GRANTED IN WRITING FROM THE LABORATORY

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Continuation of Certificate of Calibration Number CL-011-65

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 m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	Y	Standard Flow [Qs] m ³ /min
1	0.702	758.204	24.560	23.900	57.190	1.568	1.252	0.650
2	0.999	758.182	24.620	24.010	60.852	3.088	1.756	0.919
3	1.119	758.204	24.550	23.960	40.965	4.167	2.041	1.050
4	1.169	758.228	24.540	24.060	30.007	4.728	2.174	1.124
5	1.419	758.202	24.720	24.250	28.776	7.044	2.652	1.366

Slope (m): 1.96180
Intercept (b): -0.03332
Correlation coefficient (r): 0.99914
Uncertainty (k=2): 0.017 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_meter mmHg	Δp_Orifice inH ₂ O	Y	Standard Flow [Qs] m ³ /min
1	0.702	758.204	24.560	23.900	57.190	1.568	0.785	0.651
2	0.999	758.182	24.620	24.010	60.852	3.088	1.101	0.920
3	1.119	758.204	24.550	23.960	40.965	4.167	1.279	1.050
4	1.169	758.228	24.540	24.060	30.007	4.728	1.362	1.124
5	1.419	758.202	24.720	24.250	28.776	7.044	1.664	1.368

Slope (m): 1.22877
Intercept (b): -0.02091
Correlation coefficient (r): 0.99914
Uncertainty (k=2): 0.018 m³/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. 0-2717-3000-34 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 23P1400
Page : 1 of 2

Equipment : U-Tube Manometer

Manufacturer : Dwyer

Model : 1221-36-W/M

Serial No. : -

ID No. : UAE.EFM.020/2560

Condition As-Received: Used item

Received Date: 26 April 2023

Calibration Date: 09 May 2023

Reference: 2304-0703WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1010 mbar

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

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
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-PO4, 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	PG106P	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 Aussarnree
Issue Date : 11 May 2023

Approved Signatory : [Signature]
[Signature]
[Signature]

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Cert.No.: 23P1400
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			ΔP (inH ₂ O)	Error (inH ₂ O)
Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (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	7.02	-7.02	14.04	0.04
16.00	8.02	-8.02	16.04	0.04
18.00	9.04	-9.04	18.08	0.08
20.00	10.04	-10.04	20.08	0.08
22.00	11.02	-11.02	22.04	0.04
24.00	12.02	-12.02	24.04	0.04
26.00	13.02	-13.00	26.02	0.02
28.00	14.00	14.00	0.00	-28.00
30.00	15.00	-15.00	30.00	0.00
32.00	16.00	-15.98	31.98	-0.02
34.00	17.00	-16.96	33.96	-0.04
36.00	18.00	-17.94	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

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

Unit Under Calibration Details
Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 158850
ID : UAE.EFM.038/2561
Location of Calibration : LAB 4 AIR VELOCITY METER

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


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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	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 : 
Mr. Noppadol Luangart
Service Calibration Engineer

Approved By : 
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 30 August 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

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

Result of Calibration :

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

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

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

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

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Authority.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

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Certificate of Calibration

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

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

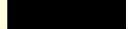
Calibration Environment and Details
Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 August 2023
Calibrated Date : 30 August 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

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

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

Certificate No : 23-TPM-424
Request No : Req-2023-1655
Page : 1/2

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

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

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

เอกสารไม่ควบคุม

Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 23-TPM-424
Request No : Req-2023-1655
Page : 2/2

Result of Calibration :

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

End of Certificate

Calibrated By : 
Mr. Sontchok Trapanakornakul

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

เอกสารไม่ควบคุม

Certificate of Calibration

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

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

Page : 1/2

Unit Under Calibration Details

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

Range Calibration : 20 °C to 50 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 3

Calibration Position (mm) : 45

Instrument Status : Used

Calibration Environment and Details


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

Reference Standard : Digital Thermometer with Sensor, 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 : 
Mr. Supaporn
Technical Manager
Issue Date : 27 September 2023

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

เอกสารไม่ควบคุม

Certificate No : 23-TPM-458

Calibration Note
UUC Adjustment : Not Adjust

Request No : Req-2023-1977

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty ± °C
T1	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.0	0.0	0.13
	35.034	35.1	-0.1	0.13
	40.040	40.1	-0.1	0.13
	45.039	45.1	-0.1	0.13
	50.043	50.1	-0.1	0.13

End of Certificate

Calibrated By : 
Mr. Supaporn Insupakornchai

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

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No. : 23P1856
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : -
Serial No. : -
ID No. : UAE.EMA2.110/2555
Condition As-Received : Used Item
Received Date : 26 May 2023
Calibration Date : 02 June 2023
Reference : 2305-0919WSC
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Atmospheric Pressure : 1006 mbar

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

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

Procedure used : The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to 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	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 Khankiew
Issue Date : 08 June 2023

Approved Signatory : 
[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

เอกสารไม่ควบคุม
B 0316956



Cert.No.: 23P1856
Page: 2 of 2

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

Range: 720 mmHg to 800 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	720.43	730.67	740.34	751.52	756.56	761.83	773.53	798.76
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	755.0	760.0	770.0	790.0
Error (mmHg)	-0.43	-0.67	-0.34	-1.52	-1.56	-1.83	-3.53	-8.76

Decreasing Pressure

Applied Pressure (mmHg)	798.76	773.60	761.89	756.65	751.59	740.72	730.68	720.59
UUC* Indication (mmHg)	790.0	770.0	760.0	755.0	750.0	740.0	730.0	720.0
Error (mmHg)	-8.76	-3.60	-1.89	-1.65	-1.59	-0.72	-0.68	-0.59

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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Attapol P.

เอกสารไม่ควบคุม
a 1165502



Certificate of Calibration

Certificate No.: 23H1201
Page: 1 of 2

Cert. No.: 23H1201
Page: 2 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.EMA2.014/2555

Condition As-Received: Used Item

Received Date: 28 May 2023

Calibration Date: 30 May 2023

Reference: 2305-0919WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, 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	23305	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 Dumvor
Issue Date: 07 June 2023

Approved Signatory: [Signature]

[Signature]
[Signature]
[Signature]

เอกสารไม่ควบคุม
B 0316275



Result of Calibration:-

Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	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: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	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: Temperature Measurement

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

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เอกสารไม่ควบคุม
a 1165294



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



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 7, 2023

Equipment: Gas Analyzer (NO₂)
Manufacturer: Thermo Scientific

Model: 42i
Serial Number: CM22387039

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	984.8	PPM
Cylinder No.:	EB0143262	
Expiration Date:	Jun 21, 2024	

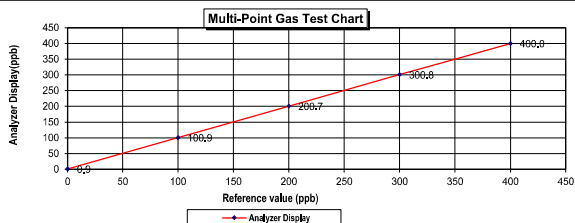
Dilutor Detail

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

Multi-point gas test data

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

:Acceptable Limit ± 5%



Calculate by

07 / Nov / 2023

08 / Nov / 2023

MULTI-POINT GAS TEST REPORT

Test Date: Nov 7, 2023

Equipment: Gas Analyzer (NO₂)
Manufacturer: Thermo Scientific

Model: 42i
Serial Number: CM22387040

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	984.8	PPM
Cylinder No.:	EB0143262	
Expiration Date:	Jun 21, 2024	

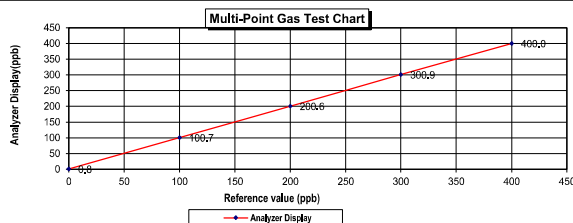
Dilutor Detail

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

Multi-point gas test data

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

:Acceptable Limit ± 5%



07 / Nov / 2023

08 / Nov / 2023

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 interferences which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 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	44.58 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423836102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

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

Standard Gas Concentration

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

Dilutor Detail

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

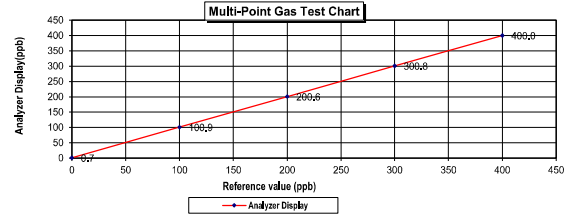
Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.70	0.70
Level 2	20.00%	100.0	100.9	0.90	0.89
Level 3	40.00%	200.0	200.6	0.60	0.30
Level 4	60.00%	300.0	300.8	0.80	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

:Acceptable Limit \pm 5%

Average Difference (%) 0.43



Calculate by

03/...../.....Nov...../.....2023

03/...../.....Nov...../.....2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

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

Standard Gas Concentration

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

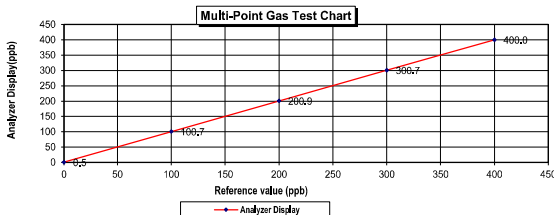
Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.5	0.50	0.50
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb

:Acceptable Limit \pm 5%

Calculate by

03/...../.....Nov...../.....2023

03/...../.....Nov...../.....2023

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 interferences which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 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	44.58 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423836102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

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

Standard Gas Concentration

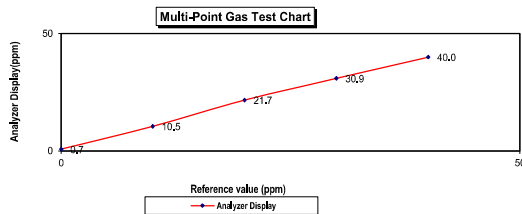
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.7	0.7
Level 2	20.00%	10.0	10.5	0.5	4.8
Level 3	40.00%	20.0	21.7	1.7	7.8
Level 4	60.00%	30.0	30.9	0.9	2.9
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm		Average Difference (%)	3.24	
:Acceptable Limit \pm 5%					



...13/...11/...2023

...13/...Nov/...2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

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

Standard Gas Concentration

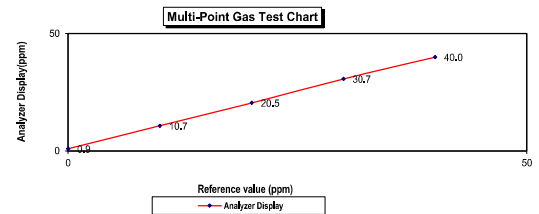
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm		Average Difference (%)	2.43	
:Acceptable Limit \pm 5%					



...13/...11/...2023

...13/...Nov/...2023

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เอกสารไม่ควบคุม



Airgas Specialty Gases
Airgas USA, LLC
690 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: 650
Gas Code: CO,NO,NOX,SO₂,BALN Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 809R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig (i.e. 0.7 megapascals)

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	\pm 1.4% NIST Traceable	08/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	\pm 1.4% NIST Traceable	08/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	\pm 1.0% NIST Traceable	08/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	\pm 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20051120	CC708098	49.82 PPM NITRIC OXIDE/NITROGEN	\pm 1.0%	Feb 02, 2025
PRM	12388	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	\pm 2.0%	Feb 26, 2020
GMIS	401423836102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	\pm 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	\pm 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	\pm 0.6%	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO ₂	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : GAL13KSE

Standard Gas Concentration

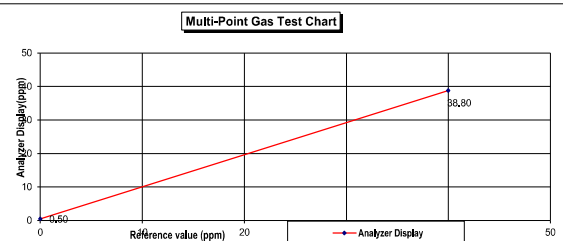
Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.50	0.50	0.50
Level 2	80.00%	40.00	38.80	-1.20	-3.09
Remark : Measuring Range	50.00 ppm		Average Difference (%)	1.80	
:Acceptable Limit \pm 5%					



...21/...12/...2023

...22/...Dec/...2023

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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 15, 2023

Equipment : Hydrocarbon Analyzer **Model** : 55i
Manufacturer : Thermo SCIENTIFIC **Serial Number** : 1182920025

Standard Gas Concentration

Sulphur Dioxide (SO₂) : - PPM
Nitric Oxide (NO) : - PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

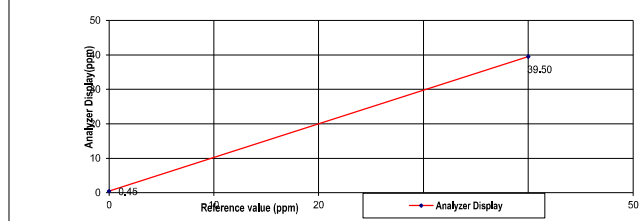
Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.45	0.45	0.45
Level 2	80.00%	40.00	39.50	-0.50	-1.27
Remark : Measuring Range	50.00 ppm			Average Difference (%)	0.86
:Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart



...15...../...12...../...2023.

.....16...../...Dec...../...2023..

