

## ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

2. 15. 1949

1. 15. 1949

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
1.	Stack Air	Particulate	Dry Gas Meter/SK25	S/N 8005333	07/02/2024	February 2025
			Digital Barometer/PHB-318	S/N B011410	25/05/2023	May 2024
			Digital Thermometer/DP-52	S/N L491771	15-19/05/2023	May 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025
		NO <sub>x</sub> as NO <sub>2</sub>	Gas Analyzer (E-instruments)/E6000-5DS	S/N 1339	03/01/2024	January 2025
			Gas Analyzer (E-instruments)/E6000-5DS	S/N 1339	03/01/2024	January 2025
			Gas Analyzer (E-instruments)/E6000-5DS	S/N 1339	03/01/2024	January 2025
		TSP	ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/09/2022	September 2023
			High Volume Air Sampler/TET	S/N TSP-26	11/07/2023	July 2024
			High Volume Air Sampler/TET	S/N TSP-34	11/07/2023	July 2024
2.	Ambient Air	PM-10	Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/09/2022	September 2023
			High Volume Air Sampler/TET	S/N PM10-25	11/07/2023	July 2024
			High Volume Air Sampler/TET	S/N PM10-28	11/07/2023	July 2024
		NO <sub>2</sub>	Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025
			CERTIFICATE OF ANALYSIS:Linde	S/N A00917SK	05/07/2023	July 2026
			NO <sub>x</sub> Analyzer/API 200E	S/N 393	22/04/2024	October 2024
			NO <sub>x</sub> Analyzer/API 200E	S/N 1281	22/04/2024	October 2024
		SO <sub>2</sub>	CERTIFICATE OF ANALYSIS:Linde	S/N D636157	18/09/2023	September 2027
			SO <sub>2</sub> Analyzer/Thermo 43C	S/N 43C73374373	24/04/2024	October 2024
			SO <sub>2</sub> Analyzer/API 100E	S/N 1488	23/04/2024	October 2024
			SO <sub>2</sub> Analyzer/API 100E	S/N 1488	23/04/2024	October 2024
		WS & WD	Wind speed and wind direction/Vantage VUE	S/N Display MT221012048	20/11/2023	November 2024
			Wind speed and wind direction/Vantage VUE	S/N Display MT221012048	20/11/2023	November 2024
			Wind speed and wind direction/Vantage VUE	S/N Display MT221012048	20/11/2023	November 2024
			Wind speed and wind direction/Vantage VUE	S/N Display MT221012048	20/11/2023	November 2024

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**TET**

Thai Environmental Technic Limited  
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์ (ต่อ)

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
3.	Working Air	Aluminium Dust (Inhalable Dust)	Personal Air Sampler/Gillian	S/N 20110505110	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20080703015	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 101157	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20110605104	06/05/2024	June 2024
			ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	28/03/2024	September 2024
		Aluminium Dust (Respirable Dust)	Personal Air Sampler/Gillian	S/N 20080703003	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20080703020	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20151003021	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20080703011	06/05/2024	June 2024
			ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	28/03/2024	September 2024
		Hydrogen Chloride	Personal Air Sampler/Gillian	S/N 20151003049	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20080703013	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20111203067	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20080703009	06/05/2024	June 2024
			Ion Chromatograph/ICS-1100	S/N 10010987	28/03/2024	September 2024
		Hydrogen Fluoride	Personal Air Sampler/Gillian	S/N 13427	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20111203056	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 101151	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20110550597	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 101156	06/05/2024	June 2024
		Oil Mist	Personal Air Sampler/Gillian	S/N 20120103069	06/05/2024	June 2024
			Personal Air Sampler/Gillian	S/N 20140705056	06/05/2024	June 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025

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**TET**

Thai Environmental Technic Limited  
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด



Thai Environmental Technic Limited  
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์ (ต่อ)

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
4.	Sound Level	Leq 24 hr & เสียงรบกวน	Sound Level Calibrator/Digicon Tenmars	S/N 180501628	16/08/2023	August 2024
			Integrated Sound Level/ACO TYPE 6226	S/N 100102	01/05/2024	31/05/2024
			Integrated Sound Level/ACO TYPE 6226	S/N 130128	01/05/2024	31/05/2024
			Integrated Sound Level/ACO TYPE 6226	S/N 130131	01/05/2024	31/05/2024
			Integrated Sound Level/ACO TYPE 6226	S/N 160096	01/05/2024	31/05/2024
			Integrated Sound Level/ACO TYPE 6226	S/N 160204	01/05/2024	31/05/2024
			Integrated Sound Level/ACO TYPE 6226	S/N 160212	01/05/2024	31/05/2024
5.	Occupational Health and Safety	Leq 8 hr	Sound Level Calibrator/Digicon Tenmars	S/N 180501628	16/08/2023	August 2024
			Integrated Sound Level/RION NL-21	S/N 00487676	01/05/2024	31/05/2024
			Integrated Sound Level/ACO TYPE 6236	S/N 112029	01/05/2024	31/05/2024
			Integrated Sound Level/ACO TYPE 6236	S/N 152074	01/05/2024	31/05/2024
			Integrated Sound Level/ACO TYPE 6236	S/N 152075	01/05/2024	31/05/2024
		Noise Dose	Noise Dose Meter/Tenmars SOUNDTEK/ST-130	S/N 170400163	01/05/2024	31/05/2024
			Noise Dose Meter/Tenmars SOUNDTEK/ST-130	S/N 220100050	01/05/2024	31/05/2024
			Noise Dose Meter/Tenmars SOUNDTEK/ST-130	S/N 220100053	01/05/2024	31/05/2024
			Noise Dose Meter/Tenmars SOUNDTEK/ST-130	S/N 220100055	01/05/2024	31/05/2024
		Heat	Thermal Environment Monitor/JANTYTECH JT2011-E2A	S/N 3522210149	20/03/2024	March 2025
6.	Wastewater	pH	pH Meter/Horiba F-71G	S/N V381F8H3	31/10/2023	October 2024
		SS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025
		TDS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025
		BOD	BOD Incubator/Model i250-DS	S/N 2059-1017-0029	29/06/2023	June 2024
		Oil & Grease	Electronic Balance/METTLER TOLEDO	S/N 1116392227	10/04/2024	April 2025
		Al	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	28/03/2024	September 2024

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THAI ENVIRONMENTAL TECHNIC LIMITED  
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

CONTROL UNIT CALIBRATION

( Metric units , mm )

Date 7-Feb-24

Initial Final Average

Barometric press, Pb 758.7 759.2 759.0 mmHg

Dry Gas Meter Data

Console No.

Reference Dry Gas Meter Data

Metering System ID

Model

Serial No.

DCM Number

8005333

Correction factor(Yr)

DCM Model

SR 25

Last Calibration Data

26-May-23

Office manometer setting ΔH mm H <sub>2</sub> O	Ref. DMG Volume V <sub>m</sub> Liters	DCM Volume V <sub>m</sub> Liters	Temperature (°C)			Time min	DCM Correction factor (Y)	ΔH@ mm H <sub>2</sub> O
			Ref DGM T <sub>i</sub>	Dry Gas Meter Inlet T <sub>i</sub>	Outlet T <sub>m</sub>			
15.00	100.00	100.02	28.00	28.00	29.00	28.50	1.0209	46.0356
25.00	100.00	99.95	28.00	28.00	29.00	28.50	6.49	1.0206
50.00	100.00	99.73	28.00	28.00	29.00	28.50	4.58	1.0204
80.00	100.00	99.47	28.00	28.00	29.00	28.50	3.59	1.0201
100.00	100.00	99.25	28.00	28.00	29.00	28.50	3.23	1.0204
Average								46.0568

Due Date of Calibrate 8-Feb-25

Calibrated by: *[Signature]*

Approved: *[Signature]*

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.  
Note: For ΔH@, Office pressure differential that equates to 0.754mm (0.0312in) in standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mmH<sub>2</sub>O).

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



THAI ENVIRONMENTAL TECHNIC LIMITED  
CALIBRATION 6888

## Certificate of Calibration

Certificate No. : 23P1667  
Page : 1 of 2

**Equipment :** Digital Barometer  
**Manufacturer:** Lutron  
**Model :** PHB-318  
**Serial No.:** B011410  
**ID No.:** No.4  
**Condition As-Received:** Used Item  
**Received Date:** 24 May 2023  
**Calibration Date:** 25 May 2023  
**Reference:** 2305-0815WSC  
**Ambient Temperature:** ( 23 ± 2 ) °C  
**Relative Humidity:** ( 50 ± 15 ) %  
**Atmospheric Pressure:** 1008 mbar

**Submitted by:** Thai Environmental Technic Limited

1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung,  
Bangkok 10240

**Procedure used:** The calibration was conducted by direct comparison method against Pressure Measuring Instruments Gauges, Edition 03/2014 \* as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments :

**Instrument**

1) Standard Barometer

**Model**

DPI142

**Serial No.**

1422505046

**Due Date**

03 May 2024

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

3. Scale and conversion factor is 1 kPa = 7.50062 mmHg

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

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

6. This result of calibration was calibrated while opening the plug to vent the atmospheric pressure.

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

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

-National Institute of Metrology Thailand (NIMT)

**Calibrated by :** Suksan Khamlaew  
**Issue Date :** 26 May 2023

**Approved Signatory :** Attapol P.  
( ) Phalinee Prabpaijal  
( ) Sura Suwannasri  
(x) Attapol Panurach

B 0315718



Cert.No.: 23P1667  
Page: 2 of 2

**Result of calibration:-** Without adjustment  
**Function:-** Absolute Pressure Measurement  
**Range :** 730 mmHg to 770 mmHg  
**Resolution :** 0.1 mmHg

### Increasing Pressure

Applied Pressure (mmHg)	729.90	739.90	749.89	759.89	769.89
UUC* Indication (mmHg)	730.6	740.6	750.6	760.6	770.6
Error (mmHg)	0.70	0.70	0.71	0.71	0.71

### Decreasing Pressure

Applied Pressure (mmHg)	769.89	759.89	749.89	739.90	729.90
UUC* Indication (mmHg)	770.6	760.6	750.6	740.6	730.6
Error (mmHg)	0.71	0.71	0.71	0.70	0.70

The uncertainty of measurement was ± 0.23 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.

a 1163290



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
334/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



RECH-STRONG  
CALIBRATION

## Certificate of Calibration

Certificate No. : 23T875  
Page : 1 of 2

Equipment : Digital Thermometer With Sensor  
Manufacturer : Digicon  
Model : DP-52  
Serial No. : 1491771  
ID No. : NO.12  
Condition As-Received: Used Item  
Received Date: 25 April 2023  
Calibration Date: 15 May 2023  
Reference: 2304-0600DSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %  
Submitted by: Thai Environmental Technic Limited  
1/6 Soi Rankhamhaeng 145, Khwaeng/Khet Saphan Sung,  
Bangkok 10240

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller and comparison with Standard Thermocouple (Type RS) into high temperature furnace.  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Digital Thermometer	1529	A66176	2211358	16 Nov 2023
2) Industrial Platinum Resistance Thermometer	5627	739437	2211358	16 Nov 2023
3) Digital Thermometer	1529	A48760	2211089	09 Sep 2023
4) Industrial Platinum Resistance Thermometer	5627	824302	2211089	09 Sep 2023
5) Digital Multimeter	2700	4016315	22E3264	05 Oct 2023
6) Thermocouple Type S	TCS	TCS-002	TT-0125-22	28 Oct 2023

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Silthitorn Poornai  
Issue Date : 25 May 2023

Approved Signatory :

[ ] Phalinee Prabpaipal  
[ ] Chatchawan Khunpluek  
[x] Wanlop Larpkern

B 0314951



Cert. No.: 23T875  
Page.: 2 of 2

Result of Calibration:- Without Adjustment  
Function: Temperature measurement for Channel T1  
This equipment was connected with Thermocouple Type K S/N. 11005002 ID No. NO.12  
Dimension of probe : Diameter 8 mm, Length 1030 mm. Sheath material : Stainless Steel

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
180	200.0035	200.4	0.3965	0.73
180	400.0038	400.2	0.1962	1.4
150	600.02	602.9	2.8800	3.1

UUC\* : Unit Under Calibration

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

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a 1163789



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/4/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANILUANG BANGKOK 10250  
TEL.0-2717-3000-29 FAX.0-2719-9484



## Certificate of Calibration

Cert.No.: 24MM272  
Page.: 1 of 3

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : AB204  
Serial No. : 1116392227  
ID No. : Ins-LAB-033  
Submitted by : Thai Environmental Technic Limited  
1/6 Soi Ramkhamhaeng 145,  
Khwaeng/Khet Saphan Sung,  
Bangkok 10240  
Location : Balance Room  
Received order : 09 April 2024  
Calibration Date : 10 April 2024  
Ambient Temperature : 15 °C to 40 °C  
Relative Humidity : 30 % to 90 %  
Calibrated by : Khit Rutanaprapachai

Approved by :  
( ) Ponpan Papim  
( ) Suwit Imjai  
(✓) Kunchit Promprat

Approved Signatory

Issue Date : 12 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.



Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2404-01130C-14

Cert.No.: 24MM272  
Page: 2 of 3

### Procedure used :-

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 | -          | 70RC138 | MM-0020-23      | 30 Jan 2025 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

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

Range capacity : 0 g to 210 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
200	200.0001	-0.0001	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	0.00008





Equipment : Electronic Balance  
Condition As-Received : Used Item  
Reference : 2404-01130C-14  
Result of calibration

## 2. Effect of off center loading

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

Position 1	Position 2	Position 3	Position 4	Position 5
(g)	(g)	(g)	(g)	(g)
0.0000	+0.0001	0.0000	+0.0001	+0.0003

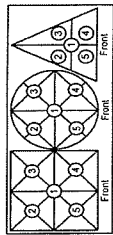
## 3. Departure from nominal value

Applied Weight (g)	Balance		Measurement		Coverage Factor (k)
	Reading (g)	Correction (g)	Uncertainty (± mg)		
Unload	0.0000	0.0000	0.14	2.11	
0.01	0.0101	-0.0001	0.14	2.11	
0.1	0.1001	-0.0001	0.14	2.11	
0.5	0.5002	-0.0002	0.14	2.11	
1	1.0002	-0.0002	0.14	2.11	
5	5.0000	0.0000	0.14	2.11	
10	10.0001	-0.0001	0.14	2.11	
25	25.0000	0.0000	0.15	2.07	
50	49.9999	+0.0001	0.15	2.06	
100	100.0002	-0.0002	0.19	2	
200	200.0002	-0.0002	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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Cert.No.: 24MM272  
Page: 3 of 3



Maximum difference between  
off-center and central loading  
(g)  
0.0003



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## Portable Gas Calibration Report

Manufacturer : E-Instruments  
Instrument Model : E6000-SDS  
Instrument serial no. : 1339  
Instrument ID : 11  
Date of Calibration: 3-Jan-24  
Ambient Condition  
Temperature (23±5 °C) : 25.0 °C  
Humidity (55±15 % RH) : 50.0 % RH  
Barometer (mmHg) : 758.4 mmHg

## Standard gas References

Standard gas	Cylinder No.	Traceability	Due date
Oxygen (O <sub>2</sub> )	36232	Linde	June 26, 2031
Nitric Oxide(NO)	D824463	Linde	June 5, 2026
	D824524	Linde	August 22, 2025
Nitrogen Dioxide(NO <sub>2</sub> )	CC518873	Aligas	August 17, 2024
	CC518878	Aligas	August 18, 2024
Sulfur Dioxide (SO <sub>2</sub> )	D824500	Linde	October 11, 2024
	D271305	Linde	October 11, 2024
Carbon Monoxide(CO)	D824500	Linde	October 11, 2024
	D271305	Linde	October 11, 2024

## Calibration Results

Parameter	Standard gas	Reading	Actual Error	Test Limit	Results
O <sub>2</sub> (%vol)	0.0	0.0	0.0	±0.2 % vol	PASS
	14.0	13.9	-0.1		
	0.0	0.0	0.0		
NO (ppm)	198.0	197.0	-1.0	±5.0 ppm 0...100 ppm ±5% measured Value 101...5000 ppm	PASS
	392.0	394.0	2.0		
	0.0	0.0	0.0		
NO <sub>2</sub> (ppm)	40.1	40.0	-0.1	±5.0 ppm 0...100 ppm ±5% measured Value 101...5000 ppm	PASS
	82.2	83.0	0.8		
	0.0	0.0	0.0		
SO <sub>2</sub> (ppm)	406.0	405.0	-1.0	±5.0 ppm 0...100 ppm ±5% measured Value 101...5000 ppm	PASS
	804.0	802.0	-2.0		
	0.0	0.0	0.0		
CO (ppm)	404.0	403.0	-1.0	±5.0 ppm 0...100 ppm ±5% measured Value 101...5000 ppm	PASS
	793.0	792.0	-1.0		
	0.0	0.0	0.0		

Calibrate by: *plus* Approved by: *Ramm M*





RECALIBRATION  
DUE DATE:  
September 21, 2023

## Certificate of Calibration

Calibration Certification Information			
Cal. Date:	September 21, 2022	Roots meter S/N:	438320
Operator:	Jim Tisch	Ta:	296 °K
Calibration Model #:	TE-5025A	Pa:	748.3 mm Hg
Calibrator S/N:	0068		

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3760	3.2	2.00
2	3	4	1	0.9710	6.4	4.00
3	5	6	1	0.8730	8.0	5.00
4	7	8	1	0.8300	8.8	5.50
5	9	10	1	0.6870	12.7	8.00

Data Tabulation

Vstd (m3)	Qstd (m3/min)	√(ΔH/Pstd) (y-axis)	Va	Qa (x-axis)	√(ΔH/Ta/Pa) (y-axis)
0.9870	0.7173	1.4080	0.9957	0.7236	0.8895
0.9828	1.0121	1.9912	0.9914	1.0211	1.2579
0.9806	1.1233	2.2262	0.9893	1.1332	1.4064
0.9796	1.1802	2.3349	0.9882	1.1907	1.4750
0.9744	1.4184	2.8160	0.9830	1.4309	1.7789
QSTD	m= 2.01042		m= 1.25889		
	b= -0.03659		b= -0.02312		
	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/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:	roots meter manometer reading (mm Hg)
Ta:	actual absolute temperature (°K)
Pa:	actual barometric pressure (mm Hg)
b:	intercept
m:	slope

Tisch Environmental, Inc.  
145 South Miami Avenue  
Village of Cleves, OH 45002  
www.tisch-env.com  
TOLL FREE: (877) 263-7610  
FAX: (513) 467-9009

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



Thai Environmental Technic Limited  
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

## High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 11-Jul-23  
ITEM : TSP Serial No : (No. 26 ) Calibrate By : Pjpat

### Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0  
Temperature (°C) : 25.0 Temperature (deg K) : 298.0  
Average Press. (mm Hg) : 750.6 Corrected Average (mm Hg) :  
Average Temp (°C) : 28.7 Average Temp (Deg K) : -

### Calibration Orifice

Make : Tisch Qstd Slope : 2.01042  
Model : TE-5025A Qstd Intercept : -0.36590  
Serial# : 0068 Calibration Due Date : 21-Sep-23

### Calibration Information

Plate or Test #	ORIFICE (in H <sub>2</sub> O)	Qstd (m <sup>3</sup> /min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 28.2957 Intercept : 2.4965 Corr. Coeff : 0.9783
1	12.90	1.969	56.0	56.00	
2	9.80	1.739	52.0	52.00	
3	7.80	1.571	50.0	50.00	
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	# of Observations: 5

### Calculations

Qstd = 1/m(Sqrt(H2O(Pa/Pstd)(Tstd/Ta))-b)  
IC = [Sqrt(Pa/Pstd)(Tstd/Ta)]  
Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Tstd = 760 mm Hg  
For subsequent calculation of sampler flow:  
1/m(1)[Sqrt(298/Tav)(Pav/760)]-b  
NOTE: Ensure calibration orifice has been certified within 12 months of use

m = sampler slope  
b = sampler intercept  
I = chart response  
Tav = daily average temperature  
Pav = daily average pressure

Calibrate By :  
Approve By : *Pramat M.*



Thai Environmental Technic Limited  
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Thai Environmental Technic Limited  
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## High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech  
ITEM : TSP  
Site ID : Bangkok  
Serial No : (No. 34 )  
Date : 11-Jul-23  
Calibrate By : Pipat

### Site Conditions

Barometric Pressure (mm Hg) : 760.00  
Temperature (°C) : 25.0  
Average Press. (mm Hg) : 750.6  
Average Temp (°C) : 29.4  
Corrected Pressure (mm Hg) : 760.0  
Temperature (deg K) : 298.0  
Corrected Average (mm Hg) :  
Average Temp: (Deg K) :

### Calibration Orifice

Make : Tisch  
Model : TB-5025A  
Serial# : 0068  
Qstd Slope : 2.01042  
Qstd Intercept : -0.36590  
Calibration Due Date : 21-Sep-23

### Calibration Information

Plate or Test #	ORIFICE (in H <sub>2</sub> O)	Qstd (m <sup>3</sup> /min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 30.1839 Intercept : 0.2667 Corr. Coeff : 0.9859
1	12.40	1.934	60.0	57.00	
2	9.40	1.707	54.0	52.00	
3	7.00	1.498	50.0	48.00	
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	

### Calculations

$$Qstd = 1/m[\text{Sort}(H_2O)(Pa/Pstd)(Tstd/Ta)^{-b}]$$
$$IC = [1/\text{Sort}(Pa/Pstd)(Tstd/Ta)^{-b}]$$

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response

m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:  
 $1/m[(1)/\text{Sort}(298/Tav)(Pav/760)]^{-b}$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Calibrate By : \_\_\_\_\_

Approve By : \_\_\_\_\_

m = sampler slope  
b = sampler intercept  
I = chart response  
Tav = daily average temperature  
Pav = daily average pressure



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## High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech  
ITEM : PM10  
Site ID : Bangkok  
Serial No : (No. 25 )  
Date : 11-Jul-23  
Calibrate By : Pipat

### Site Conditions

Barometric Pressure (mm Hg) : 760.00  
Temperature (°C) : 25.0  
Average Press. (mm Hg) : 750.8  
Average Temp (°C) : 29.2  
Corrected Pressure (mm Hg) : 760.0  
Temperature (deg K) : 298.0  
Corrected Average (mm Hg) :  
Average Temp: (Deg K) :

### Calibration Orifice

Make : Tisch  
Model : TB-5025A  
Serial# : 0068  
Qstd Slope : 2.01042  
Qstd Intercept : -0.03659  
Calibration Due Date : 21-Sep-23

### Calibration Information

Plate or Test #	ORIFICE (in H <sub>2</sub> O)	Qstd (m <sup>3</sup> /min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 35.3007 Intercept : 0.2307 Corr. Coeff : 0.9894
1	12.00	1.741	60.0	60.00	
2	9.00	1.510	54.0	54.00	
3	7.00	1.334	50.0	50.00	
4	5.00	1.130	40.0	40.00	
5	3.00	0.880	30.0	30.00	

# of Observations: 5

### Calculations

$$Qstd = 1/m[\text{Sort}(H_2O)(Pa/Pstd)(Tstd/Ta)^{-b}]$$
$$IC = [1/\text{Sort}(Pa/Pstd)(Tstd/Ta)^{-b}]$$

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response

m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K

Pstd = 760 mm Hg

For subsequent calculation of sampler flow:  
 $1/m[(1)/\text{Sort}(298/Tav)(Pav/760)]^{-b}$

NOTE: Ensure calibration orifice has been certified within 12 months of use

Calibrate By : \_\_\_\_\_

Approve By : \_\_\_\_\_

m = sampler slope  
b = sampler intercept  
I = chart response  
Tav = daily average temperature  
Pav = daily average pressure



# High Volume TSP&PM-10 Calibration Report

## Site Conditions

Average Temp: (Deg K) :

Make : Tisch  
Model : TP-5025A  
Serial# : 0068  
Qstd Slope : 2.01042  
Qstd Intercept : -0.03659  
Calibration Due Date : 21-Sep-23

Plate or Test #	ORFICE (in H <sub>2</sub> O)	Qstd (m <sup>3</sup> /min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope: 34.8675 Intercept: 0.4432 Corr. Coeff: 0.9926
1	12.00	1.741	60.0	60.00	5 of Observations: 5
2	9.00	1.543	54.0	54.00	
3	7.20	1.353	50.0	50.00	
4	5.00	1.130	40.0	40.00	
5	3.00	0.880	30.0	30.00	