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เอกสารไม่ควบคุม

THE LINDE GROUP **Linde**

Certificate Of Analysis
Special Gases Mixture

Customer Details
Name: United Analyst & Engineering Co., Ltd. Address: 3 Soi Udomsuk 41, Sukhumvit Rd., Bang Chak, Khet Phra Khanong, Bangkok 10260 Customer Tag No.:
Certificate Details
Number: 3384/20 Date of Issue: 4-Aug-2020 Expiry date: 4-Aug-2028
Material Details
Production Order: 90161442 Material Code: 400400-AL-34 Cylinder No.: D824432
Gas content: 6.60 M³ Filling pressure: 137.0 bar Valve: CGA 570 BRASS
Cylinder Owner: LINDE Cylinder Size: 50L
Laboratory Report

Component	Normal Concentration	Analysis Result ¹	Uncertainty ²	Method of Analysis ³	Assay Date
Methane	40.0 ppm	39.8 ppm	$\pm 1\%$ relative	(6) HPB-31.2	4-Aug-2020
In Air					

Reference Standard used in Assay
Reference Standard: Methane in Nitrogen Cylinder number: 25579956 Concentration: 49.29 \pm 0.39 ppm Expiry date: 3-Oct-2020
Instrument/Make/Model
FTIR Spectrometers Nicolet i550
Analytical Instruments used in Assay
Analytical Principle: FTIR-CH4 Last Multipoint Calibration: 4-Aug-2020
Recommend usage condition
Minimum utilization: 5% of actual content or before expiry date whichever comes first
Storage condition: Keep in well ventilation and secure area.
Comments
When reordering, please quote the material number
Note:
1. All results expressed in this report were made under the conditions specified. The Assay of this standard has been performed in accordance with the ISO 17025:2015 (ISO 17025:2015) for the Assay and Certification of Gases Calibration Standards using gravimetric (G).
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.
The measurement of this material is traceable to the SI through the reference gas standard which is traceable to the International Standard of Mass (M),
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analysis, (3) Electrochemical Oxygen Analysis, (4) Electrochemical Methane Analysis,
(5) Total Hydrocarbon Analysis, (6) Other - Specified
Page 1 of 1
This report shall not be reproduced except in full.
Signature and Stamp of the Analyst
Sukanya Panayassontorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.
PB-002/0006
Linde (Thailand) Public Company Limited (17 October 2019)
17th Floor, Bangkok Tower A, 17th Floor 17, Bangkok (10110), Bangkok, Thailand
Bangkok, Thailand 10110 Tel: (66) 2386 6100 Fax: (66) 2386 6333
Webpage: www.linde.co.th
Bangkok Branch: 10110 Bangkok, Thailand
Bangkok Branch: 10110 Bangkok, Thailand
Bangkok Branch: 10110 Bangkok, Thailand
Bangkok Branch: 10110 Bangkok, Thailand

เอกสารไม่ควบคุม



CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manut 29 Yaek 4, Prasert Manut Rd., Ladphrao, Bangkok 10230
Tel. 02-576-0353-4 Fax: 02-576-2672 www.cali-lab.com E-mail: sale@cali-lab.com



CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manut 29 Yaek 4, Prasert Manut Rd., Ladphrao, Bangkok 10230
Tel. 02-576-0353-4 Fax: 02-576-2672 www.cali-lab.com E-mail: sale@cali-lab.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A3301
SERIAL NO. : UM11230/UM11230
CLID. NO. : 251701315
JOB CONTROL NO. : 231019117018

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 19 October 2023

DATE OF ISSUED : 25 October 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

Approved By : Mongkol Yotsontorn
Authorized Signatory
25 October 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23117018
F3-011-04/01-12

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เอกสารไม่ควบคุม

REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A3301
SERIAL NO. : UM11230/UM11230
DATE OF CALIBRATION : 20 October 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 \pm 2) °C **Relative Humidity** : (55 \pm 15) %RH

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline. The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Vibration Calibrator Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
- Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
- Programmable Timer/Counter, Philips Model PM6680B S/N. SM6607101.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-23, Due Date 26 June 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23117018
F3-011-04/01-12

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เอกสารไม่ควบคุม



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading (g)	DUC Reading (g)	Correction (g)	Uncertainty ± (% of rdg.)
(g)	(frequency)					
0.3	50 Hz	peak	0.300	0.302	-0.002	1.9
0.4	50 Hz		0.400	0.402	-0.002	1.9
0.5	50 Hz		0.500	0.503	-0.003	1.9
0.6	50 Hz		0.600	0.603	-0.003	1.9
0.7	50 Hz		0.700	0.704	-0.004	1.9
0.3	100 Hz	peak	0.300	0.303	-0.003	1.9
0.4	100 Hz		0.400	0.404	-0.004	1.9
0.5	100 Hz		0.500	0.504	-0.004	1.9
0.6	100 Hz		0.600	0.605	-0.005	1.9
0.7	100 Hz		0.700	0.706	-0.006	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty ± (% of rdg.)
(mm/s)	(frequency)					
3	50 Hz	peak	3.000	3.033	-0.033	1.9
4	50 Hz		4.000	4.045	-0.045	1.9
5	50 Hz		5.000	5.057	-0.057	1.9
6	50 Hz		6.000	6.066	-0.066	1.9
7	50 Hz		7.000	7.081	-0.081	1.9
3	100 Hz	peak	3.000	3.039	-0.039	1.9
4	100 Hz		4.000	4.046	-0.046	1.9
5	100 Hz		5.000	5.055	-0.055	1.9
6	100 Hz		6.000	6.067	-0.067	1.9
7	100 Hz		7.000	7.079	-0.079	1.9

Certificate No. Q23117018

F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty ± (% of rdg.)
(mm)	(frequency)					
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	0.000	2.2
0.06	50 Hz		0.060	0.060	0.000	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.061	-0.001	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23117018

F3-011-04/01-12

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTINSAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 0608-2116-5860-1 FAX: 0608-2116-7140



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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-116
Request No : Req-2023-1545

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : QUEST
Model : QC-20
Serial Number : QOF110030
ID : UAE.EMA2.116/2555

Class : I
Range : 94 , 114 dB / 250 , 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	EEL	31 May 2024
Sound Calibrator	AC-300	AC-300001087	EEL	23 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 :
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :
Mr. Pacht Mathavorn
Calibration Engineer Supervisor
Issue Date : 4 August 2023

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUTINSAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 0608-2116-5860-1 FAX: 0608-2116-7140



Page 2 of 2

Certificate No : 23-ACT-116

Request No : Req-2023-1545

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class I (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.00	0.00	-	-	0.13	0.25
114 dB / 1000 Hz	113.90	-0.10	-	-	0.13	0.25
94 dB / 250 Hz	94.08	0.08	-	-	0.13	0.25
114 dB / 250 Hz	114.09	0.09	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class I (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.39	0.06	-	-	0.01	0.70
114 dB / 1000 Hz	999.35	0.06	-	-	0.01	0.70
94 dB / 250 Hz	250.74	0.30	-	-	0.01	0.70
114 dB / 250 Hz	250.72	0.29	-	-	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 I (± %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.25	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.21	-	-	-	0.40	2.5
94 dB / 250 Hz	0.49	-	-	-	0.40	2.5
114 dB / 250 Hz	0.45	-	-	-	0.40	2.5

Note :

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

End of Calibration

เอกสารไม่ควบคุม



ELECTRICAL AND ELECTRONICS INSTITUTE FOUNDATION FOR INDUSTRIAL DEVELOPMENT

975 Moo 4, Bangpoo Industrial Estate, Soi 8, Sukhumvit Road km 37,
Phraek Sai, Mueang Samut Prakan, Samut Prakan 10280

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



ISO 9001:2015
ISO 14001:2015

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 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:

(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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

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เอกสารไม่ควบคุม



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.

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เอกสารไม่ควบคุม



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

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เอกสารไม่ควบคุม



ELECTRICAL AND ELECTRONICS INSTITUTE FOUNDATION FOR INDUSTRIAL DEVELOPMENT

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

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เอกสารไม่ควบคุม

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
	0.25	90.9	-0.1	+1.0 ; -3.0
LAE	200	120.0	0.0	±0.5
	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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เอกสารไม่ควบคุม

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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เอกสารไม่ควบคุม

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 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: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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

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

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เอกสารไม่ควบคุม

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.

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เอกสารไม่ควบคุม

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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เอกสารไม่ควบคุม

Certificate No.: CP20230291EA

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

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เอกสารไม่ควบคุม

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
	200	120.0	0.0	±0.5
LAE	2	100.0	0.0	+1.0; -1.5
	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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เอกสารไม่ควบคุม

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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เอกสารไม่ควบคุม

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	National Food Institute,Ministry of Industry, Thailand	2303074-001-01	27 May 23	25 May 24
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
3	Analytical Balance	SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
4	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
5	Hot Air Oven	SUSPENDED SOLIDS TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
6	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25
7	pH Meter	pH	YSI Environmental	pH 100A / JC03354	Technology Promotion Association (Thailand-Japan)	23CH1487	22 Nov 23	21 Nov 24

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

Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 2 of 4

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFL8TH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

4. This certification is certified only for the instrument we calibrated.

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

Calibration Results:

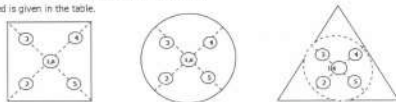
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
160	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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

2008 35 ถนนสุขุมวิท 36 แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10110
2008 Soi 36, Asoi Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
Unload	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.001003	0.001011	-0.000011	0.0000089	2.00
0.005	0.005003	0.005000	0.000003	0.0000092	2.00
0.01	0.010003	0.010000	0.000003	0.0000089	2.00
0.05	0.049996	0.050000	0.000004	0.0000096	2.00
0.1	0.100011	0.100000	0.000011	0.000011	2.00
0.5	0.500016	0.500001	0.000015	0.000014	2.00
1	1.000003	1.000002	-0.000002	0.000016	2.00
2	2.000023	2.000001	-0.000022	0.000017	2.00
5	5.000017	5.000002	-0.000015	0.000020	2.00
10	10.000009	10.000000	-0.000009	0.000026	2.00
20	20.000031	20.000000	-0.000031	0.000037	2.00
30	30.000049	30.000001	-0.000048	0.000050	2.00
50	50.000028	50.000002	-0.000026	0.000068	2.00
80	80.000068	80.000002	-0.000066	0.00011	2.00

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

2008 35 ถนนสุขุมวิท 36 แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10110
2008 Soi 36, Asoi Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
90	90.00010	90.0001	0.0000	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	-0.0001	0.00017	2.00
130	130.00010	130.0000	-0.0001	0.00019	2.00
140	140.00014	140.0000	-0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k, which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

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

2008 35 ถนนสุขุมวิท 36 แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10110
2008 Soi 36, Asoi Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Calibration Certificate

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

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR2050U

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2402283

Operation No.: 2402283-001

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

Approved by

(Mr.Ph

Manager, Division of Calibration Laboratory

Date of Issue: 9 April 2024

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 35 ถนนสุขุมวิท 36 แขวงคลองเตย เขตวัฒนา กรุงเทพมหานคร 10110
2008 Soi 36, Asoi Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.00001 g / 0.0001 g
Serial No.: C09071872
ID No.: UAE.WAO.012/2563
Capacity: 220 g

Date of Calibration: 2 April 2024 Page 2 of 4

Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %
Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H3	NFI.BTH 016/23	Quality Return	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

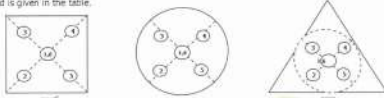
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000052
80	0.0000063
100	0.000048
200	0.000053

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.00001 g / 0.0001 g
Serial No.: C09071872
ID No.: UAE.WAO.012/2563
Capacity: 220 g

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (# g)	Coverage Factor #
Unloaded	0.000000	0.000000	0.000000	0.0000088	2.00
0.001	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Resolution: 0.00001 g / 0.0001 g
Serial No.: C09071872
ID No.: UAE.WAO.012/2563
Capacity: 220 g

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

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

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

----- End -----

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

เอกสารไม่ควบคุม



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

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

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

Cert.No.: 24TW39

Page.: 1 of 2

Certificate of Testing

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

เอกสารไม่ควบคุม



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

Condition of this result of calibration

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

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

2. Standard Material :-

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

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

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

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

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เอกสารไม่



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.: 24TM589
Page: 1 of 3

Certificate of Calibration

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

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม
A 0065065



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0004OC-3
Cert. No.: 24TM589
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

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

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

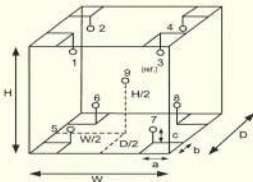
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.50 m
b = 5.0 cm W = 0.80 m
c = 5.0 cm H = 0.75 m
Capacity = 0.30 m³

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

เอกสารไม่ควบคุม
a 1209739



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0004OC-3
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close
Cert. No.: 24TM589
Page : 3 of 3

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

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม
a 1209738



Certificate of Calibration

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

Equipment : Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 2020000015535
ID No. : UAE.MIC.018/2564
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpalboon
Approved by :
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



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

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

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

Condition of this result of calibration

1. Reference standard instrument:-

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

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

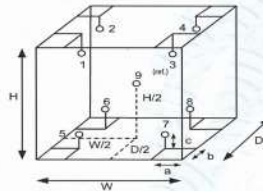
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details :

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

Dimension of Chamber :

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



Cert.No.: 23CH1487
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : EcoSense
Model : pH100A
Serial No. : JC03354
ID No. : UAE.EFM.063/2562(ENV.pH 03/62)
Condition As-Received : Used Item
Received Date : 21 November 2023
Calibration Date : 22 November 2023
Reference : 2311-0720WSC-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-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 Lemngagrakul

Approved by :

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

Issue Date : 27 November 2023

The Uncertainties are for a confidence probability of approximately 95%

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

A 0061266



Cert.No.: 23CH1487
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument :-

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

This certification is traceable to 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 6.985	CPA chem	913599	14 July 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

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

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: JC03354	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-178	10.01	0.58	2.00



Cert.No.: 23CH1487
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 230906SIA605377	4.008	4.01	174	0.0085	2.05
	6.985	7.00	-2	0.0099	2.00
	6.985	7.00	-2	0.0093	2.00
	9.997	10.00	-177	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :	-
- Serial No. :	230906SIA605377
Dimension of probe;	
- Length :	110 mm
- Diameter :	12 mm
- Immersion Depth :	100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (\pm °C)	Coverage factor k
25.0	25.002	25.1	0.098	0.13	2.00
30.0	30.001	30.1	0.099	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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a 1191352

a 1191351

เอกสารสอบเทียบเครื่องมือ

ประจำเดือนพฤษภาคม พ.ศ. 2567

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	G25A 1270	Jiranatee Associates Co., Ltd.	CO-004-66	12 Jun 23	11 Jun 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1401	9 May 23	8 May 24	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 155895	Innovative Instrument Co.,Ltd.	23-AFM-188	30 Aug 23	29 Aug 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1856	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387039	UAE Consultant Co.,Ltd.	07112023	7 Nov 23	6 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM22387040	UAE Consultant Co.,Ltd.	07112023	7 Nov 23	6 Nov 24	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N09E15A01D3	21 Jun 21	21 Jun 24	-
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387065	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387066	UAE Consultant Co.,Ltd.	03112023	3 Nov 23	2 Nov 24	-
11	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N09E15A01D3	21 Jun 21	21 Jun 24	-
12	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636467	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200906880	UAE Consultant Co.,Ltd.	13112023	13 Nov 23	12 Nov 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04ND9E15A01D3	21 Jun 21	21 Jun 24	-
15	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GAL13KSE	UAE Consultant Co.,Ltd.	21122023	21 Dec 23	20 Dec 24	-
16	Total Hydrocarbons Analyzer	Total Hydrocarbons	Thermo Scientific	55i 1182920025	UAE Consultant Co.,Ltd.	25012023	25 Dec 23	24 Dec 24	-
17	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
18	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11230	Calibration Laboratory Co.Ltd	Q23117018	20 Oct 23	19 Oct 24	-
19	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Quest Technologies, Inc	QC-20 QOF110030	Innovative Instrument Co.,Ltd.	23-ACT-116	4 Aug 23	3 Aug 24	-
20	Sound Level Meter	$L_{Aeq,1hr}$ $L_{Aeq,24hrs}$ L_{Amax} L_{d90} เสียงรบกวน	Rion, Japan	NL-62	Innovative Instrument	CP20230290EA	3 Jul 23	2 Jul 24	-
				00130356	Co.,Ltd.				
21	Sound Level Meter	$L_{Aeq,1hr}$ $L_{Aeq,24hrs}$ L_{Amax} L_{d90} เสียงรบกวน	Rion, Japan	NL-62	Innovative Instrument	CP20230291EA	3 Jul 23	2 Jul 24	-
				00130357	Co.,Ltd.				

CERTIFICATE OF CALIBRATION

Certificate No. : CO-004-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : Andersen Instruments
MODEL/TYPE : G25A
SERIAL NUMBER : 1270
ID NUMBER : UAE.ANV.009/2542
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 02 Jun 2023
MEASUREMENT DATE : 12 Jun 2023
ISSUE DATE : 12 Jun 2023

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 value during measurement are 23.3 °C and 55.0% 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.