$Q_{std} = 1/m[\sqrt{(Pa/P_{std})(T_{std}/T_a)} - b]$   
 $IC = 1/[\sqrt{(Pa/P_{std})(T_{std}/T_a)}]$   
 $Q_{std}$  = standard flow rate  
 $IC$  = corrected chart response  
 $I$  = actual chart response  
 $m$  = calibrator  $Q_{std}$  slope  
 $b$  = calibrator  $Q_{std}$  intercept  
 $T_a$  = actual temperature during calibration (deg K)  
 $P_a$  = actual pressure during calibration (mm Hg)  
 $T_{std}$  = 298 deg K  
 $P_{std}$  = 760 mm Hg  
 For subsequent calculation of sampler flow:  
 $1/m[(1/IC)\sqrt{(298/T_a)(P_a/760)} - b]$

**NOTE: Ensure calibration office has been certified within 12 months of use**

**NOTE:** Ensure calibration orifice has been certified within 12 months of use

Thal Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Khwaeng/Khet Saphan Sung Bangkok 10240 Thailand



## Customer Tag No.:

Expiry date: 5-Jul-2026

### Method of Analysis<sup>3</sup>

*used in Assay*

**Last Multipoint Calibration:**  
**28-JUN-2023**

Storage comment: \_\_\_\_\_  
Comments \_\_\_\_\_

**Comments**  
When reordering, please quote the material number

**Notes:**

1. All results expressed in this report are on *moist/moisture basis*, unless otherwise specified, in accordance with the European Pharmacopoeia (Ph. Eur.) 2.5/31 for the Assay and 2.5/32 for the moisture content. The reported expected uncertainty is based on the standard uncertainty multiplied by a coverage factor of 2. The measured content of this material is traceable to the SI through the reference gas  $\text{O}_2$ ,  $\text{H}_2$ ,  $\text{N}_2$ , and  $\text{CO}_2$ .
2. The reported expected uncertainty is based on the standard uncertainty multiplied by a coverage factor of 2.
3. (1) For Chromatography, (2) Paramagnetic Oxygen Analyzers, (3) for the term of Oxygen analyzers, (4) Electrochemical Moisture Analyzer, (5) for the term of Moisture Analyzers, (6) Other. \* Specified

Page 1 of 1

Page 1 of 1  
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บริษัท สยามเคซี (ประเทศไทย) จำกัด (มหาชน)

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[illegible]

66 67-05 38 (96) January 1961 121 11/5 88 (99) Sunday

Sukanya Parinyasontorn  
Signatory for and on behalf of Unde (Thailand) Co., Ltd.

Grinde (Thailand) Public Company Limited

LINC (University)  
 INC. Registration 0103511003185

15<sup>th</sup> Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trd Km. 6.5 Road, Bangna

Bangkok, Samutprakarn 10540, Tel (66) 2338-8169 Fax (66) 2338-8169

Welljow Plant - 105 Mto 5, J.Bangsamak, A.Bangsapak, C.  
Fax (66) JB.570-323



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## NOx Analyzer Calibration Report

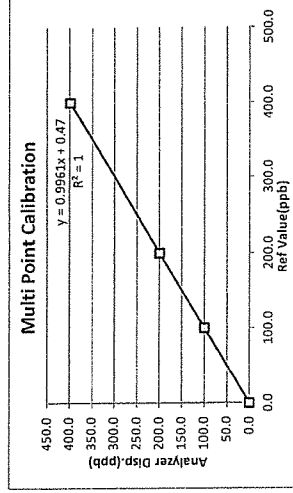
Calibrate Date : 22-Apr-24  
Analyzer Type : NOx  
Brand : API  
Model : 200 E  
Serial Number : 393 (No. 19)  
Range : 500 ppb  
Temperature (°C) : 25°C  
Barometer (mmHg) : 759.9  
Humidity (50±15 %) : 50.0%RH  
Dilutor : API M700 S/N 625  
Zero Air : API M701 S/N 1926  
Standard gas : A00917 SK

### Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)			After of Span(ppb)			% diff of Span
		NOx	NO	NO <sub>2</sub>	NOx	NO	NO <sub>2</sub>	
Zero	0.0	0.6	0.4	0.1	0.0	0.0	0.0	0.0
Span	400.0	404.0	401.0	3.0	400.0	400.0	0.0	0.0

### Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		
	NOx	NO	NO <sub>2</sub>	Diff(ppb)	% Diff	Abs (%) Diff
0.0	0.3	0.3	0.1	0.25	0.001	0.06
100.0	101.2	100.3	0.9	0.30	0.003	0.30
200.0	200.4	199.8	0.6	-0.20	-0.001	0.10
400.0	399.8	398.8	1.0	-1.20	-0.003	0.30
Average Diff (%)				0.19		



Calibrate by: Solus

Approved by: Pranada M

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

ลงนามแบบฟอร์ม : QP-QP16-06

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 345 Khwaeng/Khet Saphan Sung Bangkok 10240 Thailand  
• Tel : +66(0)2373-7799(Auto) Fax : +66(0)2373-7799 • admin@tiet1995.com • www.tiet1995.com



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## NOx Analyzer Calibration Report

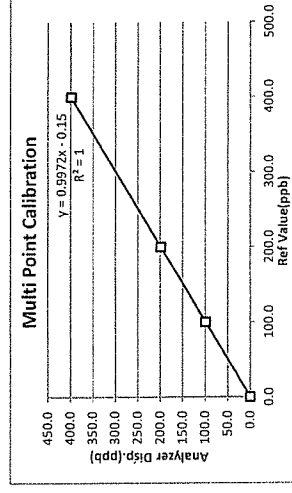
Calibrate Date : 22-Apr-24  
Analyzer Type : NOx  
Brand : API  
Model : 200 E  
Serial Number : 1281 (No. 20)  
Range : 500 ppb  
Temperature (°C) : 25°C  
Barometer (mmHg) : 759.9  
Humidity (50±15 %) : 50.1%RH  
Dilutor : API M700 S/N 625  
Zero Air : API M701 S/N 1926  
Standard gas : A00917 SK

### Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)			After of Span(ppb)			% diff of Span
		NOx	NO	NO <sub>2</sub>	NOx	NO	NO <sub>2</sub>	
Zero	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0
Span	400.0	392.0	395.0	-3.0	400.0	400.0	0.0	0.0

### Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		
	NOx	NO	NO <sub>2</sub>	Diff(ppb)	% Diff	Abs (%) Diff
0.0	0.4	0.4	0.1	0.35	0.001	0.09
100.0	99.8	99.3	0.5	-0.70	-0.007	0.70
200.0	199.2	198.7	0.5	-1.30	-0.007	0.65
400.0	399.3	399.1	0.2	-0.90	-0.002	0.22
Average Diff (%)				0.42		



Calibrate by: Solus

Approved by: Pranada M

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

ลงนามแบบฟอร์ม : QP-QP16-06

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 345 Khwaeng/Khet Saphan Sung Bangkok 10240 Thailand  
• Tel : +66(0)2373-7799(Auto) Fax : +66(0)2373-7799 • admin@tiet1995.com • www.tiet1995.com



## Analyzer Calibration Report

Calibrate Date : 24-Apr-24  
Analyzer Type : SO<sub>2</sub>  
Brand : Thermo  
Model : 43C  
Serial Number : 43C73374373 (No.10)  
Range : 500 ppb

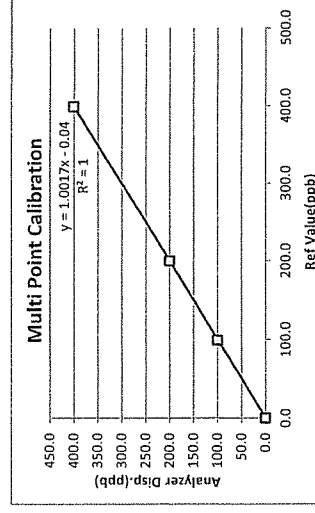
Temperature (°C) : 25°C  
Barometer (mmHg) : 760.0  
Humidity (50±15 %) : 50.0 %RH  
Dilutor : API M700 S/N 625  
Zero Air : API M701 S/N 1926  
Standard gas : D636157

### Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	1.5	0.0	0.0
Span	400.0	397.0	400.0	0.0

### Multi Point Calibration

Ref Value(ppb)	Analyzer Disp (ppb)	Diff (ppb)	Percent Diff	Abs Percent Diff
0.0	0.3	0.3	0.00	0.08
100.0	99.8	-0.2	0.00	0.20
200.0	200.1	0.1	0.00	0.05
400.0	400.8	0.8	0.00	0.20
Average Diff (%)				0.13



Calibrate by: Approved by:

แก้ไขครั้งที่ : 00 วันที่อนุมัติ : 02/09/15 เลขที่แบบฟอร์ม : QF-QP16-06



## Certificate of Analysis Special Gases Mixture

Customer Details  
Name: Thai Environmental Technic Limited.  
Address: 1/6 Soi Ramkhamhaeng 45, Sapansoong, Khet Saphan Sung, Bangkok 10240  
Customer Tag No.: -

Certificate Details  
Number: 2500/23  
Date of Issue: 18-Sep-2023  
Expiry date: 18-Sep-2027  
Material Details  
Material Code: 608400-SK-44  
Cylinder No.: D636157  
Production Order: 90179846  
Filling pressure: 145 bar  
CGA 660 SS  
Gas content: 5,520 M<sup>3</sup>  
Cylinder Owner: LINDE  
Cylinder Material: Spectra seal  
Cylinder Size: 40 L

### Laboratory Report

Analytical Result			
Component	Nominal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup> Method of Analysis <sup>3</sup> Assay Date
Sulphur Dioxide In Nitrogen	40.0 ppm	41.1 ppm	± 1% relative (6) I-PB-352 8-Sep & 18-Sep-23

Reference Standard used in Assay  
Cylinder number: BOC15062956  
Concentration: 25.35 ± 0.25 ppm  
Expiry date: 9-Jun-2024

Analytical Instruments used in Assay  
Instrument / Make / Model: FTIR Spectrometers Nicolet iS50  
Analytical Principle: FTIR-SO2  
Last Multipoint Calibration: 6-Sep-2023

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 are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA traceability Protocol EPA-600/P-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1  
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 Swiss National Standard of Mass or other recognised national metrology institutes.  
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzers, (3) Electrochemical Oxygen Analyzers, (4) Electrochemical Moisture Analyzers, (5) Total Hydrocarbon Analyzers, (6) Other - Specified

Page 1 of 1  
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Sukanya Parinyasoonitorn  
Signatory for and on behalf of Linde (Thailand) Co., Ltd  
PH-002/0906  
Iss: 1/2, 01 August 2023

บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)  
เลขที่เอกสาร: 0252003  
ที่ 15 ถนนรามคำแหง 2/3 หมู่ 14 แขวงคลองเตย เขต คลองเตย กรุงเทพมหานคร 10110 โทร (66) 2338-6100 โทร (66) 2338-6333  
โทรสาร (66) 2338-6100 โทร (66) 2338-6333  
โรงงานผลิต: 105 หมู่ 5, บางพลีใหญ่, จังหวัดสมุทรปราการ 10510 โทร (66) 38-570-479-93 โทร (66) 38-570-323

Linde (Thailand) Public Company Limited  
เลขที่เอกสาร: 0252003  
ที่ 15 ถนนรามคำแหง 2/3 หมู่ 14 แขวงคลองเตย เขต คลองเตย กรุงเทพมหานคร 10110 โทร (66) 2338-6100 โทร (66) 2338-6333  
โทรสาร (66) 2338-6100 โทร (66) 2338-6333  
โรงงานผลิต: 105 หมู่ 5, บางพลีใหญ่, จังหวัดสมุทรปราการ 10510 โทร (66) 38-570-479-93 โทร (66) 38-570-323



Thai Environmental Technic Limited

บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## Analyzer Calibration Report

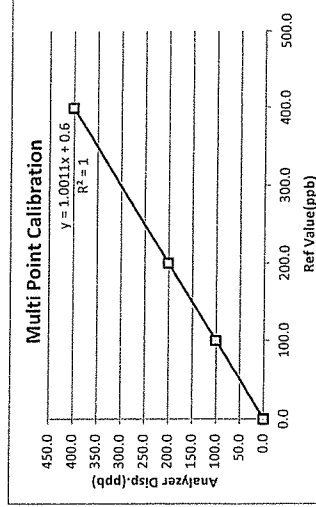
Calibrate Date : 23-Apr-24  
Analyzer Type : SO<sub>2</sub>  
Brand : API  
Model : 100E  
Serial Number : 1488 (No. 13)  
Range : 500 ppb  
Temperature (°C) : 25°C  
Barometer (mmHg) : 760.0  
Humidity (50±15 %) : 50.0 %RH  
Dilutor : API M700 S/N 625  
Zero Air : API M701 S/N 1926  
Standard gas : D636157

### Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	2.5	0.0	0.0
Span	400.0	388.0	400.0	0.0

### Multi Point Calibration

Ref Value(ppb)	Analyzer Disp(ppb)	Output Difference	
		Diff (ppb)	Percent Diff
0.0	0.4	0.4	0.00
100.0	101.0	1.0	0.01
200.0	200.8	0.8	0.00
400.0	401.0	1.0	0.00
Average Diff (%)			0.55



Calibrate by:

Approved by:

แก้ไขครั้งที่ : 00

วันที่อนุมัติ : 02/09/15

เลขที่แบบฟอร์ม : QF-QP16-06



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-3804, 0-2399-0469

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau  
Date of Issue : 20 November, 2023 Certification No. 412/23  
Page : 1 of 2

Object : Wind speed and wind direction  
Manufacturer : Davis Instruments Inc.  
Type : Vantage VUE Model No. : #6251EU  
Serial No. : Display MT221012048 Transmitter MT231004047  
Customer : Thai Environmental Technic Limited.  
1/6 Soi Ramkhamhaeng 145,  
Khwaeng/Khet Saphan Sung, Bangkok 10240.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1015.6 hPa

### NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563  
: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023  
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec  
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)  
Serial Number 110730029 (sensor 120629586)  
JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

Calibrated by :   
Mr. Watcharapol Subwal  
Mechanical Engineer  
Signed :   
Mr. Pisoot Pomsat  
Authorized Signatory for the Chief  
Sub-Standard Instrument





## The Result of Calibration

Certification No. 412/23

20 November, 2023

Page : 2 of 2

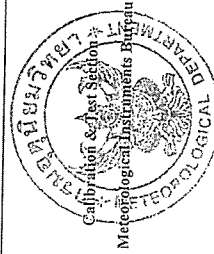
Standard Ultrasonic Anemometer m/sec	HOOK CAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H <sub>2</sub> O	Vacuum inches H <sub>2</sub> O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	0.9	0.9	0.10
3.02	-	-	2.7	2.7	0.32
5.00	-	-	4.9	4.9	0.10
7.00	-	-	6.7	6.7	0.30
9.02	-	-	9.0	9.0	0.02
11.01	-	-	10.8	10.8	0.21
13.01	-	-	13.0	13.0	0.01
15.01	-	-	15.1	15.1	-0.09
17.02	-	-	17.0	17.0	0.02
20.02	-	-	20.1	20.1	-0.08

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

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## Personal Pump Calibration Report

Equipment Type : Personal Pump/Parameter  
Equipment Range : 0.1-7.0 l/min  
Calibration Range : 0.1-4.0 l/min  
Calibration Type : Drycal  
Calibration S/N : 4491

Item	Personal Pump S/N	Hi Flow/Low Flow	ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3	Average	Uncertainty
1.	20151003021	0.5	0.4971	0.4973	0.4975	0.4973	±0.0002
2.	20080703009	0.5	0.4983	0.4983	0.4984	0.4983	±0.0001
3.	20080703013	0.5	0.4986	0.4981	0.4988	0.4987	±0.0004
4.	20111203067	0.5	0.4984	0.4975	0.4976	0.4975	±0.0005
5.	101151	1.5	1.4980	1.4990	1.4990	1.4990	±0.0006
6.	20110505097	1.5	1.4970	1.4980	1.4980	1.4980	±0.0006
7.	13427	1.5	1.4960	1.4980	1.4980	1.4970	±0.0012
8.	20111203056	1.5	1.4960	1.4960	1.4980	1.4960	±0.0012
9.	101156	2.0	1.9960	1.9970	1.9970	1.9970	±0.0006
10.	20120103069	2.0	1.9970	1.9980	1.9980	1.9980	±0.0006
11.	20140705056	2.0	1.9960	1.9970	1.9980	1.9970	±0.0010
12.	20110605104	2.0	1.9951	1.9960	1.9980	1.9980	±0.0015
13.	20110505110	2.0	1.9950	1.9960	1.9960	1.9960	±0.0006
14.	101157	2.0	1.9970	1.9960	1.9980	1.9980	±0.0010
15.	20080703015	2.0	1.9950	1.9960	1.9970	1.9960	±0.0010
16.	20080703011	2.5	2.4980	2.4980	2.4990	2.4980	±0.0006
17.	20080703003	2.5	2.4970	2.4970	2.4980	2.4970	±0.0006
18.	20080703020	2.5	2.4970	2.4970	2.4970	2.4970	±0.0000
19.	20151003049	2.5	2.4950	2.4960	2.4970	2.4960	±0.0010

Calibration Date 06 / 05 / 67

Calibration By ธีรศักดิ์

Remark : Uncertainty Type A =  $\sigma = \frac{SD}{\sqrt{n}}$

: SD = Standard deviation  
: X = Mean





FSR1223

## MAINTENANCE REPORT OPTIMA 8000

Customer : บริษัท เทคโนโลยีการคลังไทย  
จำกัด  
Address : 1/6 ซอยรามคำแหง 145,  
แขวงสะพานสูง, เขตสะพานสูง,  
กรุงเทพมหานคร 10240 TH  
User Name: คุณ ณัฐพงษ์  
Phone: 02-3737799, 081-1303495  
E-mail: Katsarin.Chuayphan@eurofinsasia.co  
Date Tested: March 28, 2024  
Recommendation Recertification  
Period 6 Months  
Recertification Due: September 27, 2027  
Date Last Certified: September 29, 2023  
Visit Number: 1 OF 2  
TH ONE SOURCE Phone: 081-7316733, 081-1086572  
E-mail : thonesource@gmail.com

### CONFIGURATION TESTED

MODEL SERIAL NUMBER  
OPTIMA 8000 078S1310024C  
N0772045 1F1380368

### TESTED EQUIPMENT

IPV Methods

### TEST STANDARD USED

Mixed standard 1/10  
Mixed standard 1/100

### CUSTOMER SUPPLIED

2 % HNO3  
10 % HNO3

### ACCESSORIES/COMPONENT

#### NOT INCLUDED

WinLab32 Version 5.5.0  
PN:6150T21E4Q1E



FSR1223

## MAINTENANCE REPORT OPTIMA 8000

SERIAL NUMBER 078S1310024C DATE TESTED March 28, 2024

### 1. MECHANICAL CHECKS

- A. Inspect and clean all fans and filters. ☐ OK
- B. Inspect and replace as necessary, all torch components including the RF Flat coil ☐ OK
- C. Inspect all tubing for sign of clacking or leaking. ☐ OK
- D. Adjust water and gas pressure regulator settings. ☐ OK
- E. Inspect and leak check pneumatics drawers. ☐ OK
- F. Clean the exterior of the instrument. ☐ OK

### 2. OPTICAL CHECKS

- A. Inspect and clean all optical components. ☐ OK
- B. As required, check and replace all purge filters. ☐ OK
- C. Recheck optical alignment. ☐ OK

### 3. COOLING SYSTEM CHECKS

- A. Perform preventive maintenance on chiller. ☐ OK
- B. Flush out water the chiller and replace with coolant mix30plus every twelve months ☐ OK

### 4. PERFORMANCE CHECKS

- A. Torch View Alignment. ☐ OK
- B. Wavelength Calibration. ☐ OK



MAINTENANCE REPORT  
OPTIMA 8000

SERIAL NUMBER	078S1310024C	DATE TESTED	March 28, 2024
PARAMETER	SPECIFICATION	FINAL VAULE	
Precision			
Zn 213.856	% RSD ≤ 1.0	0.33	
Mg 280.260	% RSD ≤ 1.0	0.63	
Mg 285.207	% RSD ≤ 1.0	0.59	
Ba 455.403	% RSD ≤ 1.0	0.28	
Detection Limits: Axial			
As 193 nm, 3(sd) ≤ 10.0 ppb		1.39	
Se 196 nm, 3(sd) ≤ 5.0 ppb		5	
Tl 190 nm, 3(sd) ≤ 10.0 ppb		1.08	
Pb 220 nm, 3(sd) ≤ 3.0 ppb		0.28	
Mn 257 nm, ≤ 30 ppb		3.80	
BEC: Axial			
Detection Limits: Radial			
As 193 nm, 3(sd) ≤ 60.0 ppb		2.53	
Zn 213 nm, 3(sd) ≤ 2.0 ppb		0.22	
Mn 257 nm, 3(sd) ≤ 1.0 ppb		0.05	
La 379 nm, 3(sd) ≤ 3.0 ppb		0.07	
Ba 455 nm, 3(sd) ≤ 0.3 ppb		0.04	
Ba 493 nm, 3(sd) ≤ 0.6 ppb		0.02	
Mn 257 nm, ≤ 30 ppb		10.83	
BEC: Radial			
Spectral Resolution: UV			
As 193 nm, ≤ 0.009		0.00687	
Ni 231 nm, ≤ 0.011		0.00792	
Ni 341 nm, ≤ 0.015		0.01195	
Spectral Resolution: VIS			
Ba 455 nm, ≤ 0.020		0.01482	



MAINTENANCE REPORT  
OPTIMA 8000

SERIAL NUMBER078S1310024C

DATE TESTEDMarch 28, 2024

Remarks :

Commissioning follow as commissioning performance sheets.

Calculate MnBEC = IB \* STD Conc / IS-IB , where standard conc = 1000 ug/L

IB = Intensity of blank

IS = Intensity of Standard

Used Mira Mist Nebulizer

ตรวจพบว่าLED(green)ในPlasma Control คือเป็นมาครั้ง แสดงว่าวงจรควบคุมในส่วนของ Neb Flow

บน Pneumatics Controller Board เป็นปกติทุก.

☒

meets

☐

does not meet

This is to certify that the above tests have been performed and the configuration tested

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department TH One Source Co., Ltd.

Krungschai T.

( Krungschai Treevichien )

Customer Support Engineer

Method Loaded  
Method Name: Precision  
IEC File:  
Method Description: N=10- 1.0% RSD  
Method Last Saved: 22/4/2554 10:20:08  
MSF File:  
Sequence No.: 3  
Sample ID: Precision  
Analyst:  
Initial Sample Wt:  
Dilution:  
Wash Time:  
Autosampler Location:  
Date Collected: 28/3/2567 13:45:32  
Data Type: Original  
Initial Sample Vol:  
Sample Prep Vol:  
Nebulizer Parameters: Precision  
Back Pressure 222.0 kPa  
Flow 0.55 L/min  
All  
Mean Data: Precision  
Analyte Mean Corrected Intensity Conc. Units Std.Dev. RSD  
Zn 286.200 146145.0 1334588.3 74404.6 3373485.1  
Mg 285.225 848.45 0.63%  
Ba 455.403 440.15 0.53%  
9501.59 0.28%  
Method Loaded  
Method Name: DLR-Cal  
IEC File:  
Method Description: Calibration for later test  
MSF File:  
Sequence No.: 1  
Sample ID: Calib Blank 1  
Analyst:  
Initial Sample Wt:  
Dilution:  
Wash Time:  
Autosampler Location:  
Date Collected: 28/3/2567 13:57:20  
Data Type: Original  
Initial Sample Vol:  
Sample Prep Vol:  
Nebulizer Parameters: Calib Blank 1  
Back Pressure 222.0 kPa  
Flow 0.55 L/min  
All  
Mean Data: Calib Blank 1  
Analyte Mean Corrected Intensity Conc. Units Std.Dev. RSD  
As 193.696 20.4 0.64 3.16%  
Zn 213.857 389.8 2.50 0.64%  
Mn 257.610 373.7 31.47 8.42%  
La 379.478 -39.2 19.10 48.73%  
Ba 455.403 565.0 298.22 52.78%  
Ba 493.408 595.9 5.51 0.92%  
Method Loaded  
Method Name: DLR-Cal  
IEC File:  
Method Description: Calibration for later test  
MSF File:  
Sequence No.: 2  
Sample ID: Calib Std 1  
Analyst:  
Initial Sample Wt:  
Dilution:  
Wash Time:  
Autosampler Location:  
Date Collected: 28/3/2567 14:00:31  
Data Type: Original  
Initial Sample Vol:  
Sample Prep Vol:  
Nebulizer Parameters: Calib Std 1  
Back Pressure 222.0 kPa  
Flow 0.55 L/min  
All  
Mean Data: Calib Std 1  
Analyte Mean Corrected Intensity Conc. Units Std.Dev. RSD  
As 193.696 5829.0 7.43 0.13%  
Zn 213.857 68281.4 370.49 0.54%  
Mn 257.610 682084.8 550.96 0.08%  
La 379.478 151940.7 798.65 0.53%  
Ba 455.403 389420.9 422.28 0.11%  
Ba 493.408 293177.5 436.31 0.15%  
Calibration Summary  
As 193.696 1 Lin, Calc Int 0.0 1156 0.00000 1.00000  
Zn 213.857 1 Lin, Calc Int 0.0 68280 0.00000 1.00000