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/MC/W2-0p. The W6-GE-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"

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 m^3/min	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
1	0.705	755.787	24.17	23.48	47.401	1.708	1.305	0.661
2	0.999	755.849	23.95	23.54	51.522	1.881	1.837	0.930
3	1.119	755.810	23.39	22.98	35.502	4.448	2.100	1.068
4	1.170	755.752	23.42	23.02	26.462	4.999	2.235	1.131
5	1.425	755.681	23.52	23.12	26.582	7.431	2.735	1.376

Slope (m): 1.98581
Intercept (b): -0.00879
Correlation coefficient (r): 0.99984
Uncertainty (k=2): 0.015 m^3/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m^3/min	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
1	0.705	755.787	24.17	23.48	47.401	1.708	0.820	0.663
2	0.999	755.849	23.95	23.54	51.522	1.881	1.153	0.932
3	1.119	755.810	23.39	22.98	35.502	4.448	1.321	1.068
4	1.170	755.752	23.42	23.02	26.462	4.999	1.401	1.131
5	1.425	755.681	23.52	23.12	26.582	7.431	1.708	1.377

Slope (m): 1.24382
Intercept (b): -0.00554
Correlation coefficient (r): 0.99984
Uncertainty (k=2): 0.015 m^3/min

End of Certificate of Calibration



Calibrated by:
☐ Mr. Spravit Thachalad
☒ Miss Jiraporn Lertsomphol

Approved signatory

Calibration Department Manager

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

เอกสารไม่ควบคุม



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

Certificate of Calibration

Certificate No.: 23P1401
Page: 1 of 2

Equipment: U-Tube Manometer
Manufacturer: Dwyer
Model: 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.022/2560

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

Reference: 2304-0703WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 mbar

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

81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
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	PC108P	1189	MP-0137-22	24 Aug 2023

- This result of calibration was made on requested at the point specified by customer.
- Scale and conversion factor is $1\text{ kPa} = 0.0146283\text{ inH}_2\text{O}$
- This instrument was used clean air and oil as pressure media.
- This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.
- This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.
- The certificate is valid only to the item calibrated on date and place of calibration.
- 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:

☐ Phrasone Pradaporn
☐ Sura Suwannasri
☒ Attapol Panurach

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B 0314241



Cert.No.: 23P1401
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)

Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	ΔP (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98	-0.02
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-2.98	5.98	-0.02
8.00	4.00	-3.98	7.98	-0.02
10.00	5.00	-4.98	9.98	-0.02
12.00	6.00	-6.00	12.00	0.00
14.00	7.00	-7.00	14.00	0.00
16.00	8.00	-8.00	16.00	0.00
18.00	9.00	-9.00	18.00	0.00
20.00	10.00	-10.00	20.00	0.00
22.00	11.00	-11.00	22.00	0.00
24.00	12.02	-12.00	24.02	0.02
26.00	13.02	-13.00	26.02	0.02
28.00	14.02	-14.00	28.02	0.02
30.00	15.04	-15.00	30.04	0.04
32.00	16.04	-16.00	32.04	0.04
34.00	17.02	-17.00	34.02	0.02
36.00	18.00	-17.96	35.96	0.16

The uncertainty of measurement was $\pm 0.11\text{ inH}_2\text{O}$

* 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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a 1160340

Certificate of Calibration

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

Certificate No : 23-AFM-188
Request No : Req-2023-1656

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 155895
ID : UAE.EFM.076/2560
Location of Calibration : LAB 4 AIR VELOCITY METER

Sensor Model : -
Sensor Serial Number : -

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Semidyne	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012012	Semidyne	12 July 2024
Temperature meter	GT 11	08000057	Oreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	7 November 2023

Traceability :

This Certificate is traceable to SI Unit through Semidyne A2LA Accreditation No. 3943.B1

Note :

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

Calibration By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Noppadon Luangart
Calibration Engineer Supervisor

Issue Date : 30 August 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the laboratory.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

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Certificate No : 23-AFM-188
Request No : Req-2023-1656

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.00	100.50	14.50	14.46	-0.04	0.20
24.10	100.50	15.00	14.95	-0.05	0.21
24.10	100.50	15.80	15.74	-0.06	0.22
24.10	100.50	16.67	16.61	-0.06	0.23
24.20	100.70	18.30	18.20	-0.10	0.26

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

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

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

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the laboratory.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

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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-TPM-425
Request No : Req-2023-1656

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 155895
Resolution : 0.1 °C
ID Number : UAE.EFM.076/2560

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

Calibration Environment and Details


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

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/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 : 
Mr. Noppadon Luangart
Technical Manager

Issue Date : 30 August 2023

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

เอกสารไม่ควบคุม

Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 23-TPM-425
Request No : Req-2023-1656
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
Ta	20.032	19.9	+ 0.1	0.13
	25.034	25.0	0.0	0.13
	30.035	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.038	40.0	0.0	0.13
	45.041	45.1	- 0.1	0.13
	50.044	50.1	- 0.1	0.13

End of Certificate

Calibrated By : 
Mr. Noppadon Luangart

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

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No : 23-TPM-459

Request No : Req-2023-1976

Customer

Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Air Flow meter

Range Calibration : 20 °C to 50 °C

Manufacturer : BGI

Type of Sensor : RTD

Model : Delta Cal DC1

Sensor Diameter (mm) : 3

Serial Number : 155895

Calibration Position (mm) : 45

Resolution : 0.1 °C

Instrument Status : Used

ID Number : UAE.EFM.076/2560

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 14 September 2023

Calibrated Date : 27 September 2023

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

Reference Standard : Digital Thermometer with Sensor, 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 :



Technical Manager

Issue Date :

27 September 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Institute of Metrology Thailand (NIMT).
FM-708-TPM-01 Rev.01 Issue date 13/02/20

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Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-459

Request No : Req-2023-1976

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
IT	20.031	19.8	+0.2	0.13
	25.033	24.8	+0.2	0.13
	30.033	29.9	+0.1	0.13
	35.034	34.9	+0.1	0.13
	40.034	39.8	+0.2	0.13
	45.038	44.8	+0.2	0.13
	50.042	49.8	+0.2	0.13

End of Certificate

Calibrated By :

Mr. Sittichok Jirapaksornakul

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Institute of Metrology Thailand (NIMT).
FM-708-TPM-01 Rev.01 Issue date 13/02/20

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No. : 23P1856

Page : 1 of 2

Equipment : Aneroid Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No. : UAE.EMA2.110/2555

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 : 1006 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 Khankeaw

Issue Date : 08 June 2023

Approved Signatory :



Sura Suwannasri

Attapol Panurach

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B 0316956



Cert.No.: 23P1856

Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 720 mmHg to 800 mmHg

Scale Interval: 1 mmHg (The Fifth Estimate)

Increasing Pressure

Applied Pressure (mmHg)	720.43	730.67	740.34	751.52	756.56	761.83	773.53	798.76
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	755.0	760.0	770.0	790.0
Error (mmHg)	-0.43	-0.67	-0.34	-1.52	-1.56	-1.83	-3.53	-8.76

Decreasing Pressure

Applied Pressure (mmHg)	798.76	773.60	761.89	756.65	751.59	740.72	730.68	720.59
UUC* Indication (mmHg)	790.0	770.0	760.0	755.0	750.0	740.0	730.0	720.0
Error (mmHg)	-8.76	-3.60	-1.89	-1.65	-1.59	-0.72	-0.68	-0.59

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 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: 28 May 2023

Calibration Date: 30 May 2023
to 06 June 2023

Reference: 2305-0919WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, 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	23305	15 Mar 2024

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

3. This Calibration 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 Dumvor
Issue Date: 07 June 2023

Approved Signatory:

✓ Chakrit Wanwanjui
| Ponnthippa Tameyaku
| Viporn Tantiyawutti

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B 0316275



Result of Calibration:-

Function: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	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: Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	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: Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°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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Cert. No.: 23H1201
Page: 2 of 2

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a 1165294



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



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 7, 2023

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

Standard Gas Concentration

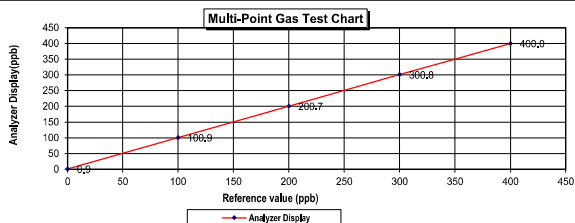
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer:	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model:	146i
Methane (CH ₄)	-	PPM	Serial Number:	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No.:	EB0143262			
Expiration Date:	Jun 21, 2024			

Dilutor Detail

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

Multi-point gas test data

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



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

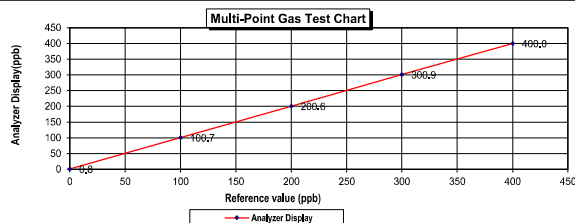
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer:	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model:	146i
Methane (CH ₄)	-	PPM	Serial Number:	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No.:	EB0143262			
Expiration Date:	Jun 21, 2024			

Dilutor Detail

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

Multi-point gas test data

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



Calculate by:

07 / Nov / 2023

Approve by:

08 / Nov / 2023

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 interferences which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 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	44.58 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423836102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

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

Triad 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.

Release



เอกรสารไมควบลุ่ม

MULTI-POINT GAS TEST REPORT

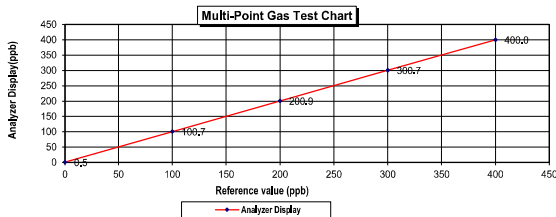
Test Date : Nov 3, 2023

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

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

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.5	0.50	0.50
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	200.9	0.45	0.45
Level 4 60.00%	300.0	300.7	0.23	0.23
Level 5 80.00%	400.0	400.0	0.00	0.00

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



Calculate by

...03/.../...Nov.../...2023

...03/.../...Nov.../...2023

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 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 interferences which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 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	44.58 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423836102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



เอกรสารไมควบลุ่ม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

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

Standard Gas Concentration

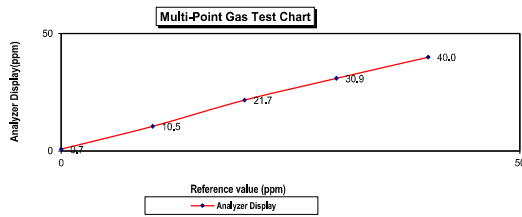
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.7	0.7
Level 2	20.00%	10.0	10.5	0.5	4.8
Level 3	40.00%	20.0	21.7	1.7	7.8
Level 4	60.00%	30.0	30.9	0.9	2.9
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm		Average Difference (%)	3.24	
:Acceptable Limit \pm 5%					



13/11/2023

13/Nov/2023

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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

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

Standard Gas Concentration

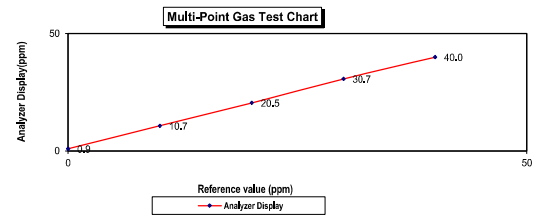
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range	50.0 ppm		Average Difference (%)	2.43	
:Acceptable Limit \pm 5%					



13/11/2023

13/Nov/2023

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เอกสารไม่ควบคุม



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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3
Cylinder Number: EB0143262
Laboratory: 124 - Durham (SAP) - NC
PGVP Number: B22021
Gas Code: CO,NO,NOX,SO2,BALN
Reference Number: 122-402135167-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 650
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 809R-12/01, 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 interferences which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig. (i.e. 0.7 megapascals)

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	\pm 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	\pm 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	\pm 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	\pm 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20051120	CC708098	49.82 PPM NITRIC OXIDE/NITROGEN	\pm 1.0%	Feb 02, 2025
PRM	12388	D685025	9.91 PPM NITROGEN DIOXIDE/AM	\pm 2.0%	Feb 26, 2020
GMIS	401423836102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	\pm 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	\pm 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	\pm 0.6%	Nov 15, 2025

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

Triad 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

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : GAL13KSE

Standard Gas Concentration

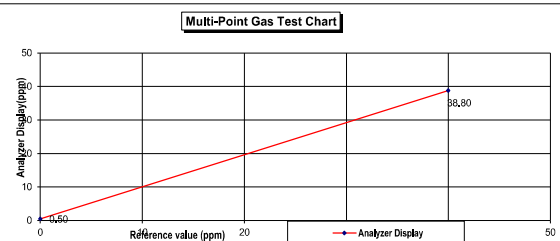
Sulphur Dioxide (SO₂) - PPM
Nitric Oxide (NO) - PPM
Methane (CH₄) 39.8 PPM
Carbon Monoxide (CO) - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.50	0.50	0.50
Level 2	80.00%	40.00	38.80	-1.20	-3.09
Remark : Measuring Range	50.00 ppm		Average Difference (%)	1.80	
:Acceptable Limit \pm 5%					



21/12/2023

21/Dec/2023

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เอกสารไม่ควบคุม



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading (g)	DUC Reading (g)	Correction (g)	Uncertainty ± (% of rdg.)
(g)	(frequency)					
0.3	50 Hz	peak	0.300	0.302	-0.002	1.9
0.4	50 Hz		0.400	0.402	-0.002	1.9
0.5	50 Hz		0.500	0.503	-0.003	1.9
0.6	50 Hz		0.600	0.603	-0.003	1.9
0.7	50 Hz		0.700	0.704	-0.004	1.9
0.3	100 Hz	peak	0.300	0.303	-0.003	1.9
0.4	100 Hz		0.400	0.404	-0.004	1.9
0.5	100 Hz		0.500	0.504	-0.004	1.9
0.6	100 Hz		0.600	0.605	-0.005	1.9
0.7	100 Hz		0.700	0.706	-0.006	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty ± (% of rdg.)
(mm/s)	(frequency)					
3	50 Hz	peak	3.000	3.033	-0.033	1.9
4	50 Hz		4.000	4.045	-0.045	1.9
5	50 Hz		5.000	5.057	-0.057	1.9
6	50 Hz		6.000	6.066	-0.066	1.9
7	50 Hz		7.000	7.081	-0.081	1.9
3	100 Hz	peak	3.000	3.039	-0.039	1.9
4	100 Hz		4.000	4.046	-0.046	1.9
5	100 Hz		5.000	5.055	-0.055	1.9
6	100 Hz		6.000	6.067	-0.067	1.9
7	100 Hz		7.000	7.079	-0.079	1.9

Certificate No. Q23117018

F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty ± (% of rdg.)
(mm)	(frequency)					
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	0.000	2.2
0.06	50 Hz		0.060	0.060	0.000	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.061	-0.001	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23117018

F3-011-04/01-12

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เอกสารไม่ควบคุม



INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SONTINAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 0680-2116-5860-1 FAX: 0680-2116-7140



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-116
Request No : Req-2023-1545

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : QUEST
Model : QC-20
Serial Number : QOF110030
ID : UAE.EMA2.116/2555

Class : I
Range : 94 , 114 dB / 250 , 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
Sound Calibrator	AC-300	AC-300001087	EEI	23 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 :

Mr. [redacted] ngart
Service Calibration Engineer

Approved By :

Calibration Engineer Supervisor

Issue Date : 4 August 2023

เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SONTINAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 0680-2116-5860-1 FAX: 0680-2116-7140



Page 2 of 2

Certificate No : 23-ACT-116

Request No : Req-2023-1545

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class I (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.00	0.00	-	-	0.13	0.25
114 dB / 1000 Hz	113.90	-0.10	-	-	0.13	0.25
94 dB / 250 Hz	94.08	0.08	-	-	0.13	0.25
114 dB / 250 Hz	114.09	0.09	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class I (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.39	0.06	-	-	0.01	0.70
114 dB / 1000 Hz	999.35	0.06	-	-	0.01	0.70
94 dB / 250 Hz	250.74	0.30	-	-	0.01	0.70
114 dB / 250 Hz	250.72	0.29	-	-	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 I (± %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.25		-	-	0.40	2.5
114 dB / 1000 Hz	0.21		-	-	0.40	2.5
94 dB / 250 Hz	0.49		-	-	0.40	2.5
114 dB / 250 Hz	0.45		-	-	0.40	2.5

Note :

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

End of Calibration

เอกสารไม่ควบคุม

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
	0.25	90.9	-0.1	+1.0 ; -3.0
LAE	200	120.0	0.0	±0.5
	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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เอกสารไม่ควบคุม

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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เอกสารไม่ควบคุม

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 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:

(Mr. Sittichai Swakunyawong)
Group Manager

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

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

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เอกสารไม่ควบคุม

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

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.

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เอกสารไม่ควบคุม

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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เอกสารไม่ควบคุม

Certificate No.: CP20230291EA

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

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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
	200	120.0	0.0	±0.5
LAE	2	100.0	0.0	+1.0; -1.5
	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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เอกสารไม่ควบคุม

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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เอกสารไม่ควบคุม

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
3	Analytical Balance	SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
4	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
5	Hot Air Oven	SUSPENDED SOLIDS TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
6	Cooled Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / WTB20200000015535	Technology Promotion Association (Thailand-Japan)	24TM647	1 Apr 24	31 Mar 25
7	Kjelttec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	9810	8 Feb 24	7 Feb 25
8	Kjelttec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjelttec 8100 / 91889052	FOSS South East Asia	9807	8 Feb 24	7 Feb 25
9	pH Meter	pH	YSI Environmental	pH 100A / JC03345	Technology Promotion Association (Thailand-Japan)	23CH806	27 Jun 23	26 Jun 24

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

Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210683394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 2 of 4

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505367572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFL8TH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

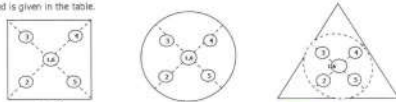
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
160	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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

2008 36 ถนนสุขุมวิท 36 แขวงคลองตันใต้ เขตวัฒนา กรุงเทพมหานคร 10110 ประเทศไทย
2008 Soi 36, Asoke Subdistrict, Bangkok 10110, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210683394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
Unload	0.000000	0.00000	0.00000	0.0000086	2.00
0.001	0.001803	0.00181	-0.00001	0.0000089	2.00
0.005	0.005003	0.00500	0.00000	0.0000092	2.00
0.01	0.010003	0.01000	0.00000	0.0000089	2.00
0.05	0.049996	0.05000	0.00000	0.0000096	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00000	0.00003	0.000037	2.00
30	30.000040	30.00001	0.00003	0.000050	2.00
50	50.000028	50.00002	0.00001	0.000068	2.00
80	80.000058	80.00002	0.00005	0.00011	2.00

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

2008 36 ถนนสุขุมวิท 36 แขวงคลองตันใต้ เขตวัฒนา กรุงเทพมหานคร 10110 ประเทศไทย
2008 Soi 36, Asoke Subdistrict, Bangkok 10110, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210683394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor
90	90.00010	90.0001	0.0000	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	0.0001	0.00017	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

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

***** End *****

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

2008 36 ถนนสุขุมวิท 36 แขวงคลองตันใต้ เขตวัฒนา กรุงเทพมหานคร 10110 ประเทศไทย
2008 Soi 36, Asoke Subdistrict, Bangkok 10110, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8545



Calibration Certificate

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

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR2050U

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2402283

Operation No.: 2402283-001

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Papawuttipong
Scientist

Approved by

(Mr.P)

Manager, Division of Calibration Laboratory

Date of Issue: 9 April 2024

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 36 ถนนสุขุมวิท 36 แขวงคลองตันใต้ เขตวัฒนา กรุงเทพมหานคร 10110 ประเทศไทย
2008 Soi 36, Asoke Subdistrict, Bangkok 10110, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C099071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 2 of 4

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quilty Return	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

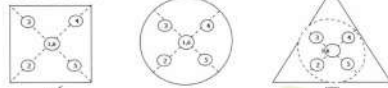
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000052
80	0.0000063
100	0.000048
200	0.000053

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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

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Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C099071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
Unload	0.000000	0.000000	0.000000	0.0000088	2.00
0.001	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00

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

เอกสารไม่ควบคุม



nfi.com

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C099071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor
90	90.00019	90.0000	0.0001	0.00015	2.00
100	100.00006	100.0000	0.0001	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0000	0.0001	0.00018	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0000	0.0002	0.00028	2.00

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

----- End -----

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

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

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

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

Cert.No.: 24TW39

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 20 February 2024
Test Date : 21 February 2024
Reference : 2402-0629DSC-1
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirthean

Approved by :

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

Issue Date : 22 February 2024

เอกสารไม่ควบคุม

ខេត្តកោះកុង
a 1209738



Certificate of Calibration

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

Equipment : Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 2020000015535
ID No. : UAE.MIC.018/2564
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon

Approved by :
() Ponpan Palpim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



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

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

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

Condition of this result of calibration

1. Reference standard instrument:-

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

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

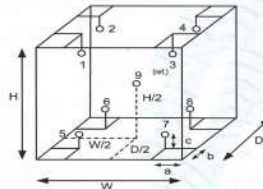
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

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



Probe Installation Details :

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

Dimension of Chamber :

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

FOSS

Customer Service Report

FOSS South East Asia
3388 Sirinrat Building, 25th - 26th Floor, Unit No. 3388/90,
Rama IV Road, Klongton, Klongtoey, Bangkok, Thailand 10110

Report No: 9810

Date: 9 Feb 2024
Customer: UAE
Instrument: K7200

Address: Bangkok

Serial: 91790524

Hours Start: 08:30
Finish: 09:30

Labour: 09:30
2 hrs

Travel From Customer: 16:30
2 hrs

Application		Special		Standard	
Normal	x	Courtesy Visit	x	Installation	x
Distributor	x	PMA Onboarding	x	Quote	x
Internal	x	Warranty	x	Repair	x
Digital Service	x	Sales Support	x	Remote	x
				Other	x

PO/Quote Number: If applicable

PMA Type: FOSScare If applicable Contract No. If applicable

Details of Work / Test		Condition / Status
# PM K7200		
- ตรวจเช็คอุณหภูมิ ภายใน PM		
- ตรวจเช็คอุณหภูมิ ภายใน 100 ml		
- ค่าเฉลี่ย 30 ml = 30 ml		
- ไม่พบข้อผิดพลาด		
- ตรวจสอบการตั้งค่า		
# ตรวจพบ 80PH Head ข้อผิดพลาดเล็กน้อย จัดการเรียบร้อยแล้ว		
10000725 Serial not complete 1 PC		
Instrument Ready for Use		(OK) Not OK If not OK - Comment

Part No:	Batch	Description	Qty
10009965	14.12.2020	FOSS PM kit K7200 to client Analymeter 8100	1

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

เอกสารไม่ควบคุม

เอกสารสอบเทียบเครื่องมือ

ประจำเดือนมิถุนายน พ.ศ. 2567

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Tisch Environmental, Inc.	05072022	5 Jul 22	4 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1250	10 Apr 24	9 Apr 25	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	Mesa Labs	DeltaCal DC1 159822	Innovative Instrument Co., Ltd.	23-AFM-203	27 Sep 23	26 Sep 24	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1859	2 Jun 23	1 Jun 24	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050148	UAE Consultant Co., Ltd.	13112023	13 Nov 23	12 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i CM19050149	UAE Consultant Co., Ltd.	01112023	1 Nov 23	31 Oct 24	-
8	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N09E15A01D3	21 Jun 21	21 Jun 24	-
9	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906875	UAE Consultant Co., Ltd.	03112023	3 Nov 23	2 Nov 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1200906876	UAE Consultant Co., Ltd.	09112023	9 Nov 23	8 Nov 24	-
11	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04N09E15A01D3	21 Jun 21	21 Jun 24	-
12	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200636467	UAE Consultant Co., Ltd.	13112023	13 Nov 23	12 Nov 24	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1200906880	UAE Consultant Co., Ltd.	13112023	13 Nov 23	12 Nov 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
15	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 KWWV1R96	UAE Consultant Co.,Ltd.	21122023	21 Dec 23	20 Dec 24	-
16	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 RATFJBXS	UAE Consultant Co.,Ltd.	21122023	21 Dec 23	20 Dec 24	-
17	Standard Gas	Total Hydrocarbons	Linde	D824432	Linde	09042013	4 Aug 20	4 Aug 28	-
18	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11230	Calibration Laboratory Co.,Ltd	Q23117018	20 Oct 23	19 Oct 24	-
19	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Quest Technologies, Inc	QC-20 QOF110030	Innovative Instrument Co.,Ltd.	23-ACT-116	4 Aug 23	3 Aug 24	-
20	Sound Level Meter	$L_{Aeq,1hr}$ $L_{Aeq,24hrs}$ L_{Amax} L_{A90} เสียงรบกวน	Rion, Japan	NL-62 00130356	Innovative Instrument Co.,Ltd.	CP20230290EA	3 Jul 23	2 Jul 24	-
21	Sound Level Meter	$L_{Aeq,1hr}$ $L_{Aeq,24hrs}$ L_{Amax} L_{A90} เสียงรบกวน		NL-62 00130357	Innovative Instrument Co.,Ltd.	CP20230291EA	3 Jul 23	2 Jul 24	-

Certificate of Calibration

Calibration Certification Information			
Cal. Date: July 5, 2022	Rootsometer S/N: 438320	Ta: 297 °K	
Operator: Jim Tisch		Pa: 750.1 mm Hg	
Calibration Model #: G25A	Calibrator S/N: 1901		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3540	3.3	2.00
2	3	4	1	0.9650	6.4	4.00
3	5	6	1	0.8640	8.0	5.00
4	7	8	1	0.8200	8.9	5.50
5	9	10	1	0.6780	12.9	8.00

Data Tabulation					
Vstd (m3)	Qstd (x-axis)	$\sqrt{\Delta H \left(\frac{Pa}{Pstd} \right) \left(\frac{Tstd}{Ta} \right)}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\Delta H \left(\frac{Ta}{Pa} \right)}$ (y-axis)
0.9859	0.7281	1.4073	0.9956	0.7353	0.8899
0.9818	1.0174	1.9902	0.9915	1.0274	1.2585
0.9797	1.1339	2.2251	0.9893	1.1451	1.4071
0.9785	1.1933	2.3337	0.9881	1.2050	1.4757
0.9732	1.4354	2.8146	0.9828	1.4496	1.7798
QSTD		m= 1.98897	QA		m= 1.24546
		b= -0.03691			b= -0.02334
		r= 0.99996			r= 0.99996

Calculations			
Vstd=ΔVol((Pa-ΔP)/Pstd)(Tstd/Ta)		Va=ΔVol((Pa-ΔP)/Pa)	
Qstd=Vstd/ΔTime		Qa=Va/ΔTime	
For subsequent flow rate calculations:			
Qstd= 1/m (√ΔH (Pa Pstd) (Tstd Ta)) -b		Qa= 1/m (√ΔH (Ta/Pa)) -b	

Standard Conditions	
Tstd: 298.15 °K	
Pstd: 760 mm Hg	
Key	
ΔH: calibrator manometer reading (in H2O)	
ΔP: rootsmeter manometer reading (mm Hg)	
Ta: actual absolute temperature (°K)	
Pa: actual barometric pressure (mm Hg)	
b: intercept	
m: slope	

RECALIBRATION	
US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30	

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, OH 45002

www.tisch-env.com
TOLL FREE: (877)263-7610
(937)777-9009

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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.: 24P1250
Page: 1 of 2

Equipment : U Tube Manometer
Manufacturer: Dwyer
Model : 1221-36-W/M
Serial No.: -
ID No.: UAE.EFM.076/2666

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: 03 April 2024
Calibration Date: 10 April 2024

Reference: 2404-0118WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1007 mbar

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

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0176-23	12 Sep 2024
2.This result of calibration was made on requested at the point specified by customer.				
3.Scale and conversion factor is 1 kPa = 4.0146293 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), NSC-ONSC Accredited No, Calibration 0144				

Calibrated by : Suksan Khankaew
Issue Date : 17 April 2024

Approved Signatory :
[] Phalinee Prabpaipal
[] Sura Suwannasri
[✓] Attapol Panurach

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Cert.No.: 24P1250
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 Second Estimate)

Applied Pressure		UUC Indication		Error	
High-port side	Low-port side	ΔP			
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	5.05	-4.95	10.00	0.00	
12.00	6.05	-5.95	12.00	0.00	
14.00	7.05	-6.95	14.00	0.00	
16.00	8.10	-7.95	16.05	0.05	
18.00	9.10	-8.95	18.05	0.05	
20.00	10.10	-9.95	20.05	0.05	
22.00	11.10	-10.95	22.05	0.05	
24.00	12.10	-11.95	24.05	0.05	
26.00	13.15	-12.95	26.10	0.10	
28.00	14.15	-13.95	28.10	0.10	
30.00	15.20	-14.95	30.15	0.15	
32.00	16.20	-15.95	32.15	0.15	
34.00	17.20	-16.95	34.15	0.15	
35.50	18.00	-17.70	35.70	0.20	

The uncertainty of measurement was ± 0.11 inH2O
* ΔP = High-port side - Low-port side
* UUC = Unit Under Calibration

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

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INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
719 MOO 13, SUBSISTANCEKORN 11 TAMBON BANG KAELE
AMPHOE BANG PHUENSAIT PRAKARN PROVINCE 10140 THAI AND
TEL: 0669-2116-5909-1 FAX: 0669-2116-5140



Certificate of Calibration

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

Certificate No : 23-AFM-203
Request No : Req-2023-1919

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 159822
ID : UAE-EFM-039/2581

Sensor Model : -
Sensor Serial Number : -

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 : 7 September 2023
Calibration Date : 27 September 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	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDL0651082	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 :
Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By :
Mr. Paiti Mathavorn
Calibration Engineer Supervisor
Issue Date : 27 September 2023

Certificate No : 23-APM-203
Request No : Req-2023-1919

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.90	100.64	14.58	14.50	-0.08	0.20
24.90	100.64	15.06	15.00	-0.06	0.21
25.00	100.63	15.90	15.80	-0.10	0.22
24.90	100.63	16.78	16.67	-0.11	0.23
24.90	100.63	18.46	18.30	-0.16	0.26