Method Loaded  
Method Name: Precision  
IEC File:  
Method Description: N=10- 1.0% RSD  
Method Last Saved: 22/4/2554 10:20:08  
MSF File:  
Sequence No.: 3  
Sample ID: Precision  
Analyst:  
Initial Sample Wt:  
Dilution:  
Wash Time:  
Autosampler Location:  
Date Collected: 28/3/2567 13:45:32  
Data Type: Original  
Initial Sample Vol:  
Sample Prep Vol:  
Nebulizer Parameters: Precision  
Back Pressure 222.0 kPa  
Flow 0.55 L/min  
All  
Mean Data: Precision  
Analyte Mean Corrected Intensity Conc. Units Std.Dev. RSD  
Zn 286.200 146145.0 1334588.3 74404.6 3373485.1  
Mg 285.225 848.45 0.63%  
Ba 455.403 440.15 0.53%  
9501.59 0.28%  
Method Loaded  
Method Name: DLR-Cal  
IEC File:  
Method Description: Calibration for later test  
MSF File:  
Sequence No.: 1  
Sample ID: Calib Blank 1  
Analyst:  
Initial Sample Wt:  
Dilution:  
Wash Time:  
Autosampler Location:  
Date Collected: 28/3/2567 13:57:20  
Data Type: Original  
Initial Sample Vol:  
Sample Prep Vol:  
Nebulizer Parameters: Calib Blank 1  
Back Pressure 222.0 kPa  
Flow 0.55 L/min  
All  
Mean Data: Calib Blank 1  
Analyte Mean Corrected Intensity Conc. Units Std.Dev. RSD  
As 193.696 20.4 0.64 3.16%  
Zn 213.857 389.8 2.50 0.64%  
Mn 257.610 373.7 31.47 8.42%  
La 379.478 -39.2 19.10 48.73%  
Ba 455.403 565.0 298.22 52.78%  
Ba 493.408 595.9 5.51 0.92%  
Method Loaded  
Method Name: DLR-Cal  
IEC File:  
Method Description: Calibration for later test  
MSF File:  
Sequence No.: 2  
Sample ID: Calib Std 1  
Analyst:  
Initial Sample Wt:  
Dilution:  
Wash Time:  
Autosampler Location:  
Date Collected: 28/3/2567 14:00:31  
Data Type: Original  
Initial Sample Vol:  
Sample Prep Vol:  
Nebulizer Parameters: Calib Std 1  
Back Pressure 222.0 kPa  
Flow 0.55 L/min  
All  
Mean Data: Calib Std 1  
Analyte Mean Corrected Intensity Conc. Units Std.Dev. RSD  
As 193.696 5829.0 7.43 0.13%  
Zn 213.857 68281.4 370.49 0.54%  
Mn 257.610 682084.8 550.96 0.08%  
La 379.478 151940.7 798.65 0.53%  
Ba 455.403 389420.9 422.28 0.11%  
Ba 493.408 293177.5 436.31 0.15%  
Calibration Summary  
As 193.696 1 Lin, Calc Int 0.0 1156 0.00000 1.00000  
Zn 213.857 1 Lin, Calc Int 0.0 68280 0.00000 1.00000

Mn 257.610 1 Lin, Calc Int 0.0 682100 0.00000 1.000000  
La 379.478 1 Lin, Calc Int 0.0 151900 0.00000 1.000000  
Ba 455.403 1 Lin, Calc Int 0.0 389400 0.00000 1.000000  
Ba 493.408 1 Lin, Calc Int 0.0 293200 0.00000 1.000000

Sequence No.: 3 Autosampler Location:  
Sample ID: 2% Date Collected: 28/3/2567 14:03:02  
Analyst: DLXL-200324 Data Type: Original  
Initial Sample Wt: Initial Sample Vol:  
Dilution: Sample Prep Vol:  
Wash Time:

Method Loaded  
Method Name: DLXL-Cal  
Back Pressure 222.0 kPa Flow 0.55 L/min  
Nebulizer Parameters: 2%  
All

Mean Data: 2%  
Analyte Mean Corrected Conc. Units Std.Dev. RSD Sample  
As 193.696 43.7 0.0 mg/L 0.01 37.5 g/L 9.68 25.84%  
Zn 213.857 -20.4 -0.0 mg/L 0.00 0.3 g/L 0.41 136.74%  
Mn 257.610 394.8 0.0 mg/L 0.00 0.6 g/L 0.10 16.69%  
La 379.478 67.0 0.0 mg/L 0.00 0.4 g/L 0.24 55.45%  
Ba 455.403 -236.1 -0.0 mg/L 0.00 -0.1 g/L 0.00 4.98%  
Ba 493.408 -38.6 -0.0 mg/L 0.00 -0.0 g/L 0.02 177.50%

Method Loaded  
Method Name: DLXL-Check  
IEC File: Method Last Saved: 25/2/2543 11:12:48  
MSF File:  
Method Description: As-60,Zn-2, Mn1.0,La-3,Ba455-0.3,Ba493-0.6

Sequence No.: 4 Autosampler Location:  
Sample ID: 2 % HNO3 Date Collected: 28/3/2567 14:06:15  
Analyst: DLXL-2003 Data Type: Original  
Initial Sample Wt: Initial Sample Vol:  
Dilution: Sample Prep Vol:  
Wash Time:

Nebulizer Parameters: 2 % HNO3  
Analyte Back Pressure 222.0 kPa Flow 0.55 L/min  
All

Mean Data: 2 % HNO3  
Analyte Mean Corrected Conc. Units Std.Dev. RSD Sample  
As 193.696 -7.1 -0.0 mg/L 0.01 6.36 104.68%  
Zn 213.857 192.0 0.0 mg/L 0.00 2.8 g/L 0.14 4.99%  
Mn 257.610 91.2 0.0 mg/L 0.00 0.1 g/L 0.02 15.88%  
La 379.478 223.8 0.0 mg/L 0.00 1.5 g/L 0.31 21.20%  
Ba 455.403 -86.9 -0.0 mg/L 0.00 0.03 139.07%  
Ba 493.408 -179.8 -0.0 mg/L 0.00 0.05 86.77%

Analysis Begun  
Start Time: 28/3/2567 14:15:49 Plasma On Time: 28/3/2567 13:19:06  
Logged In Analyst: IET Technique: ICP Continuous  
Spectrometer: Optima 8000 Autosampler: 510

Sample Information File: C:\Users\Public\PerkinElmer\ICP\Data\Sample Information\24-03-28.sif  
Batch ID: Results Data Set: DLXL\_200324  
Results Library: C:\Users\Public\PerkinElmer\ICP\Data\Results\Results.mdb

Method Loaded  
Method Name: DLXL-Cal  
Back Pressure 223.0 kPa Flow 0.55 L/min  
Nebulizer Parameters: Calibration for later test  
IEC File: Method Last Saved: 5/10/2552 13:39:33  
MSF File:  
Method Description: Calibration for later test

Sequence No.: 1 Autosampler Location:  
Sample ID: Calib Blank 1 Date Collected: 28/3/2567 14:15:53  
Analyst: Initial Sample Wt: Data Type: Original  
Dilution: Initial Sample Vol:  
Wash Time: Sample Prep Vol:

Nebulizer Parameters: Calib Blank 1  
Analyte Back Pressure 223.0 kPa Flow 0.55 L/min  
All

Mean Data: Calib Blank 1  
Analyte Mean Corrected Conc. Units Std.Dev. RSD  
As 193.696 32.6 8.30 25.92% [0.00] g/L  
Zn 213.857 26.5 5.11 19.26% [0.00] g/L  
Mn 257.610 -38.3 10.38 27.07% [0.00] g/L  
La 379.478 353.9 3.91 1.11% [0.00] g/L  
Pb 220.353

Sequence No.: 2 Autosampler Location:  
Sample ID: DL-Standard Date Collected: 28/3/2567 14:18:16  
Analyst: Initial Sample Wt: Data Type: Original  
Dilution: Initial Sample Vol:  
Wash Time: Sample Prep Vol:

Nebulizer Parameters: DL-Standard  
Analyte Back Pressure 223.0 kPa Flow 0.55 L/min  
All

Mean Data: DL-Standard  
Analyte Mean Corrected Conc. Units Std.Dev. RSD  
As 193.696 5169.6 94.41 1.83% [1000] g/L  
Se 196.026 237.1 23.20 9.78% [500] g/L  
Ti 190.801 6707.8 43.25 0.64% [1000] g/L  
Pb 220.353 13000.0 22.38 0.17% [500] g/L

Calibration Summary  
As 103.696 1 Lin, Calc Int 0.0 5.169 0.00000 1.000000  
Se 106.026 1 Lin, Calc Int 0.0 0.4743 0.00000 1.000000  
Ti 190.801 1 Lin, Calc Int 0.0 6.708 0.00000 1.000000  
Pb 220.353 1 Lin, Calc Int 0.0 26.60 0.00000 1.000000

Sequence No.: 3 Autosampler Location:  
Sample ID: QC01 MQCS Date Collected: 28/3/2567 14:21:26

Analyst: Data Type: Original  
Initial Sample Wt: Initial Sample Vol:  
Dilution: Sample Prep Vol:  
Wash Time:

Nebulizer Parameters: Q01 MQCS  
Analyte Back Pressure Flow  
All 222.0 kPa 0.55 L/min

Mean Data: Q01 MQCS  
Analyte Mean Corrected Conc. Units Std. Dev. Sample Conc. Units Std. Dev. RSD  
As 193.696 135.4 30 g/L 4.50 30 g/L 4.50 17.16%  
Se 196.026 8.8 20 g/L 37.93 20 g/L 37.93 204.11%  
Tl 190.801 2.4 0 g/L 0.03 0 g/L 0.03 9.11%  
Pb 220.353 60.4 2 g/L 1.14 2 g/L 1.14 50.16%

Method Loaded  
Method Name: DLXU-Check  
IFC File:  
Method Description: Sample Std.Dev As/Tl <=10 g/L, Se<=5 g/L, Pb<=3 g/L  
Method Last Saved: 25/2/2543 10:51:16  
MSF File:

Sequence No.: 4  
Sample ID: 2 % HNO3  
Analyst: Location:  
Initial Sample Wt: Date Collected: 28/3/2567 14:24:11  
Dilution: Initial Sample Vol:  
Sample Prep Vol:  
Wash Time:

Nebulizer Parameters: 2 % HNO3  
Analyte Back Pressure Flow  
All 222.0 kPa 0.55 L/min

Mean Data: 2 % HNO3  
Analyte Mean Corrected Conc. Units Std. Dev. Sample Conc. Units Std. Dev. RSD  
As 193.696 -1.6 20 g/L 1.39 20 g/L 1.39 459.43%  
Se 196.026 10.9 20 g/L 11.69 20 g/L 11.69 50.84%  
Tl 190.801 1.1 0.2 g/L 1.08 0.2 g/L 1.08 649.16%  
Pb 220.353 -21.4 -0.8 g/L 0.28 -0.8 g/L 0.28 34.35%



## Global Service Training Department Service Engineer Certification

Krungchai Treevichien

This is to certify that the above mentioned  
PerkinElmer representative has trained to  
service the instrument indicated below:

ICP-Optima 7X00/8X00 Series

Instructor-:

Geoff Cook

Date:-13 FEB 2011 to 24 FEB 2011

Certified by :

(Manager, Global Training Operations)

# Qualification Report

PM Check list, CM OQ and PQ  
ICS-1100 : Anion (ID#377)

For

Thai Environmental Technic Co.,Ltd.  
(1<sup>st</sup> Contract)



## Certificate of Calibration

ICS-1100 : Anion (ID#377)

This certificate is to verify that instrument below are calibrated  
by Archemica Lab Co.,Ltd.