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

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

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

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Calibration Note
UUC Adjustment : Not Adjust

Certificate No : 23-TPM-461
Request No : Req-2023-1919
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
Ta	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.1	-0.1	0.13
	40.040	40.0	0.0	0.13
	45.039	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
Tf	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.033	30.1	-0.1	0.13
	35.034	35.2	-0.2	0.13
	40.040	40.2	-0.2	0.13
	45.039	45.2	-0.2	0.13
	50.043	50.2	-0.2	0.13

End of Certificate

Calibrated By : 
Mr. Jirachet Jirachakorn

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
FM-708-TPM-01 Rev.01 Issue date 15/03/20

Certificate of Calibration

Certificate No : 23-TPM-461
Request No : Req-2023-1919
Customer
Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO., LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 159822
Resolution : 0.1 °C
ID Number : UAE.EFM.039/2561
Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 7 September 2023
Calibrated Date : 27 September 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, 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 : 
Mr. Noppadon Luangart
Technical Manager
Issue Date : 27 September 2023

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3880-24 FAX: 0-2710-9484



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 : 2305-0919WSG
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Atmospheric Pressure : 1007 mbar

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

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

Procedure used : The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to 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] Atapol Panurech

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the **เอกสารไม่ควบคุม**
B 0316959



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

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

Range: 960 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	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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a 1165505



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10258
TEL. 0-2717-3000-34 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023
to 06 June 2023

Reference: 2305-0919WSC

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-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	23105	15 Mar 2024

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

3. This Certificate is traceable to the International System of Unit 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:

[Signature]
Chakrit W...
Ponthippa Tamayakul
Viporn Tantiyawutti

เอกสารไม่ควบคุม
B 0316274



Cert. No.: 23H1200
Page: 2 of 2

Result of Calibration:-

Function: Humidity Measurement

Before Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:-

Function: Humidity Measurement

After Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:-

Function: Temperature Measurement

Without Adjustment

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

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

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a 1165295



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.uaconsultant.com E-mail: uae@uaconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date: Nov 13, 2023

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

Standard Gas Concentration

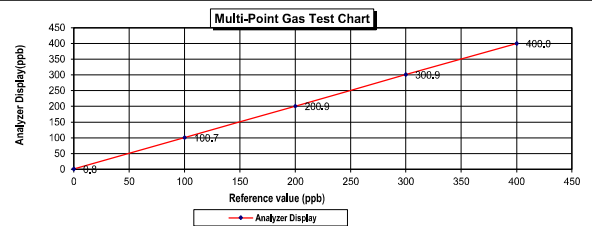
Sulphur Dioxide (SO ₂)	44.68	PPM
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	984.8	PPM
Cylinder No.:	EB0143262	
Expiration Date:	Jun 21, 2024	

Dilutor Detail

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

Multi-point gas test data

	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.8	0.80	0.80
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.9	0.45	0.45
Level 4	60.00%	300.0	300.9	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark:	Measuring Range	500.0 ppb	Average Difference (%)	0.45	
	Acceptable Limit \pm 5%				



Calculated by: [Signature]
.....13...../.....Nov...../.....2023

Calculated by: [Signature]
.....13...../.....Nov...../.....2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 1, 2023

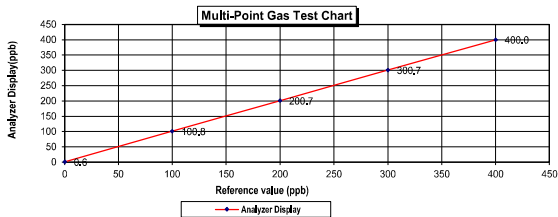
Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : CM19050149

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

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.60	0.60
Level 2	20.00%	100.0	0.80	0.79	0.79
Level 3	40.00%	200.0	0.70	0.35	0.35
Level 4	60.00%	300.0	0.70	0.23	0.23
Level 5	80.00%	400.0	0.00	0.00	0.00

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



Calculate by

01/Nov/2023

เอกสารไม่ควบคุม

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,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
(Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals)

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

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708008	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	DS85025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423836102	CC505981	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14080119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Nov 15, 2025

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 8700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 8700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 8700 AHR0801333 NO2	FTIR	Jun 03, 2021
Nicolet 8700 AHR0801333 SO2	FTIR	Jun 03, 2021

Triad 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 [redacted] and does not conclude the test report.

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

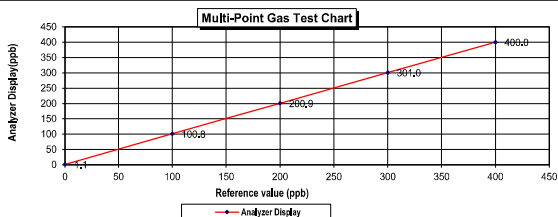
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906875

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM	Model :	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

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	1.1	1.10	1.10
Level 2	20.00%	100.0	0.80	0.79	0.79
Level 3	40.00%	200.0	0.90	0.45	0.45
Level 4	60.00%	300.0	1.00	0.33	0.33
Level 5	80.00%	400.0	0.00	0.00	0.00

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



Calculate by

03/Nov/2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 9, 2023

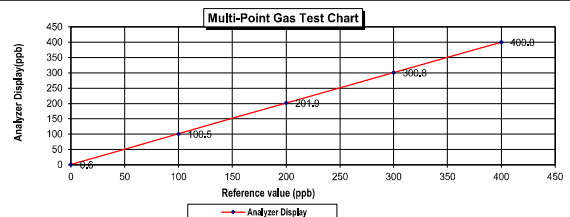
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : 1200906876

Standard Gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68 PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94 PPM	Model :	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

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.6	0.60	0.60
Level 2	20.00%	100.0	0.50	0.50	0.50
Level 3	40.00%	200.0	1.90	0.94	0.94
Level 4	60.00%	300.0	0.80	0.27	0.27
Level 5	80.00%	400.0	0.00	0.00	0.00

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



Calculate by

09/Nov/2023

เอกสารไม่ควบคุม

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600R-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 mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.58 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423836102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



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

Approved for Release



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : 1200636467

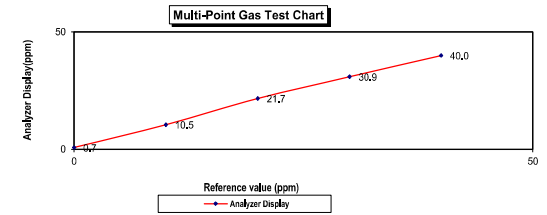
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.68 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO)	45.94 PPM Model : 146i
Methane (CH ₄)	- PPM Serial Number : 1180540071
Carbon Monoxide (CO)	984.8 PPM
Cylinder No. :	EB0143262
Expiration Date :	Jun 20, 2024

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.7	0.7	0.7
Level 2	20.00%	10.0	10.5	0.5	4.8
Level 3	40.00%	20.0	21.7	1.7	7.8
Level 4	60.00%	30.0	30.9	0.9	2.9
Level 5	80.00%	40.0	40.0	0.0	0.0

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

Average Difference (%) 3.24



Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

Equipment : Gas Analyzer (CO) Model : 481
Manufacturer : Thermo Scientific Serial Number : 1200906880

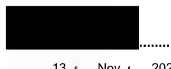
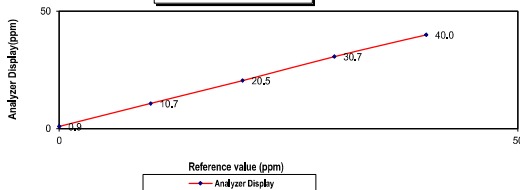
Standard Gas Concentration	Dilutor Detail
Sulphur Dioxide (SO ₂)	44.68 PPM Manufacturer : Thermo Scientific
Nitric Oxide (NO)	45.94 PPM Model : 146i
Methane (CH ₄)	- PPM Serial Number : 1180540071
Carbon Monoxide (CO)	984.8 PPM
Cylinder No. :	EB0143262
Expiration Date :	Jun 20, 2024

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.9	0.9	0.9
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0

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

Multi-Point Gas Test Chart



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



เอกสารไม่ควบคุม

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เอกสารไม่ควบคุม

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: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600R-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 mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
NITRIC OXIDE	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	08/14/2021, 08/21/2021
SULFUR DIOXIDE	45.00 PPM	44.58 PPM	G1	+/- 1.0% NIST Traceable	08/14/2021, 08/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	08/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708098	48.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423836102	CC505681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025

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

Triad Data Available Upon Request

NOTES: PO #5221002807
GROSS WT: 28.40kg
NET WT: 4.73kg



MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer **Model** : APHA-370
Manufacturer : HORIBA **Serial Number** : KWVV1R96

Standard Gas Concentration

Sulphur Dioxide (SO₂) : - PPM
Nitric Oxide (NO) : - PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

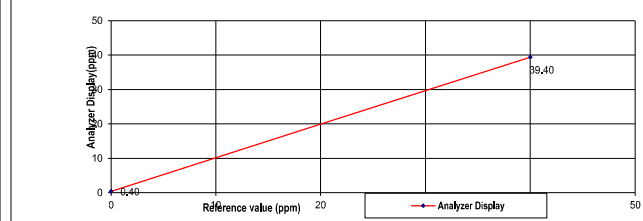
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.40	0.40	0.40
Level 2	80.00%	40.00	39.40	-0.60	-1.52
Remark : Measuring Range	50.00 ppm			Average Difference (%)	0.96

:Acceptable Limit \pm 5%

Multi-Point Gas Test Chart



21/...../.....2023

.....22/.....Dec.....2023

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เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Dec 21, 2023

Equipment : Hydrocarbon Analyzer **Model** : APHA-370
Manufacturer : HORIBA **Serial Number** : RATFJBXS

Standard Gas Concentration

Sulphur Dioxide (SO₂) : - PPM
Nitric Oxide (NO) : - PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail

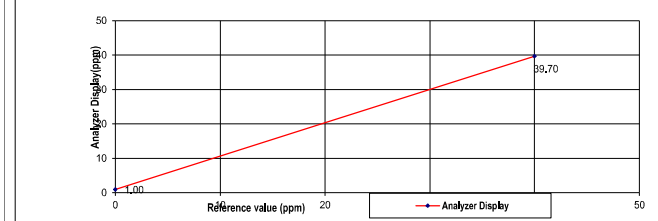
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	1.00	1.00	1.00
Level 2	80.00%	40.00	39.70	-0.30	-0.76
Remark : Measuring Range	50.00 ppm			Average Difference (%)	0.88

:Acceptable Limit \pm 5%

Multi-Point Gas Test Chart



21/...../.....2023

.....22/.....Dec.....2023

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เอกสารไม่ควบคุม



Certificate Of Analysis
Special Gases Mixture

Customer Details
Name: United Analyst & Engineering Co., Ltd.
Address: 3 Soi Udomsuk 41, Sukhumvit Rd., Bang Chak, Khet Phra Khanong, Bangkok 10260
Customer Tag No.:

Certificate Details
Number: 3384/20
Date of Issue: 4-Aug-2020
Expiry date: 4-Aug-2028
Material Details
Production Order: 90161442
Material Code: 400400-AL-34
Cylinder No.: D824412
Gas content: 6.60 M³
Filling pressure: 137.0 bar
Valve: CGA 570 BRASS
Cylinder Owner: LINDE
Cylinder Size: 50L

Laboratory Report
Component
Methane in Air
Nominal Concentration
40.0 ppm
Analysis Result
39.8 ppm
Uncertainty
 \pm 1% relative
Method of Analysis
(6) FID-312
Assay Date
4-Aug-2020

Reference Standard
Methane in Nitrogen
Reference Standard used in Assay
Cylinder number: 2539956
Concentration: 49.25 \pm 0.39 ppm
Expiry date: 4-Oct-2028

Instrument/Make/Model
FID Spectrometers Nicolet 550
Analytical Instruments used in Assay
Analytical Principle: FID-CH4
Last Multi-point Calibration: 4-Aug-2020

Recommend usage condition
Minimum utilization: 5% of actual content or before expiry date whichever comes first.
Storage condition: Keep in well ventilation and secure area.

Comments
When rendering, please quote the material number

Note:
1. All results expressed in this report are on made/into basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol (EPA-800/9-12/531) for the Assay and Certification of Gascon Calibration Standards using gravimetric (G) and volumetric (V) methods.
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to National Standard of Mass or other recognized national metrology institutes.
3. (1) Gas (Thermogravimetry), (2) Gravimetric Oxygen Analyser, (3) Electrochemical Oxygen Analyser, (4) Electrochemical Methane Analyser, (5) Total Hydrocarbon Analyser, (6) Other - Specified

Sukanya Panyasontorn
Signatory for and on behalf of Linde (Thailand) Public Company Limited

Linde (Thailand) Public Company Limited
17th Floor, Bangkok Tower 6, 17th Floor 14, Bangkok Tower 6, 17th Floor, Bangkok
Bangkok, Thailand 10110 Tel: (66) 2308-4700 Fax: (66) 2308-4333
Bangkok Head: 103 Moo 3, Bangpakong, Bangkok 10110
Bangkok, Thailand Tel: (66) 3630-470-470 Fax: (66) 3630-470-470



CALIBRATION LABORATORY CO., LTD.

210-11-14, 55 Soi Prasert Manut 29 Yaek 4, Prasert Manut Rd., Ladphras, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: sales@cali-lab.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A3301
SERIAL NO. : UMI11230/UMI11230
CLID. NO. : 251701315
JOB CONTROL NO. : 231019117018

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 19 October 2023 **DATE OF ISSUED** : 25 October 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
25 October 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23117018
F3-011-04/01-12

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เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



ANAB
ANSI National Accreditation Board
ACCREDITED
CALIBRATION LABORATORY
NVLAP 0103

เอกสารไม่ควบคุม

Certificate No : 23-ACT-116
Request No : Req-2023-1545

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	94.00	0.00	-	-	0.13	0.25
114 dB / 1000 Hz	113.90	-0.10	-	-	0.13	0.25
94 dB / 250 Hz	94.08	0.08	-	-	0.13	0.25
114 dB / 250 Hz	114.09	0.09	-	-	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	999.39	0.06	-	-	0.01	0.70
114 dB / 1000 Hz	999.35	0.06	-	-	0.01	0.70
94 dB / 250 Hz	250.74	0.30	-	-	0.01	0.70
114 dB / 250 Hz	250.72	0.29	-	-	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	0.25	-	0.40	2.5
114 dB / 1000 Hz	0.21	-	0.40	2.5
94 dB / 250 Hz	0.49	-	0.40	2.5
114 dB / 250 Hz	0.45	-	0.40	2.5

Note :

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

End of Calibration

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

เอกสารไม่ควบคุม



ELECTRICAL AND ELECTRONICS INSTITUTE
FOUNDATION FOR INDUSTRIAL DEVELOPMENT
975 Moo 4, Bangsoo Industrial Estate, Soi 8, Sukhumvit Road km 37,
Phraek Sa, Mueang Samut Prakan, Samut Prakan 10280
Tel: +66 2709 4860 Fax: +66 2324 0917



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 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 Kunhakorn

Approved by:

(Mr. Sittichai Sittichaiyong) Group Manager

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

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

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เอกสารไม่ควบคุม



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	U89038	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.