ICS-1100 S/N : 10010987

AS-DV S/N : 10010912

for

Thai Environmental Technic Co., Ltd

บริษัท เทคโนโลยี สิ่งแวดล้อม จำกัด  
ARCHEMICA LAB CO.,LTD

Operator Signature : K. Channarong Khiao-Un

Date : Mar 28, 2024

(Mr. Channarong Khiao-Un)

Test Engineer



Dionex Ion Chromatography  
Preventive Maintenance Report

Customer Organization	Name/ Department
Thai Environmental Technic Co., Ltd.	Khun, Kelsarin / Lab
Engineer	Date
Mr. Channarong Khiao-Un	28/Mar/2024

Instrument Detail

Instrument Model	Application
ICS-1100 (ID#377)	Anion
Instrument components	
ICS-1100	10010987
AS-DV	10010912

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS22	AG22	AERS 500	-	-
Remark:				

Perform By Archemica



ARCHERICA LAB CO., LTD.

K. Channarong

Archemica

28/Mar/2024

Date

Customer

Date

Preventive Maintenance Check List





## General ICS Maintenance Checklist

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



## AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial number	Firmware Version
<input checked="" type="checkbox"/> AS-DV	10010987	-

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

Others / comments



Chromeleon Operational Qualification

General Information

Computer Name (Server): USERICU  
Computer Name (Client): USERICU  
Version Number: 6.80 SR8  
Operator: Mr.Channarong Khiao-Un

General System Suitability Test: Test passed

Comparison Formats:

All Parameters: (Exceptions see below)	Significant Digits: (They must match exactly)	10
Time Related Frac. Coll. Parameters: [The parameters are marked with *.]	Max. Deviation:	0.02 s

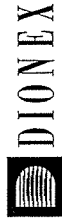


K. Channarong 28/Mar/2024

Operator's Signature // Date

Reviewer's Signature // Date

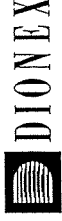
Chromeleon Operational Qualification  
(CM\_OQ)



## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

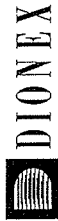
Report Variable	Peak Name	Status
Calibration Type: LOff		
Integration Type: Area		
Standard Method: External		
Calibration Mode: Total		
Auto Recalibrate: ON		
Offset (c0)	n.a.	ok
	n.a.	ok
	n.a.	ok
Slope (c1)		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Correlation Coeffi.		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Std. Deviation		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Rel. Std. Dev.		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Variance Coeff.		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok



## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Calibration Point Y		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Amount [ng]		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Resolution (EP)		
	Methylparabene	ok
	Ethylparabene	ok
Resolution (USP)		
	Methylparabene	ok
	Ethylparabene	ok
Peak Asymmetry (EP/USP)		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Peak Asymmetry (AIA)		
	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok



### Chromeleon Operational Qualification, Part 1

#### Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (USP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok
Theoretical Plates (JP)	Methylparabene	ok
	Ethylparabene	ok
	Propylparabene	ok

Test Result:

Passed

Reviewer's Signature // Date

Operator's Signature // Date



3/28/2024

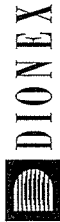


### Chromeleon Operational Qualification, Part 3

#### Post-Acquisition Steps: Comparison with Expected Results

Calibration Type: LOff  
Integration Type: Area  
Standard Method: External  
Calibration Mode: Total  
Auto Recalibrate: ON

Channel Name	Report Variable	Peak Name	Status
EXT230NM Extract UV Channel:	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
	Area	Methylparabene	ok
EXT290NM	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Base Peak Width	Methylparabene	ok
	Base Peak Width	Ethylparabene	ok
	Base Peak Width	Propylparabene	ok
	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok
Smooth Data:	UV_VIS_1_IMA_005_001		
	UV_VIS_1_OL_051_001		
	EXT290NM_SG_005_010		



### Chromeleon Operational Qualification, Part 3

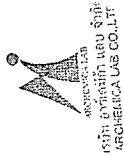
Post-Acquisition Steps: Comparison with Expected Results

Channel Name	Report Variable	Peak Name	Status
Arith. Comb. of Channels:			
ADD_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
ADD_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Methylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Ethylparabene	ok
MUL_UV_VIS_1_UV_VIS_1	Area	Propylparabene	ok

Test Result:

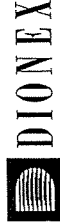
Passed

Reviewer's Signature // Date



K. Hanuwan 28/03/2024

Operator's Signature // Date



### Chromeleon Operational Qualification, Part 4

System Suitability Test: Comparison with Expected Results

Calibration Type: LOff  
Integration Type: Area  
Standard Method: External  
Calibration Mode: Total  
Auto Recalibrate: ON

Variable Category	Report Variable	Status
SST	Test No.	ok
	Test Name	ok
	Sample Condition	ok
	Sample Condition Result	ok
	Test Condition	ok
	Peak Condition	ok
	Aggregate Condition	ok
	Compare Operator	ok
	Compare Value	ok
	Result of Compare Value	ok
	Channel	ok
	Aggregated Samples	ok
	List of Aggr. Smp.	ok
	Result List for Aggr. Smp.	ok
	Result of Test Condition or Aggregate	ok
	N.A.	ok
	Test Result	ok
	Fail-Action	ok

Test Result: Passed

Reviewer's Signature // Date



K. Hanuwan 28/03/2024

Operator's Signature // Date



Chromeleon Operational Qualification, Part 5  
Fraction Collection: Comparison with Expected Results

Calibration Type: LOff  
Integration Type: Area  
Standard Method: External  
Calibration Mode: Total  
Auto Recalibrate: ON

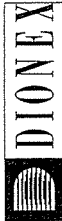
Variable Category	Report Variable	Status
Fraction Report	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	Position	ok
	Peak Name	ok
Tube Report	No. of Peaks	ok
	Position	ok
	Tube Starttime *)	ok
	Tube Endtime *)	ok
	Max. Tube Volume	ok
	Peak Name	ok
	No. of Peaks	ok
	Fract. No.	ok
	Fract. Starttime *)	ok
	Fract. Endtime *)	ok
	No. of Tubes	ok
	No. of Peaks	ok

Test Result: Passed

K. Hernandez 28/Mar/2024

Operator's Signature // Date

Reviewer's Signature // Date



Performance Qualification Rev. 6.10

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1. 1. 0
Detector	ICS-1100	Dionex	10010987	1. 1. 0
Autosampler	AS-DV	Dionex	10010912	1. 5. 0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1. 1. 0
Chromelcon	6.80 SR8	Dionex	62483	n.a.

• Accessories

Name	Description	Lot / Serial	Exp. Date
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.	n.a.
Blank	Water	n.a.	n.a.
Sample 1	Nitrate, 5 ppm	Thermo 231226	Dec-2024
Sample 2	Nitrate, 10 ppm	Thermo 231226	Dec-2024
Sample 3	Nitrate, 25 ppm	Thermo 231226	Dec-2024
Sample 4	Nitrate, 50 ppm	Thermo 231226	Dec-2024
Sample 5	Nitrate, 100 ppm	Thermo 231226	Dec-2024
Sample 6	Nitrate, 1000 ppm	Thermo 231226	Dec-2024
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	n.a.	n.a.
Balance	Mettler Toledo XP 205	1129273885	n.a.
Temperature Probe	-	-	-
IC Validation Test Box	-	-	-
Amneter / Multimeter	-	-	-

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelcon (s) DIONEX 2011  
Version 6.8 SR 8

*K. Channarong* 29/Mar/2024  
ARCHIMECHA LAB CO.,LTD.  
บริษัท อีซีเอ็มเคแอล จำกัด

Executor Signature \_\_\_\_\_ Date \_\_\_\_\_  
OQ\_PQ\_Integrated Validation / Specification  
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• Limits

Test	Customized Limits	Dionex Recommended Limits
ICS-1100 Conductivity Noise (nS)	<= 2.0	<= 2.0
ICS-1100 Conductivity Drift (nS/hr)	<= 20	<= 20
Injector Precision (Area %RSD)	<= 1.0	<= 1.0
Injector Carryover (Area %)	<= 0.1	<= 0.1
ICS-1100 Detector Linearity (Corr.)	>= 0.999	>= 0.999
ICS-1100 Detector Linearity (%RSD)	<= 5.0	<= 5.0
ICS-1100 Pump Flow Rate Accuracy (mL/min)	<= 0.05	<= 0.05
ICS-1100 Pump Flow Rate Precision (%RSD)	<= 2.0	<= 2.0

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date: 28-Mar-2024
Qualification	Mr. Channarong / Archemica	Period between Qualifications: 6 months
Executor/Company:		Next Qualification: Sep-2024

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelcon (s) DIONEX 2011  
Version 6.8 SR 8

*K. Channarong* 28/Mar/2024  
ARCHIMECHA LAB CO.,LTD.  
บริษัท อีซีเอ็มเคแอล จำกัด

Executor Signature \_\_\_\_\_ Date \_\_\_\_\_  
OQ\_PQ\_Integrated Validation / Specification  
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Performance Qualification Rev. 6.10

Detector Noise and Drift:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

• Accessories

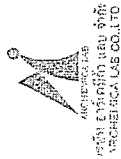
Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date:	28-Mar-2024
Qualification Executor/Company:	Mr. Channarong / Archemica	Next Qualification:	Sep-2024

• Test Results Summary

Test	Result
ICS-1100 Conductivity Noise (nS)	PASS
ICS-1100 Conductivity Drift (nS/hr)	PASS



K. Channarong 28/Mar/2024

Customer Signature      Date  
Chromeleon (c) DIONEX 2011  
Version 6.8 SR 8  
OQ\_PO\_Integrated\_Validation / Detector Noise and Drift  
Printed: 3/29/2024 1:57 PM

• Data for detector noise

Segment number	Noise, nS
1	0.46
2	0.38
3	0.46
4	0.51
5	0.40
6	0.54
7	0.51
8	0.44
9	0.48
10	0.38
11	0.50
12	0.38
13	0.57
14	0.42
15	0.41
16	0.36
17	0.41
18	0.43
19	0.44
20	0.44
Average, nS	0.4
Limit, nS	2.0
Result	PASS

• Data for detector drift

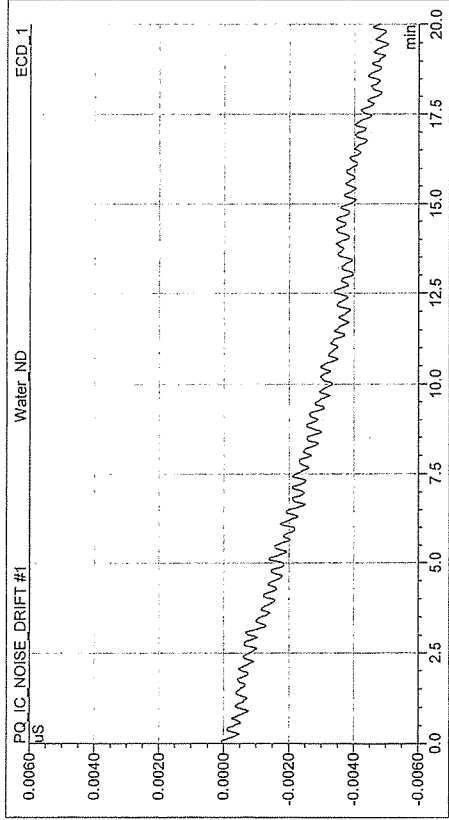
20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
-4.6	13.9	20.0	PASS



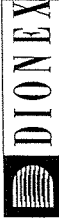
K. Channarong 28/Mar/2024

Customer Signature      Date  
Chromeleon (c) DIONEX 2011  
Version 6.8 SR 8  
OQ\_PO\_Integrated\_Validation / Detector Noise and Drift  
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Chromatogram of Detector Noise and Drift



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28/Mar/2024



Performance Qualification Rev. 6.10

Injector Precision:

Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Sample 4	Nitrate, 50 ppm	231228
Eluent	Water	n.a.

Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date:	28-Mar-2024
Qualification	Mr. Channarong / Arche mica	Next Qualification:	Sep-2024

Test Results Summary

Test	Result
Injector Precision (Area %RSD)	PASS

ARCHCHEMICA LAB CO.,LTD.  
28/Mar/2024



Performance Qualification Rev. 6.10

Injector Carryover:

Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512')	n.a.
Sample 6	Nitrate, 1000 ppm	231226
Blank	Water	n.a.
Eluent	Water	n.a.