เอกสารไม่ควบคุม



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

เอกสารไม่ควบคุม

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

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เอกสารไม่ควบคุม

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
LAeq	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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เอกสารไม่ควบคุม

Certificate No.: CP20230290EA

Calibration Report

Function : 10. Overload indication

Positive one-half cycle	Negative one-half cycle	Deviated value (dB)	Acceptance limits (dB)
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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เอกสารไม่ควบคุม

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 (Preamp)lifier)
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: 
(Mr. Sittichai Swaksuriyawong)
Group Manager

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

Page 1 of 6

เอกสารไม่ควบคุม

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 CH20220080EA	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.

เอกสารไม่ควบคุม

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

เอกสารไม่ควบคุม

Certificate No.: CP20230291EA

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

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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
	200	120.0	0.0	±0.5
LAE	2	100.0	0.0	+1.0; -1.5
	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 --

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11 May 24	10 May 25
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
3	Analytical Balance	SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25
4	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	23TM1176	21 Jul 23	20 Jul 24
5	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21 Feb 24	20 Feb 25
6	Hot Air Oven	TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B212,0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
7	Kjelttec System Distilling Unit	TOTAL KJELDAHL NITROGEN	Foss Tecator (Labtec)	KT200 / 91790524	FOSS South East Asia	9810	8 Feb 24	7 Feb 25
8	Kjelttec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	Kjelttec 8100 / 91889052	FOSS South East Asia	9807	8 Feb 24	7 Feb 25
9	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0020	technology promotion association (thailand-japan)	24CH38	12 Jan 24	10 Jan 25

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



Certificate of Calibration

Cert.No.: 24MM292
Page.: 1 of 3

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S/FACT
Serial No. : 1129361010
ID No. : UAE.WAS.002/2552
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Sol Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room (108)
Received order : 11 May 2024
Calibration Date : 11 May 2024
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by :
Approved by :
() Ponpan Palpim
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-1
Procedure used :-

Cert.No.: 24MM292
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0013-24	25 Jan 2026

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

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
100	100.0000	0.0000	0.19	2.03
200	200.0006	-0.0006	0.30	2

After Adjustment :

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

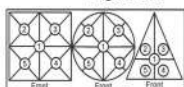
Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00007
200	0.00005

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-1
Result of calibration

Cert.No.: 24MM292
Page: 3 of 3



Maximum difference between
off-center and central loading
(g)
0.0001

2. Effect of off center loading

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

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
0.01	0.0100	0.0000	0.15	2.13
0.05	0.0500	0.0000	0.15	2.13
0.1	0.1000	0.0000	0.15	2.13
0.5	0.5000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
50	49.9999	+0.0001	0.17	2.06
100	99.9999	+0.0001	0.19	2.03
150	149.9998	+0.0002	0.29	2
200	199.9990	+0.0010	0.30	2

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

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เอกสารไม่ควบคุม



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



Calibration Certificate

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

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Order No.: 2402283
Operation No.: 2402283-002
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

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

Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210683394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

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

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFL8TH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

4. This certification is certified only for the instrument we calibrated.

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

Calibration Results:

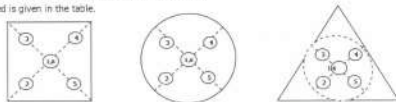
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
160	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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

2008 35 ซอย 36 ถนนสุขุมวิท แขวงคลองวัฒนา เขตวัฒนา กรุงเทพมหานคร 10110 ประเทศไทย
2008 Soi 36, Asoin Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210683394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024 **Page 3 of 4**

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.001003	0.00101	-0.00001	0.0000089	2.00
0.005	0.005003	0.005000	0.000003	0.0000092	2.00
0.01	0.010003	0.010000	0.000003	0.0000089	2.00
0.05	0.049996	0.050000	0.000004	0.0000096	2.00
0.1	0.100011	0.100000	0.000011	0.000011	2.00
0.5	0.500016	0.500001	0.000015	0.000014	2.00
1	1.000003	1.000002	-0.000001	0.000016	2.00
2	2.000023	2.000001	-0.000022	0.000017	2.00
5	5.000017	5.000002	-0.000015	0.000020	2.00
10	10.000009	10.000000	-0.000009	0.000026	2.00
20	20.000031	20.000000	-0.000031	0.000037	2.00
30	30.000049	30.000001	-0.000048	0.000050	2.00
50	50.000028	50.000002	-0.000026	0.000068	2.00
80	80.000068	80.000002	-0.000066	0.00011	2.00

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

2008 35 ซอย 36 ถนนสุขุมวิท แขวงคลองวัฒนา เขตวัฒนา กรุงเทพมหานคร 10110 ประเทศไทย
2008 Soi 36, Asoin Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR2050U
Serial No.: C210683394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

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

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.0001	0.0000	0.00015	2.00
100	100.00006	100.0001	0.0000	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00016	2.00
120	120.00009	120.0000	-0.0001	0.00017	2.00
130	130.00010	130.0000	-0.0001	0.00019	2.00
140	140.00014	140.0000	-0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0002	0.0000	0.00028	2.00

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

----- End -----

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

2008 35 ซอย 36 ถนนสุขุมวิท แขวงคลองวัฒนา เขตวัฒนา กรุงเทพมหานคร 10110 ประเทศไทย
2008 Soi 36, Asoin Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Calibration Certificate

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

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR2050U

Serial No.: C009071872

ID No.: UAE.WAO.012/2563

Order No.: 2402283

Operation No.: 2402283-001

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

Approved by (Mr. [Signature])
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

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

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

2008 35 ซอย 36 ถนนสุขุมวิท แขวงคลองวัฒนา เขตวัฒนา กรุงเทพมหานคร 10110 ประเทศไทย
2008 Soi 36, Asoin Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand
Tel: +66(0) 2422 8568 Fax: +66(0) 2422 8545



Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 2 of 4

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

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

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

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

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H3	NFI.BTH 016/23	Quality Return	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

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

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

Calibration Results:

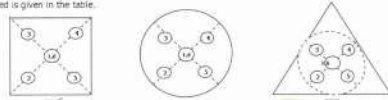
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000052
80	0.0000063
100	0.000048
200	0.000053

2. Off-Center Error:

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

The balance reading obtained is given in the table.



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

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

เอกสารไม่ควบคุม



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Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
Unloaded	0.000000	0.000000	0.000000	0.0000088	2.00
0.001	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000068	80.00005	0.00002	0.00011	2.00

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

เอกสารไม่ควบคุม



nfi.cdn

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C09071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

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

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor k
90	90.00010	90.0000	0.0001	0.00015	2.00
100	100.00006	100.0000	0.0001	0.00015	2.00
110	110.00007	110.0001	0.0000	0.00017	2.00
120	120.00009	120.0000	0.0001	0.00018	2.00
130	130.00010	130.0000	0.0001	0.00019	2.00
140	140.00014	140.0000	0.0001	0.00020	2.00
150	150.00009	150.0001	0.0000	0.00020	2.00
160	160.00010	160.0001	0.0000	0.00022	2.00
170	170.00012	170.0001	0.0000	0.00023	2.00
200	200.00016	200.0000	0.0002	0.00028	2.00

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

----- End -----

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

เอกสารไม่ควบคุม



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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: 0-2717-3000-29 FAX: 0-2719-9484



Cert. No.: 23TM1176
Page: 1 of 3

Certificate of Calibration

Equipment: BOD Incubator
Manufacturer: Arco
Model: UC4-1320
Serial No.: -
ID No.: UAE.WAO.002/2550
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: 21 July 2023
Calibration Date: 21 July 2023
Ambient Temperature: (26 ± 10) °C
Relative Humidity: (50 ± 30) %
Calibrated by: Khit Ruttanaprapachai
Approved by:
() Pornthippa Tameyakul
() Malee Butkruea
(x) Suwit Imjai
Issue Date: 10 August 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



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2307-0615OC-1
Procedure Used :-

Cert. No.: 23TM1176
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

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

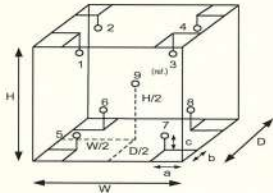
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	28
REL.Humid. (%)	65	67
AC Supply (Volt)	222	223

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

Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.53 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
	Capacity = 0.76 m ³

เอกสารไม่



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2307-0615OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM1176
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	19.7	0.48	0.55	1.2	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.048	20.200	20.072	19.768	19.985	20.074	19.861	19.827	19.977	0.74

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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เอกสารไม่



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

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

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 20 February 2024
Test Date : 21 February 2024
Reference : 2402-0629DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirinthean

Approved by :

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

Issue Date : 22 February 2024

เอกสารไม่ควบคุม



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

Condition of this result of calibration

1. Reference Standard Instruments :

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

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

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 22B100125

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

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

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เอกสารไม่

Date: 8-9 Feb 2024

Customer: UAE

Address: BANGKOK

Instrument: KTF100

Serial: 91889052

Hours	Travel To Customer	Labour	Travel From Customer
Start	08:00	09:50	16:00
Finish	09:50	12:00	18:00

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

PO/Quote Number: If applicable

PMA Type: P055020 If applicable Contract No. If applicable

Details of Work / Test	Condition / Status
<p>PM KTF100</p> <p>- ตรวจวัด pH ของน้ำดื่ม</p> <p>- วัดค่า Alkalinity = 50 ± 50 mg</p> <p>- วัดค่า Conductivity = 0.000 ± 1.000 µS</p> <p>- วัดค่า Dissolved PM kit</p> <p>- Follow up PM ที่ตรวจวัด</p> <p>- ตรวจวัด pH ของน้ำดื่ม</p> <p>Display = 0.14</p> <p>Accuracy = 0.01</p>	<p>OK</p>

Part No.	Batch	Description	Qty
60031807	13-10-2023	PM kit 500/1000 12.00	1

I confirm this report is accurate and complete

Signed FOSS: [Signature]

Name: [Name]

Would you be willing to participate in a brief survey in order to tell us how we performed? Email: [Email]

เอกสารไม่ควบคุม



Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0F0026
ID No. : UAE.EFM.068/2564(EFM.pH.01/64)
Condition As-Received: Used Item
Received Date : 09 January 2024
Calibration Date : 11 January 2024
Reference : 2401-0219WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udumuk 41, Sukhumvit Road,
Bangchak, Phrakharong, 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 : 15 January 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0062454



Condition of this calibration result

1. Reference Standard Instrument : -

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

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	931959	01 Oct 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement	Coverage factor
	pH	mV	mV	(±mV)	k
pH Meter	4.00	177.48	177.6	0.058	2.00
S/N.: HA0F0026	7.00	0.00	0.2	0.058	2.00
	7.00	0.00	0.2	0.058	2.00
	10.00	-177.48	-177.2	0.058	2.00



Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode	4.008	4.01	171.6	0.0079	2.00
S/N.: -	6.986	7.01	-2.4	0.0093	2.00
	6.986	7.01	-2.2	0.0093	2.00
	9.997	10.00	-176.2	0.0095	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : -
Dimension of probe:
- Length : 104 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	25.001	25.0	-0.001	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
35.0	35.003	34.9	-0.103	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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ภาคผนวก จ

หนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์

ที่ อก ๐๓๑๐(๑)/ ๑ ๖ ๕๑ ๘



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๑๓ ธันวาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๖ พฤษภาคม ๒๕๖๖

ตามที่ขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท
แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์
จำนวน ๖ ราย ได้แก่

- | | |
|-----------------------------|---------------|
| ๑) นางสาวพรพิมล ประชาพันธุ์ | ทะเบียนเลขที่ |
| ๒) นายวีรภัทร บุญญาธิ | ทะเบียนเลขที่ |
| ๓) นางสาวณัฐชา แก้วภาพ | ทะเบียนเลขที่ |
| ๔) นายณิพนทล สุทธิ | ทะเบียนเลขที่ |
| ๕) นายสิทธิพล พรหมทองชัยบุญ | ทะเบียนเลขที่ |
| ๖) นางสาวนภัสพร การงานดี | ทะเบียนเลขที่ |

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ทันหน้าเว็บไซต์
กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประจักษ์ คำวงศ์)
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษทางอากาศ
ผู้ตรวจราชการมลพิษทางอากาศ กรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษทางอากาศ

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

ไปรษณีย์อิเล็กทรอนิกส์ sarabangcdw@mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๘ ๗ ๒ ๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๕ พฤษภาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๖ พฤษภาคม ๒๕๖๖

ตามที่ขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๕ ราย

๑) นางสาวสุวิภา เจริญชัยสมบัติ ทะเบียนเลขที่

๒) นายสุภกรรณ์ มาลัยทอง ทะเบียนเลขที่

๓) นางสาวอรอนงค์ คุณาพันธ์ชัย ทะเบียนเลขที่

๔) นางสาวอนงค์ ลาพรม ทะเบียนเลขที่

๕) นางสาวสุภาวดี จันทร์ประทีป ทะเบียนเลขที่

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

๑) นางสาววิภา ฝ้ายสิงห์ ทะเบียนเลขที่

๒) นางสาวเมธิพร สุทธิ ทะเบียนเลขที่

๓) นางสาวเพ็ญทิศา รอดทอง ทะเบียนเลขที่

๔) นางสาวณิชา แสงสว่าง ทะเบียนเลขที่

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ทันหน้าเว็บไซต์
กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประจักษ์ คำวงศ์)
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษทางอากาศ
ผู้ตรวจราชการมลพิษทางอากาศ กรมโรงงานอุตสาหกรรม

กองวิจัยและเฝ้าระวังมลพิษทางอากาศ

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

ไปรษณีย์อิเล็กทรอนิกส์ sarabangcdw@mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๖ ๐ ๒ ๘



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒๒ มีนาคม ๒๕๖๖

เรื่อง เปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๐ มกราคม ๒๕๖๖

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์
บริษัท ยูโนเด็ค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด จำนวน ๒ แผ่น

ตามที่ขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอคืนสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท
แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรและสารมลพิษที่วิเคราะห์
ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นายวิชญ์ สุวรรณวรา ทะเบียนเลขที่

๒) นายพิพัฒน์ สันตกุล ทะเบียนเลขที่

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย

๑) นางสาวอรุณ ประสานศรี ทะเบียนเลขที่

๒) นายพศุต เปี่ยมมิ่งม ทะเบียนเลขที่

๓) นายศุภกร สวนศรี ทะเบียนเลขที่

๔) นายศุภพล คุ้มแก้ว ทะเบียนเลขที่

๕) นายโชคชัย พุ่มไธวัล ทะเบียนเลขที่

๖) นายวรวิทย์ กลิ่นบ้านเกาะ ทะเบียนเลขที่

๗) นายธีรวัฒน์ ธรรมสุวรรณ ทะเบียนเลขที่

๘) นายบัณฑิต ทะเบียนเลขที่

๙) นางสาวณัฐดา พลนิกรกิจ ทะเบียนเลขที่

๑๐) นางสาวไพบร ทองบุญมี ทะเบียนเลขที่

๑๑) นางสาวพรธิชา ขจรเบญจกุล ทะเบียนเลขที่

๓. ให้เพิ่มขอบข่ายสารมลพิษที่วิเคราะห์ในใบขึ้นทะเบียนด้วย



UAE

อนึ่ง...

อนึ่ง หนังสือฉบับนี้จะหมดอายุพร้อมหนังสือต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
ที่ อก ๐๓๑๐(๑)/๘๗๘๘ ลงวันที่ ๕ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ทันหน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประจักษ์ คำวงศ์)
ผู้อำนวยการกองวิจัยและเฝ้าระวังมลพิษทางอากาศ
ผู้ตรวจราชการมลพิษทางอากาศ กรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเฝ้าระวังมลพิษทางอากาศ

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕ โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

ไปรษณีย์อิเล็กทรอนิกส์ sarabangcdw@mail.go.th



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



UAE

อนึ่ง...

เอกสารแนบท้ายหนังสือเปลี่ยนแปลงบุคลากรและสารเคมีที่วิเคราะห์
บริษัท ยูนิค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ว-๑๔๕
ที่ อก ๐๓๑๐(๑)/ ๖ ๐ ๒ ๘ ลงวันที่ ๒๒ มีนาคม ๒๕๖๖
ขอข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๖ รายการ

ดิน จำนวน 16 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Benzene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
2	Carbon tetrachloride	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
3	1,2-Dichloroethane	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
4	1,1-Dichloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
5	cis-1,2-Dichloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
6	trans-1,2-Dichloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
7	Ethylbenzene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
8	Methylene chloride	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
9	Styrene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
10	Tetrachloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
11	Toluene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
12	Trichloroethylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
13	m-Xylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
14	o-Xylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
15	p-Xylene	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)
16	Xylene (Total)	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method (1,2)

เอกสารอ้างอิง...

เอกสารอ้างอิง

1. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis. SW-846 Method 5021A, 2014.
2. United States Environmental Protection Agency. Test Methods for Evaluation Solid Waste Physical/Chemical Methods. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW-846 Method 8260D, 2018.

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ดำเนินธุรกิจ

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและประเมินผลปฏิบัติการ ภายใต้ระบบไอเอสซีวี 9001:2015 และระบบไอเอสซีวี 17025:2017



ที่ อก ๐๓๑๐(๑)/ ๓ ๕ ๕ ๕ ๓

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งสุพรรณ
เขตราชเทวี กรุงเทพฯ ๑๐๑๐๐

๒๕ ตุลาคม ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูนิค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และนักวิเคราะห์ของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๑๘ ตุลาคม ๒๕๖๕

ตามที่หนังสือที่อ้างถึง บริษัท ยูนิค แอนาไลติกส์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ว-๑๔๕ ตามที่แจ้งเลขที่ ๓ ขยยอุตสาหกรรม ๕๑ ถนนสุขุมวิท แขวงบางจาก
เขตพรหมินทร์ กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้อยกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๔ ราย

๑) นายสุธรรม แก้วช้อนอก ทะเบียนเลข

๒) นายกันตพงศ์ บุญพร ทะเบียนเลข

๓) นายกฤตพล พงศ์สัทพร ทะเบียนเลข

๔) นางสาวธัญลักษณ์ อนิโชติกาญจนกร ทะเบียนเลข

๒. ให้เพิ่มผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นายกันตพงศ์ บุญพร ทะเบียนเลข

๒) นายสุธรรม แก้วช้อนอก ทะเบียนเลข

๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๒ ราย

๑) นายชินวัฒน์ หอยสังข์ ทะเบียนเลข

๒) นายประพันธ์ แก้วภาคำ ทะเบียนเลข

๓) นายกิตติศักดิ์ มุสิกเกตุ ทะเบียนเลข

๔) นายคุณานนท์ สุทธากานนท์ ทะเบียนเลข

๕) นายชาญณรงค์ อัสสอย ทะเบียนเลข

๖) นางสาวจิตราภัส ศรีวรรณ ทะเบียนเลข

๗) นายสุจิตต์ ไปสินเงิน ทะเบียนเลข

๘) นายเจษฎา ช่างศรี ทะเบียนเลข

๙) นายรชต เหมะสุรินทร์ ทะเบียนเลข

๑๐) นายสุวิทย์ ชุมชัยดี ทะเบียนเลข

๑๑) นายสุวิทย์ หล้าไท ทะเบียนเลข

๑๒) นายชัย บัวศรี ทะเบียนเลข

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อนึ่ง หนังสือฉบับนี้...

- ๒ -

อนึ่ง หนังสือฉบับนี้จะมีผลต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๑๐(๑)/๑๔๗๕ ลงวันที่ ๕ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๘ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ทันทีเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นายประสม ตารงพร)
ผู้อำนวยการกองวิจัยและประเมินผลพิษโรงงาน
ปฏิบัติการตามแผนอำนวยการกรมโรงงานอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและประเมินผลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและประเมินผลปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๑๗

ไปรษณีย์อิเล็กทรอนิกส์ sarabang@iw.mail.go.th

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ดำเนินธุรกิจ



"อุตสาหกรรมก้าวไกล ประเทศไทยก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๑๒ ๒๕๖๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๐ ๑ กันยายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูนิค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอใบสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๒๖ สิงหาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูนิค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๘ ราย

๑) นายปริศา ไชยภูมิกุล ทะเบียนเลขที่

๒) นายปิยะธิดา ศรีสุริยา ทะเบียนเลขที่

๓) นายธีรเมธ สุทธิ ทะเบียนเลขที่

๔) นางสาวศิริวรรณ ชอนหา ทะเบียนเลขที่

๕) นายศักดิ์สิทธิ์ เกียรติ ทะเบียนเลขที่

๖) นางสาวอิตติวณิช โพธิ์พันธ์ ทะเบียนเลขที่

๗) นางสาวกมลวรรณ เจริญทรัพย์ ทะเบียนเลขที่

๘) นางสาวจันทร์จิรา ประกอบทรัพย์ ทะเบียนเลขที่

๒. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๑ ราย

๑) นางสาวนาคา หาญในเมือง ทะเบียนเลขที่

๒) นางสาวพิมพ์วรรณ สิงหา ทะเบียนเลขที่

๓) นายนิพนธ์วัฒน์ วงศ์คำ ทะเบียนเลขที่

๔) นายประพันธ์ฤทธิ์ เกื้อกานา ทะเบียนเลขที่

๕) นางสาวกมลวิภา ลำเลิศ ทะเบียนเลขที่

๖) นางสาวกนกพร ชื่นนุกุล ทะเบียนเลขที่

๗) นางสาวเบญญา มอนกุล ทะเบียนเลขที่

๘) นายสมรพล อมาลักษณ์ ทะเบียนเลขที่

๙) นางสาวทิพย์พร ทองขาว ทะเบียนเลขที่

๑๐) นางสาวนิชากร สุขชาติกุล ทะเบียนเลขที่

๑๑) นางสาววิมลวรรณ คำตัน ทะเบียนเลขที่

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CONSULTANT COMPANY LIMITED

อนึ่ง หนังสือฉบับนี้...

- ๒ -

อนึ่ง หนังสือฉบับนี้จะมีผลใช้บังคับเมื่อได้รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๑๐(๑)/๑๕๕๕ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๕ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางจินดา นาคะศรีวัน)

ผู้อำนวยการกองส่งเสริมและสนับสนุนโรงงาน
ปฏิบัติการตามแผนและโครงการอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๖ ๖๓๒๒ ต่อ ๒๕๐๓-๕

โทรสาร ๐ ๒๕๓๖ ๖๓๒๒ ต่อ ๒๕๐๓

ไปรษณีย์อิเล็กทรอนิกส์ sarabak@dlw.mail.go.th

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อำนาจถูกต้อง



"อุตสาหกรรมก้าวไกล ประสิทธิภาพก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"



ที่ อก ๐๓๑๐(๑)/ ๔๗ ๘ ๕



กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท
เขตราชเทวี กรุงเทพฯ ๑๐๕๐๐

๒ ๑ เมษายน ๒๕๖๕

เรื่อง เปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์

เรียน กรรมการผู้จัดการ บริษัท ยูนิค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอใบสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ มีนาคม ๒๕๖๕

ตามหนังสือที่อ้างถึง บริษัท ยูนิค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
ห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๕๕ สถานที่ตั้งเลขที่ ๓ ซอยอุดมสุข ๔๑ ถนนสุขุมวิท แขวงบางจาก
เขตพระโขนง กรุงเทพมหานคร ขอเปลี่ยนแปลงบุคลากรของห้องปฏิบัติการวิเคราะห์ ความละเอียดแจ้งแล้ว นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว มีความเห็นดังนี้

๑. ให้ออกเลิกบุคลากรของห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นางณิศา ภูมิไธย ทะเบียนเลขที่

๒) นางสาวกมลวรรณ คงคำ ทะเบียนเลขที่

๒. ให้ออกเลิกเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นางสาวศิริพร อภิการวัฒน์ ทะเบียนเลขที่

๒) นางสาวพรวิภา กาสิณุ ทะเบียนเลขที่

๓. ให้เพิ่มเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๒ ราย

๑) นางสาวณิชากร ชื่นนุกุล ทะเบียนเลขที่

๒) นางสาวจันทร์จิรา ประกอบทรัพย์ ทะเบียนเลขที่

อนึ่ง หนังสือฉบับนี้จะมีผลใช้บังคับเมื่อได้รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
ที่ อก ๐๓๑๐(๑)/๑๕๕๕ ลงวันที่ ๙ กุมภาพันธ์ ๒๕๖๕ คือในวันที่ ๒ กุมภาพันธ์ ๒๕๖๕ ทั้งนี้ สามารถยื่นคำขอ
ผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบหนังสือฉบับนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

(นางจินดา นาคะศรีวัน)

ผู้อำนวยการกองส่งเสริมและสนับสนุนโรงงาน
ปฏิบัติการตามแผนและโครงการอุตสาหกรรม



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๖ ๖๓๒๒ ต่อ ๒๕๐๓-๕ โทรสาร ๐ ๒๕๓๖ ๖๓๒๒ ต่อ ๒๕๐๓

ไปรษณีย์อิเล็กทรอนิกส์ sarabak@dlw.mail.go.th



"อุตสาหกรรมก้าวไกล ประสิทธิภาพก้าวหน้า ร่วมกันพัฒนา อุตสาหกรรมสีเขียว"





เรื่อง คัดสรรผู้รับจ้างรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูไนเต็ แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และชนิดสารเคมีของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๒๓ ธันวาคม ๒๕๖๔

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย

๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย

๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามหนังสือที่อ้างถึง บริษัท ยูไนเต็ แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ขอต่ออายุห้องขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๔๔ สดวที่ ๑๖๖๗๗๗ ที่ ๓ ขออายุเลข ๔๔ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูไนเต็ แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด ขอต่ออายุห้องขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย ตามสิ่งที่ส่งมาด้วย ๒

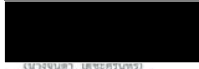
ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย น้ำดื่ม อากาศเสีย สิ่งปฏิกูล หรือวัสดุที่ไม่ได้ชื่อ และอื่น ๆ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๕ หากประสงค์จะต่ออายุหนังสือ รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อ กรมโรงงานอุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นสุดของหนังสือขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบมา

ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้าเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบมา

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



สำนักงานวิศวกรรม
และ
การวิเคราะห์และ
การตรวจสอบ
จำกัด
UNITE ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

กองวิจัยและพัฒนาวิศวกรรม

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบและประเมินห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๖๒ ต่อ ๑๐๑๔-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๖๒ ต่อ ๑๐๑๕

ไปรษณีย์อิเล็กทรอนิกส์ saraban@dw.go.th

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูไนเต็ แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๔๔

ที่ อก ๐๓๑๐(๑)/ ๑๘๗๗

ลงวันที่ ๐ ๙ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์ จำนวน ๔๐ ราย

๑) นางสาวสุพรรณ ภัทรวีกุล

๒) นายณรงค์ นิพัทธ์

๓) นางสาวนันทิศา บุญไชย

๔) นางปิยะพัชร สุทธิประสิทธิ์

๕) นางมาลินี วัฒนชัย

๖) นางสาวบุญธรรม วิริยะชัย

๗) นายพรพัฒน์ วงศ์สุริยชัย

๘) นางสาววิมลวรรณ บุญลา

๙) นายสุวิทย์ จอดอก

๑๐) นางสาวโชติกา สมบูรณ์

๑๑) นางสาวบุษกร เลิศกาญจน์

๑๒) นางสาววิไลลักษณ์ ศรีสุข

๑๓) นางสาวปวีณา จรัสเชิดศิริ

๑๔) นายศิลา บรรจงใจ

๑๕) นายปริญญ์ วัฒนชัย

๑๖) นายธีรวัฒน์ ชะเม็ง

๑๗) นางสาวศิริพร ศรีประสิทธิ์

๑๘) นางสาวศิริวิทย์ วิริยะ

๑๙) นางสาวพรพรรณ สุราษฎร์

๒๐) นายสุรเชษฐ์ พานิชย์เลิศ

๒๑) นายธีรวัฒน์ แสงสวัสดิ์

๒๒) นายเสกสรรค์ ปะทะจันทร์

๒๓) นางสาวศิริกานต์ ศรีกุลสิทธิ์

๒๔) นางสาวเจษฎาจันทร์ ทำเลียด

๒๕) นางสาวสุพรรณ คงทอง

๒๖) นางสาวกรรณ พัดธงชัย

๒๗) นายวิรัช ไม้แก้ว

๒๘) นายวิรัชพงศ์ เทพคุณศรี

๒๙) นายอนุชา สวัสดิ์

๓๐) นายกรวิทย์ เจริญศิริกุล

๓๑) นางสาวอริกา รุ่งสวัสดิ์

๓๒) นางสาวสุพรรณ คงคำ

๓๓) นายสุทธิพงษ์ อุดมจันทร์

๓๔) นางสาวพนิดา ยืนยงค์

๓๕) นางสาวพรพรรณ สมบูรณ์

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๓๖) นายสุกัญญา...

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท ยูไนเต็ แอนนาลิสต์ แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๔๔

ที่ อก ๐๓๑๐(๑)/ ๑๘๗๗

ลงวันที่ ๐ ๙ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๐๖ ราย

๑) นายสุกัญญา พันสิงห์

๒) นางสาวธรรมา แก้วชัยอนอก

๓) นายพิรุณ เจริญผล

๔) นางสาววิไลลักษณ์ เกื้อสง

๕) นายสมชาติ อุทุมรัตน์

๖) นางสาวปัทมากรณ์ ทอมแก้ว

๗) นางสาวกัญญา สมพงษ์

๘) นายอรรถพร เทพทอง

๙) นางสาวธรรมากรณ์ พุทธิ

๑๐) นางสาววรรณิ สายบุญเรือน

๑๑) นายฤทธิชัย นามศิริ

๑๒) นางสาวอภรณ์ อ่อนคง

๑๓) นายคิตติศักดิ์ ทรงจำรัส

๑๔) นางสาวอภิญญา บุญคง

๑๕) นางสาวพินิจ นวาทอง

๑๖) นายวิชัย สุวรรณราช

๑๗) นายอภิรักษ์ พ่วงดี

๑๘) นางมานิศา ปานใจ

๑๙) นายศุภพร ธนพิรุณ

๒๐) นางสาวกัญญา โมตา

๒๑) นางสาวเกวลิ สุทธิ

๒๒) นางสาวธนัญญา อภิสิทธิ์ปภา

๒๓) นายศิริพัชร จงแสงเกียรติ

๒๔) นางสาวสุภาวดี อินยาศิริ

๒๕) นายพงศ์เทพ เหล่าจรร

๒๖) นายวิชัย พันทุก

๒๗) นางสาวพัชรา ศิริพิศาล

๒๘) นางสาวเมธิกา เสือคำจันทร์

๒๙) นางกานต์พงศ์ บุญทอง

๓๐) นางสาวสุภา จรรย์ชัยสมปิต

๓๑) นายพนิต จงใจ

๓๒) นายพิรุณ บุญศิริ

๓๓) นายปริศา ไชยภูมิ

๓๔) นายธีรวัฒน์ เสือทอง

๓๕) นายปิยะชัย ศรีโรจน์

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๓๖) นายกนก...