Additional Information

Customer/Company:	Khun.KatsarinThai Environmental Technic Co.,Ltd	Date:	28-Mar-2024
Qualification	Mr. Channarong / Arche mica	Next Qualification:	Sep-2024
Executor/Company:			

Test Results Summary

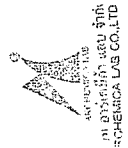
Test	Result
Injector Carryover (Area %)	PASS



K. Katsarinthai 28-Mar-2024

Customer Signature  
Chromleon (c) DIONEX 2011  
Version 6.8 SR 8

Executor Signature  
OO\_PO\_Integrated Validation / Injector Precision  
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K. Katsarinthai 28-Mar-2024

Customer Signature  
Chromleon (c) DIONEX 2011  
Version 6.8 SR 8

Executor Signature  
OO\_PO\_Integrated Validation / Injector Carryover  
Printed: 3/29/2024 2:02 PM



## Performance Qualification Rev. 6.10

### Detector Linearity:

#### • Instruments:

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

#### • Accessories

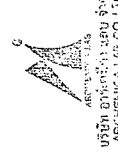
Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Sample 1	Nitrate, 5 ppm	231226
Sample 2	Nitrate, 10 ppm	231226
Sample 3	Nitrate, 25 ppm	231226
Sample 4	Nitrate, 50 ppm	231226
Sample 5	Nitrate, 100 ppm	231226
Eluent	Water	n.a.

#### • Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date:	28-Mar-2024
Qualification	Mr. Channarong / Archechemica	Next Qualification:	Sep-2024

#### • Test Results Summary

Test	Result
ICS-1100 Detector Linearity (Corr.)	PASS
ICS-1100 Detector Linearity (%RSD)	PASS

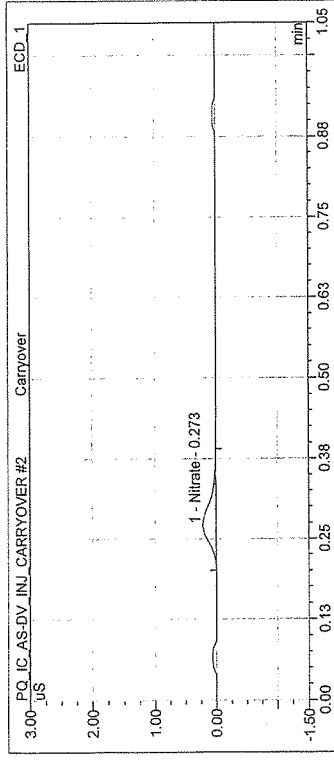


28/Mar/2024

Customer Signature  
Chromelcon (c) DIONEX 2011  
Version 6.8 SR 8

Executor Signature  
OQ\_PQ\_Integrated\_Validation / Detector Linearity  
Printed: 3/29/2024 2:03 PM

### • Chromatogram for Carryover test



#### • Data for Carryover test

Name	Ret. Time (detected) min	Area uS*min
	Nitrate	
	ECD_1	
High Level	0.27	52.058
Carryover	0.27	0.015
Water	0.27	0.011
Carryover (%):		0.008
Limit (%):		0.100
Result:		PASS



28/Mar/2024

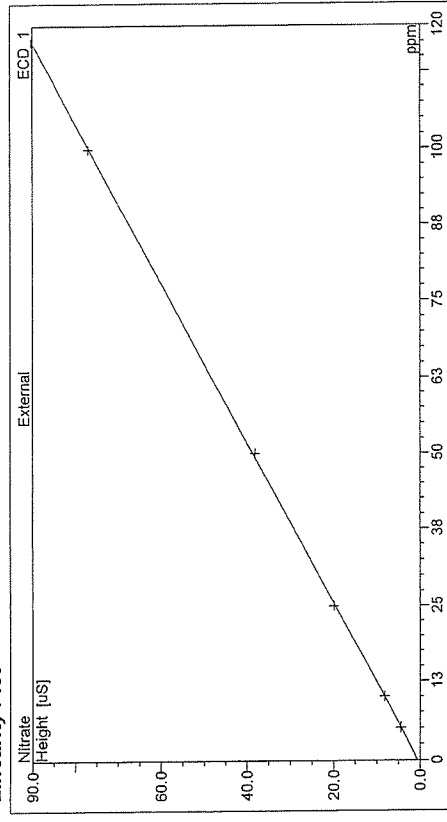
Customer Signature  
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Version 6.8 SR 8

Executor Signature  
OQ\_PQ\_Integrated\_Validation / Injector Carryover  
Printed: 3/29/2024 2:02 PM

• Data for Detector Linearity

Name	Amount ppm Nitrate ECD_1	Height uS Nitrate ECD_1
Detector linearity_1	5.000	4.403
Detector linearity_2	10.000	8.153
Detector linearity_3	25.000	19.920
Detector linearity_4	50.000	38.150
Detector linearity_5	100.000	76.964

• Linearity Plot



Calibration Type	Number of Points	Offset	Slope
LOff	5	0.548	0.762

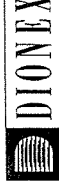
Linearity:	Correlation Coefficient	% RSD
Limit:	1.000	1.2
Result:	0.999	5.0
	PASS	PASS



K. Chanarong 28/Mar/2024

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromleon (c) DIONEX 2011  
Version 6.8 SR 8

Executor Signature \_\_\_\_\_ Date \_\_\_\_\_  
OQ\_PQ\_Integrated Validation / Detector Linearity  
Printed: 3/29/2024 2:03 PM



Performance Qualification Rev. 6.10

Pump Flow Rate Accuracy and Precision Test:

• Instruments

Instrument Name	Model	Supplier	Serial Number	Moduleware Version
Pump	ICS-1100	Dionex	10010987	1.1.0
Detector	ICS-1100	Dionex	10010987	1.1.0
Autosampler	AS-DV	Dionex	10010912	1.5.0
Eluent Generator	EG40 with n.a.	Dionex	10010987	1.1.0

• Accessories

Name	Description	Lot / Serial
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m (512")	n.a.
Eluent	Water	n.a.
Balance	Mettler Toledo	XP 205
		1129273885

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,L	Date:	28-Mar-2024
Qualification	Mr. Channarong / Archemica	Next Qualification:	Sep-2024
Executor/Company:			

• Test Results Summary

Test	Result
ICS-1100 Pump Flow Rate Accuracy (mL/min)	PASS
ICS-1100 Pump Flow Rate Precision (%RSD)	PASS



ARCHCHEMICAL LAB  
CO., LTD.  
10010912100 512m  
ARCHCHEMICAL LAB CO., LTD.

K. Chanarong 28/Mar/2024

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromleon (c) DIONEX 2011  
Version 6.8 SR 8

Executor Signature \_\_\_\_\_ Date \_\_\_\_\_  
OQ\_PQ\_Integrated Validation / Pump Flow Rate  
Printed: 3/29/2024 2:04 PM

• Data for Pump Flow Rate Accuracy and Precision Test

Ambient Temperature (°C)	20
--------------------------	----

Segment	Measured Eluent Weight (g)	Calculated Eluent Flow Rate (mL/min)	Deviation from 1.00 mL/min	Limit (mL/min)	Result
0	31.163	-	-	-	-
1	35.996	0.968	0.032	0.05	PASS
2	40.824	0.967	0.033	0.05	PASS
3	45.649	0.967	0.033	0.05	PASS
4	50.479	0.968	0.032	0.05	PASS
5	55.308	0.967	0.033	0.05	PASS
Average		0.968		Overall	PASS
Standard Deviation		0.001			
% RSD		0.1			
Limit (%)		2.0			
Result		PASS			

CERTIFICATE



*K. Thompson* 28/Mar/2024

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelson (c) DIONEX 2011  
Version 6.8 SR 8

Executive Signature \_\_\_\_\_ Date \_\_\_\_\_  
OQ\_PQ\_Integrated\_VValidation / Pump Flow Rate  
Printed: 3/29/2024 2:04 PM

# Certificate of Analysis

Better Separations Through  
Better Chemistry

## Dionex Nitrate OQ/PQ IC Standards Kit (Set of 6)

Product Number 060254  
Certificate of Analysis

Lot Number 231226

Expiration of Certification  
December 2024

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in  $\geq 18.2$  megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

### Dionex Nitrate Standard

Vial #	Concentration (mg/L)
1	5.08 $\pm$ 0.03
2	10.03 $\pm$ 0.14
3	25.16 $\pm$ 0.65
4	50.43 $\pm$ 0.09
5	99.7 $\pm$ 3
6	1014 $\pm$ 17



K. Channarong  
28/Mar/2024

The concentration value is based on a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 078690-01 20-Dec-2011

thermoscientific.com/dionex

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XX21149-EN-02165 03/13/16-10

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## Certificate of Completion

This certifies that

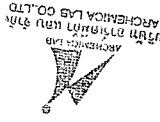
### Channarong Khiao-Un

Has successfully completed

## eLearn: RPG IC-Specific Qualification Service Training

Issued electronically and  
approved by:

TFS - Learning Management  
System, Training, Mentoring,  
and Certification Group  
tmc.training@thermofisher.com



K. Channarong  
28/Mar/2024

Valid for 3 years from:  
Nov/19/2021

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The certificate is only valid during employment with the Thermo Fisher Scientific including its subsidiaries and certified contractors.





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0632

MTC No. EEL. BP. 28/0866

## CALIBRATION CERTIFICATE

Submitted by : THAI ENVIRONMENTAL TECHNIC LIMITED.  
Address : 1/6 Soi Rankhamhaeng 145, Khwaeng/Khet Saphansung, Bangkok, 10240, Thailand.  
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Calibrator  
Manufacturer : Digicon  
Model : Tenmars  
Serial No. : 180501628  
Ambient Environment  
Temperature :  $(23 \pm 3) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Ambient Pressure :  $(101.325 \pm 1.500) \text{ kPa}$

### Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2633526.

**Calibration Procedure:** CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 10 Aug. 2023

Date of Calibration : 16 Aug. 2023

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

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E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0632

MTC No. EEL. BP. 28/0866

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.

Nominal Output of Unit Under Test = 94 dB re 20μPa at 1000 Hz

Acoustic Output in dB re 20μPa, Corrected to Reference Conditions : 101.325 kPa, 23.0°C. and 50 %RH

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	94.45	0.45	$\pm 0.10$	$\pm 0.75 \text{ dB}$

### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	991.4	-8.6	$\pm 1.5$	$\pm 1.0\%$

### 3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjær 4180	1.40	$\pm 0.50$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 16 Aug. 2023

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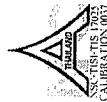
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0632

MTC No. EEL BP. 28/0866

Nominal Output of Unit Under Test = 114 dB re 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, Corrected to Reference Conditions : 101.325 kPa, 23.0 °C and 50 %RH

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	114.28	0.28	± 0.10	IEC60942:2003 Class 2 ±0.75 dB

### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	986.9	-13.1	± 1.5	IEC60942:2003 Class 2 ±2.0%

### 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	3.14	± 0.70	IEC60942:2003 Class 2 ±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Dechaiyae)

Approved by :

(Mr. Pavate Klusya)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Aug. 2023

Date of Issue : 21 Aug. 2023

Ref : 2011266081003103001

End of Certificate

3 / 3

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

#### Head Office

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Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th

FM&L-MTC.002 Rev.4



Thai Environmental Technic Limited  
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

## Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 1-May-2024  
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg  
Standard : IEC 60942 Temperature (23±3)°C : 25.00 °C  
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB Relative Humidity(50±15 %) : 50.0 % RH  
Frequency : at 1,000 Hz ±1% Dued Date of Calibrate : 31-May-2024  
Calibrator Serial NO. : 180501628

Item	Instrument Calibrated	Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
			ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
21	ACO 6226 070049	94.0	94.2	94.2	94.2	94.0	0.2	PASS
		114.0	114.1	114.1	114.1			
23	RION NL-21 00487676	94.0	93.9	93.9	93.9	94.0	0.1	PASS
		114.0	113.9	113.9	113.9			
25	ACO 6226 100098	94.0	94.1	94.1	94.1	94.0	0.1	PASS
		114.0	114.0	114.0	114.0			
26	ACO 6226 100099	94.0	94.2	94.2	94.2	94.0	0.2	PASS
		114.0	114.1	114.1	114.1			
28	ACO 6226 100101	94.0	93.9	93.9	93.9	94.0	0.1	PASS
		114.0	114.0	114.0	114.0			
29	ACO 6226 100102	94.0	94.1	94.1	94.1	94.0	0.1	PASS
		114.0	114.0	114.0	114.0			
30	ACO 6226 100106	94.0	94.2	94.2	94.2	94.0	0.2	PASS
		114.0	114.1	114.1	114.1			
31	ACO 6226 110098	94.0	93.7	93.7	93.7	94.0	0.3	PASS
		114.0	113.7	113.7	113.7			
32	ACO 6226 110105	94.0	94.1	94.1	94.1	94.0	0.1	PASS
		114.0	114.0	114.0	114.0			
34	ACO 6226 110099	94.0	93.8	93.8	93.8	94.0	0.2	PASS
		114.0	113.8	113.8	113.8			