สำนักงานวิศวกรรม
และ
การวิเคราะห์และ
การตรวจสอบ
จำกัด
UNITE ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

ลำดับ	สารเคมี	วิธีวิเคราะห์
36	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ⁽²⁾ 2) Soxhlet Extraction Method ⁽⁴⁾
37	pH	Electrometric Method ⁽⁴⁾
38	Phenols	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Distillation, Direct Photometric Method ⁽⁴⁾
39	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
40	Sulfide	1) Iodometric Method ⁽⁴⁾ 2) Methylene Blue Method ⁽⁴⁾
41	Temperature	Laboratory and Field Methods ⁽⁴⁾
42	Total Dissolved Solids	Dried at 180 °C ⁽⁴⁾
43	Total Kjeldahl Nitrogen	Semi-Micro-Kjeldahl Method ⁽⁴⁾
44	Total Suspended Solids	Dried at 103-105 °C ⁽⁴⁾
45	Trivalent Chromium	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
46	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

น้ำเค็ม จำนวน 126 รายการ

ลำดับ	สารเคมี	วิธีวิเคราะห์
1	Acenaphthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
2	Acetone	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
3	Aldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

4 Anthracene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
4	Anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
5	Antimony	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
8	Barium	1) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
9	Benzo(a)anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
10	Benzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
11	Benzo(b)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
12	Benzo(k)fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
13	Benzoic acid	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
14	Benzo(a)pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

15 Benzo(g,h,i)perylene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
16	Beryllium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
19	Bromodichloromethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
20	Bromoform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
21	Butanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
22	Butyl benzyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
23	Cadmium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
25	Carbon disulfide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
26	Carbon tetrachloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
27	Chlordane	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
29	Chlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

30 Chlorodibromomethane...

ลำดับ	สารเคมี	วิธีวิเคราะห์
30	Chlorodibromomethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
31	Chloroform	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
33	Chromium	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
34	Chromium (III)	1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ⁽⁴⁾
35	Chromium (VI)	1) Colorimetric Method ⁽⁴⁾ 2) Extraction, Air-Acetylene Flame Method ⁽⁴⁾
36	Chrysene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
37	Cyanide	Distillation, Colorimetric Method ⁽⁴⁾
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
39	DDD	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
40	DDE	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
41	DDT	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

42 Dibenz(a,h)anthracene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
42	Dibenz[a,h]anthracene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
43	Di-n-butyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
44	1,2-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
45	1,3-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
46	1,4-Dichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
47	3,3'-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
48	1,1-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
49	1,2-Dichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
50	1,1-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
51	cis-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
52	trans-1,2-Dichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
54	1,2-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
55	1,3-Dichloropropane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
56	1,3-Dichloropropene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
57	Dieldrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

58 Diethyl phthalate...

ลำดับ	สารเคมี	วิธีวิเคราะห์
58	Diethyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
63	Di-n-Octyl phthalate	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
64	Endosulfan	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
65	Endrin	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
66	Ethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
67	Fluoranthene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
68	Fluorene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
69	Heptachlor	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

70 Heptachlor epoxide...

ลำดับ	สารเคมี	วิธีวิเคราะห์
70	Heptachlor epoxide	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
72	Hexachloro-1,3-butadiene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
73	n-Hexane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
74	α -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
75	β -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
76	γ -HCH	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
81	Lead	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Spectrometric Method ⁽⁴⁾

82 Manganese...

ลำดับ	สารเคมี	วิธีวิเคราะห์
82	Manganese	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
83	Mercury	Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾
84	Methanol	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾
86	Methyl bromide	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
87	Methylene chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-butyl ether	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-propylamine	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

96 Polychlorinated Biphenyls...

ลำดับ	สารเคมี	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB-1242 - PCB-1248 - PCB-1254 - PCB-1260	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
98	pH	Electrometric Method ⁽⁴⁾
99	Phenanthrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
100	Phenol	1) Distillation, Chloroform Extraction Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
101	Pyrene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
102	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
103	Silver	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
104	Styrene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
105	1,1,2,2-Tetrachloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
106	Tetrachloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
107	Toluene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

108 Toxaphene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
108	Toxaphene	1) Liquid-Liquid Extraction, Gas Chromatographic Method ⁽⁴⁾ 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
109	TPH (C ₉ - C ₉)	1) Purge and Trap, Gas Chromatographic Method ^(11,21) 2) Purge and Trap, Gas Chromatographic/Mass spectrometric Method ^(11,21)
110	TPH (C ₁₀ - C ₁₆)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21)
111	TPH (C ₁₆ - C ₃₃)	Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(9,21)
112	1,2,4-Trichlorobenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
113	1,1,1-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
114	1,1,2-Trichloroethane	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
115	Trichloroethylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
118	1,3,5-Trimethylbenzene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
119	Vanadium	Digestion, Inductively Coupled Plasma Method ⁽⁴⁾
120	Vinyl acetate	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
121	Vinyl chloride	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
122	m-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
123	o-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾

124 p-Xylene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
124	p-Xylene	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
125	Xylene (Total)	Purge and Trap Gas Chromatographic/Mass Spectrometric Method ⁽⁴⁾
126	Zinc	1) Digestion, Direct Air-Acetylene Flame Method ⁽⁴⁾ 2) Digestion, Electrothermal Atomic Absorption Spectrometric Method ⁽⁴⁾ 3) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾

อากาศเสีย (ปล่อยระบาย) จำนวน 25 รายการ

ลำดับ	สารเคมี	วิธีวิเคราะห์
1	Antimony	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
2	Arsenic	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
3	Cadmium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
4	Carbon Monoxide	Instrumental Analyzer Method ⁽³⁾
5	Chlorine	Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾
6	Chromium	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
7	Cobalt	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
8	Copper	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
9	Cresol	Absorption Sampling, Gas Chromatographic Method ⁽³⁾

10 Dioxins/Furans...

ลำดับ	สารเคมี	วิธีวิเคราะห์
10	Dioxins/Furans	Isokinetic Sampling ⁽³⁾
11	Hydrogen Chloride	Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾
12	Hydrogen Fluoride	Isokinetic Sampling, Ion Chromatographic Method ⁽³⁾
13	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ⁽³⁾
14	Lead	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
15	Manganese	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
16	Mercury	Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽³⁾
17	Nickel	1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
18	Opacity	Ringelmann's Method ⁽³⁾
19	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic acid Method ⁽³⁾ 2) Instrumental Analyzer Method ⁽³⁾
20	Selenium	1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽³⁾ 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
21	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ⁽³⁾ 2) Instrumental Analyzer Method ⁽³⁾
22	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ⁽³⁾
23	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ⁽³⁾
24	Vanadium	Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method ⁽³⁾
25	Xylene	1) Gas Sampling, Gas Chromatographic Method ⁽³⁾ 2) Absorption Sampling, Gas Chromatographic Method ⁽³⁾

สิ่งปฏิกูล...

สืบค้นด้วยวิธีค้นหาไม่เต็มตัว จำนวน 35 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
2	Antimony	Digestion, Inductively Coupled Plasma Method ^(7,13)
3	Arsenic	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(2,6,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,13) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
6	Cadmium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
8	Chromium	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)

3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
9	Chromium (III)	3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,14,16) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation ^(2,6,13,16) 3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,6,14,16) 4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,6,13,16)
10	Chromium (VI)	1) Waste Extraction, Colorimetric Method ^(2,14) 2) Alkaline Digestion, Colorimetric Method ^(6,16)
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
12	Copper	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)

15 DDE...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
17	Dieldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
20	Lead	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(2,11) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(7,11) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)

3) Digestion,...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
23	Methoxychlor	3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁴⁾ 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹³⁾
24	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
25	Nickel	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,14) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)
26	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22) 3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁴⁾ 4) Digestion, Inductively Coupled Plasma Method ^(7,13) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,9,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(16,22)

- 2,2',4,5,5'...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
27	- 2,2',4,5,5'- Pentachlorobiphenyl - 2,3,3',4',6'- Pentachlorobiphenyl - 2,2',3,4,4',5'- Hexachlorobiphenyl - 2,2',3,4,5,5'- Hexachlorobiphenyl - 2,2',3,5,5',6'- Hexachlorobiphenyl - 2,2',4,4',5,5'- Hexachlorobiphenyl - 2,2',3,3',4,4',5'- Heptachlorobiphenyl - 2,2',3,4,4',5,5'- Heptachlorobiphenyl - 2,2',3,4',5',6'- Heptachlorobiphenyl - 2,2',3,4',5',6'- Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'- Nonachlorobiphenyl Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(2,3,26) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(15,26) Electrometric Method ^(31,32) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,13) 4) Digestion, Inductively Coupled Plasma Method ^(2,6,13)
28	pH	
29	Selenium	1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(5,6,20) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,13) 4) Digestion, Inductively Coupled Plasma Method ^(2,6,13)

30 Silver...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
30	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
31	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
32	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(2,3,22) 2) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
33	Trichloroethylene	1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(2,12,22) 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
35	Zinc	1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method ^(2,6,13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(2,6,13) 3) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 4) Digestion, Inductively Coupled Plasma Method ^(7,13)

สิ้น จำนวน 125 รายการ

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
1	Acenaphthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
2	Acetone	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)

3 Aldrin...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
3	Aldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
4	Anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
5	Antimony	Digestion, Inductively Coupled Plasma Method ^(7,13)
6	Arsenic	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ^(7,13) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
7	Atrazine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
8	Barium	Digestion, Inductively Coupled Plasma Method ^(7,13)
9	Benz(a)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
10	Benzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
11	Benzo(b)fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
12	Benzo(k)fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
13	Benzoic acid	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
14	Benzo(a)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)

15 Benzo(g,h,i)perylene...

ลำดับ	สารมลพิษ	วิธีวิเคราะห์
15	Benzo(g,h,i)perylene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
16	Beryllium	Digestion, Inductively Coupled Plasma Method ^(7,13)
17	Bis(2-chloroethyl)ether	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
18	Bis(2-ethylhexyl)phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
20	Bromofom	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
21	Butanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
22	Butyl benzyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
23	Cadmium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
24	Carbazole	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
25	Carbon disulfide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
27	Chlordane	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
28	p-Chloroaniline	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,26)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)

31 Chloroform...

ลำดับ	สารเคมี	วิธีวิเคราะห์
31	Chloroform	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,23)
32	2-Chlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
33	Chromium	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
34	Chromium (III)	1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,14,16) 2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation ^(7,8,13,16)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8,16)
36	Chrysene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(18,29,30)
38	2,4-D	Ultrasonic Extraction, Gas Chromatographic Method ⁽²⁷⁾
39	DDD	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
40	DDE	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
41	DDT	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
42	Dibenz(a,h)anthracene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)

43 Di-n-butyl phthalate...

ลำดับ	สารเคมี	วิธีวิเคราะห์
43	Di-n-butyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
47	3,3'-Dichlorobenzidine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
53	2,4-Dichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
57	Dieldrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
58	Diethyl phthalate	Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)
59	2,4-Dimethylphenol	Ultrasonic Extraction, Gas Chromatographic Method ^(10,22)

60 2,4-Dinitrophenol...

ลำดับ	สารเคมี	วิธีวิเคราะห์
60	2,4-Dinitrophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
61	2,4-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
62	2,6-Dinitrotoluene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
63	Di-n-Octyl phthalate	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
64	Endosulfan	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
65	Endrin	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
67	Fluoranthene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
68	Fluorene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
69	Heptachlor	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
70	Heptachlor epoxide	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)

71 Hexachlorobenzene...

ลำดับ	สารเคมี	วิธีวิเคราะห์
71	Hexachlorobenzene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
73	n-Hexane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^(12,25)
74	α -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
75	β -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
76	γ -HCH	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,22) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
77	Hexachlorocyclopentadiene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
78	Hexachloroethane	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
79	Indeno(1,2,3-cd)pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ^(10,24) 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
80	Isophorone	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ^(10,24)
81	Lead	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)
82	Manganese	1) Digestion, Flame Atomic Absorption Spectrometric Method ^(7,14) 2) Digestion, Inductively Coupled Plasma Method ^(7,13)

83 Mercury...

ลำดับ	สารเคมี	วิธีวิเคราะห์
83	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁾⁽⁸⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹³⁾ 3) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁾⁽⁸⁾
84	Methanol	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
85	Methoxychlor	1) Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²²⁾ 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁴⁾
86	Methyl bromide	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
87	Methylene chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²⁵⁾
88	2-Methylphenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
89	2-Methylnaphthalene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
90	Methyl tert-butyl ether	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
91	Naphthalene	1) Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²⁶⁾ 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
92	Nickel	1) Digestion, Flame Atomic Absorption Spectrometric Method ⁽⁷⁾⁽¹⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹³⁾
93	Nitrobenzene	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
94	N-Nitrosodiphenylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
95	N-Nitrosodi-n-propylamine	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾

96 Polychlorinated Biphenyls...

ลำดับ	สารเคมี	วิธีวิเคราะห์
96	Polychlorinated Biphenyls - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 Polychlorinated Biphenyls - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4,6'-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6'-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,6'-Heptachlorobiphenyl	1) Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²³⁾ 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾ Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²³⁾

- 2,2',3,4',5,5',6...

ลำดับ	สารเคมี	วิธีวิเคราะห์
97	- 2,2',3,4',5,5',6'-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6'-Nonachlorobiphenyl Pentachlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁴⁾
98	Phenanthrene	1) Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²⁴⁾ 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
99	Phenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
100	Pyrene	1) Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²⁴⁾ 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
101	Selenium	1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method ⁽⁷⁾⁽²²⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹³⁾
102	Silver	Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹³⁾
103	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
106	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
107	Toxaphene	Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²²⁾
108	TPH (C ₁₅ -C ₂₅)	1) Purge and Trap, Gas Chromatographic Method ⁽¹²⁾⁽²³⁾ 2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
109	TPH (C ₂₅ -C ₃₅)	Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²²⁾
110	TPH (C ₃₅ -C ₄₅)	Ultrasonic Extraction, Gas Chromatographic Method ⁽¹⁶⁾⁽²²⁾
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾

112 1,1,1-Trichloroethane...

ลำดับ	สารเคมี	วิธีวิเคราะห์
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
115	2,4,5-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
116	2,4,6-Trichlorophenol	Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method ⁽¹⁶⁾⁽²⁶⁾
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
118	Vanadium	Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹³⁾
119	Vinyl acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
120	Vinyl chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
121	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
122	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
123	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ⁽¹²⁾⁽²³⁾
125	Zinc	1) Digestion, Flame Atomic Absorption Spectrometric Method ⁽⁷⁾⁽¹⁴⁾ 2) Digestion, Inductively Coupled Plasma Method ⁽⁷⁾⁽¹³⁾

เอกสารอ้างอิง

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