Calibration By :

Approve by :

Thai Environmental Technic Limited 1/6 Soi Ramlahlaeng 145 Khwaeng Siet Saphan Sung Bangkok 10240 Thailand  
Tel : +66(0)2373-7799(Auto) Fax : +66(0)2373-7799 E-mail : admin@tetr1995.com www.tetr1995.com





Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

### Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 1-May-2024  
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg  
Standard : IEC 60942 Temperature (23±3)°C : 25.00 °C  
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB Relative Humidity(50±15 %) : 50.0 % RH  
Frequency : at 1,000 Hz ±1% Dued Date of Calibrate : 31-May-2024  
Calibrator Serial NO. : 180501628

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
35	ACO	6226	110097	94.1	94.1	94.1	94.0	0.1	PASS
36	ACO	6226	110102	114.2	114.2	114.2	94.0	0.1	PASS
37	ACO	6226	110101	93.9	93.9	93.9	94.0	0.0	PASS
38	ACO	6226	110106	113.8	113.8	113.8	94.0	0.2	PASS
39	ACO	6226	110104	94.1	94.1	94.1	94.0	0.1	PASS
40	ACO	6226	110100	114.1	114.1	114.1	94.0	0.1	PASS
41	ACO	6226	130127	94.2	94.2	94.2	94.0	0.2	PASS
42	ACO	6226	130128	114.1	114.1	114.1	94.0	0.1	PASS
44	ACO	6226	130130	93.9	93.9	93.9	94.0	0.1	PASS
45	ACO	6226	130131	113.9	113.9	113.9	94.0	0.3	PASS

Calibration By :   
Approve by : 


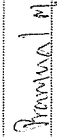


Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

### Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 1-May-2024  
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg  
Standard : IEC 60942 Temperature (23±3)°C : 25.00 °C  
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB Relative Humidity(50±15 %) : 50.0 % RH  
Frequency : at 1,000 Hz ±1% Dued Date of Calibrate : 31-May-2024  
Calibrator Serial NO. : 180501628

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
46	ACO	6236	112029	94.1	94.1	94.1	94.0	0.1	PASS
48	ACO	6236	152074	114.0	114.0	114.0	94.0	0.1	PASS
49	ACO	6236	152075	94.1	94.1	94.1	94.0	0.2	PASS
50	ACO	6236	152076	114.2	114.2	114.2	94.0	0.1	PASS
51	ACO	6236	152077	93.9	93.9	93.9	94.0	0.3	PASS
52	ACO	6226	150142	113.8	113.8	113.8	94.0	0.1	PASS
53	ACO	6226	160095	94.3	94.3	94.3	94.0	0.3	PASS
54	ACO	6226	160096	114.3	114.3	114.3	94.0	0.2	PASS
55	ACO	6226	160097	94.1	94.1	94.1	94.0	0.1	PASS
56	ACO	6226	160098	114.1	114.1	114.1	94.0	0.1	PASS

Calibration By :   
Approve by : 



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

### Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 1-May-2024  
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg  
Standard : IEC 60942 Temperature (23±3)°C : 25.00 °C  
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB Relative Humidity(50±15 %) : 50.0 % RH  
Frequency : at 1,000 Hz ±1% Dued Date of Calibrate : 31-May-2024  
Calibrator Serial NO. : 180501628

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
57	ACO	6226	160089	94.2	94.2	94.2	94.0	0.2	PASS
58	ACO	6226	160143	94.0	94.2	94.2	94.0	0.2	PASS
59	ACO	6228	160203	114.0	114.2	114.2	114.0	0.2	PASS
60	ACO	6226	160204	94.0	94.1	94.1	94.0	0.1	PASS
61	ACO	6226	160205	114.0	113.9	113.9	113.9	0.1	PASS
62	ACO	6226	160211	94.0	94.1	94.1	94.0	0.1	PASS
63	ACO	6226	160212	114.0	113.9	113.9	113.9	0.1	PASS
64	ACO	6226	160213	94.0	94.1	94.1	94.0	0.1	PASS
66	ACO	6226	160215	114.0	113.9	113.9	113.9	0.1	PASS
67	ACO	6226	160216	94.0	93.7	93.7	94.0	0.3	PASS

Calibration By :

Approve by :

*[Signature]*

*[Signature]*



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

### Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 1-May-2024  
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg  
Standard : IEC 60942 Temperature (23±3)°C : 25.00 °C  
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Frequency : at 1,000 Hz ±1% Dued Date of Calibrate : 31-May-2024  
Calibrator Serial NO. : 180501628

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
21	ACO	6226	070049	94.2	94.2	94.2	94.0	0.2	PASS
23	RION	NL-21	00487676	114.0	114.1	114.1	114.1	0.1	PASS
25	ACO	6226	100098	94.0	94.1	94.1	94.0	0.1	PASS
26	ACO	6226	100099	114.0	114.0	114.0	114.0	0.2	PASS
28	ACO	6226	100101	94.0	93.9	93.9	94.0	0.1	PASS
29	ACO	6226	100102	114.0	114.0	114.0	114.0	0.1	PASS
30	ACO	6226	100106	94.0	94.2	94.2	94.0	0.2	PASS
31	ACO	6226	110098	114.0	114.1	114.1	114.1	0.3	PASS
32	ACO	6226	110105	94.0	94.1	94.1	94.0	0.1	PASS
34	ACO	6226	110099	114.0	113.8	113.8	113.8	0.2	PASS

Calibration By :

Approve by :

*[Signature]*

*[Signature]*


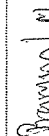


Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

### Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 1-May-2024  
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg  
Standard : IEC 60942 Temperature (23±3)°C : 25.00 °C  
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB Relative Humidity(50±15 %) : 50.0 % RH  
Frequency : at 1,000 Hz ±1% Dued Date of Calibrate : 31-May-2024  
Calibrator Serial NO. : 180501628

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
46	ACO	6236	112029	94.1	94.1	94.1	94.0	0.1	PASS
48	ACO	6236	152074	114.0	114.0	114.0	114.0	0.1	PASS
49	ACO	6236	152075	94.0	94.2	94.2	94.0	0.2	PASS
50	ACO	6236	152076	114.0	114.1	114.1	114.1	0.1	PASS
51	ACO	6236	152077	94.0	93.9	93.9	94.0	0.3	PASS
52	ACO	6226	150142	114.0	114.3	114.3	114.3	0.1	PASS
53	ACO	6226	160095	94.0	94.1	94.1	94.0	0.1	PASS
54	ACO	6226	160096	114.0	114.1	114.1	114.1	0.2	PASS
55	ACO	6226	160097	94.0	93.9	93.9	94.0	0.1	PASS
56	ACO	6226	160098	114.0	113.9	113.9	113.9	0.1	PASS

Calibration By :   
Approve by : 


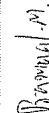


Thai Environmental Technic Limited  
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### Noise Dose Meter Calibration Report

Calibrator : TENMARS Sound Calibrator TM-100 Calibration Date : 1-May-2024  
Standard : IEC 60942 Barometric pressure (mmHg) : 759.0 mmHg  
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB Temperature (23±3)°C : 25 °C  
Frequency : at 1,000 Hz ±1% Relative Humidity(50±15 %) : 50 % RH  
Calibrator Serial NO. : 180501628 Dued Date of Calibrate : 31-May-2024

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
20	Tenmars	ST-130	170400163	94.0	94.0	94.0	94.0	0.0	PASS
21	Tenmars	ST-130	170400165	94.0	94.2	94.2	94.2	0.2	PASS
22	Tenmars	ST-130	170400177	94.0	93.9	93.9	94.0	0.1	PASS
23	Tenmars	ST-130	170800191	94.0	93.9	93.9	94.0	0.1	PASS
24	Tenmars	ST-130	170800193	94.0	94.2	94.2	94.0	0.2	PASS
25	Tenmars	ST-130	170800201	94.0	94.1	94.1	94.1	0.1	PASS
26	Tenmars	ST-130	170800207	94.0	93.9	93.9	94.0	0.1	PASS
27	Tenmars	ST-130	170800208	94.0	94.0	94.0	94.0	0.0	PASS
28	Tenmars	ST-130	200300133	94.0	94.0	94.0	94.0	0.0	PASS
29	Tenmars	ST-130	200300134	94.0	94.1	94.1	94.1	0.1	PASS

Calibration By :   
Approve by : 




**TET**

Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## Noise Dose Meter Calibration Report

Calibrator : TENMARS Sound Calibrator TM-100  
Standard : IEC 60942  
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB  
Frequency : at 1,000 Hz ±1%  
Calibrator Serial No. : 180501628  
Calibration Date : 1-May-2024  
Barometric pressure (mmHg) : 759.0 mmHg  
Temperature (23±3)°C : 25 °C  
Relative Humidity(50±15 %) : 50 % RH  
Dued Date of Calibrate : 31-May-2024

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
30	Tenmars	ST-130	220100050	94.0	94.0	94.0	94.0	0.0	PASS
31	Tenmars	ST-130	220100051	94.0	94.1	94.1	94.0	0.1	PASS
32	Tenmars	ST-130	220100052	94.0	93.9	93.9	94.0	0.1	PASS
33	Tenmars	ST-130	220100053	94.0	94.0	94.0	94.0	0.0	PASS
34	Tenmars	ST-130	220100054	94.0	94.1	94.1	94.0	0.1	PASS
35	Tenmars	ST-130	220100055	94.0	94.1	94.1	94.0	0.1	PASS
36	Tenmars	ST-130	220100056	94.0	93.9	93.9	94.0	0.1	PASS
37	Tenmars	ST-130	220100057	94.0	94.0	94.0	94.0	0.0	PASS

Calibration By :   
Approve by : Praveen M.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3006-24 FAX. 0-2719-9484



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## Certificate of Calibration

Certificate No. : 24H585  
Page : 1 of 2

Equipment : Thermal Environment Monitor  
Manufacturer : JANTYTECH  
Model : JT2011-E2A  
Serial No. : 3522210149  
ID No. : HD 10  
Condition As-Received: Used Item  
Received Date: 12 March 2024  
Calibration Date: 20 March 2024  
Reference: 2403-0381DSC  
Submitted by: Thai Environmental Technic Limited  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %  
1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung,  
Bangkok 10240

Procedure used: Calibration were conducted using in-house calibration procedure CP-HQ3 according to 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) Handheld Thermometer With Sensor	1521	A5A339	2311238	16 Oct 2024

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

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

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Sonchai Durnwor  
Issue Date : 25 March 2024

Approved Signatory :

(✓) Chakrit Waewwanjua  
( ) Ponthippa Tameyakul  
( ) Unnopphol Harachai



Cert. No.: 24H565  
Page.: 2 of 2

Result of Calibration:- Without Adjustment  
Function: Temperature Measurement for Tn

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.970	19.8	-0.170	0.42
29.975	29.8	-0.175	0.42
40.004	39.5	-0.504	0.42

Result of Calibration:- Without Adjustment  
Function: Temperature Measurement for Tnw

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.970	19.9	-0.070	0.42
29.975	29.8	-0.175	0.42
40.004	39.5	-0.504	0.42

Result of Calibration:- Without Adjustment  
Function: Temperature Measurement for Tg

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.970	19.9	-0.070	0.42
29.975	29.9	-0.075	0.42
40.004	39.7	-0.304	0.42

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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*[Signature]*

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert.No.: 23CHO841  
Page.: 1 of 2

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : Horiba  
Model : F-71G  
Serial No. : V3B1F8H3  
ID No. : Ins-LAB-025  
Condition As-Received: Used Item  
Received Date : 31 October 2023  
Calibration Date : 31 October 2023  
Reference : 2310-0843OC-1  
Submitted by : Thai Environmental Technic Limited  
1/6 Soi Ramkhamhaeng 145,  
Khwaeng/Khet Saphan Sung,  
Bangkok 10240  
Calibration Place : Laboratory (Thai Environment Technic Limited)  
Ambient Temperature : (25.8 - 24.6) °C  
Relative Humidity : (69.3 - 65.6) %  
Calibration Procedure : In - house method :  
- CP-OCH2 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by : Khit Rutanaprapachai

Approved by : *Saithip*  
Approved Signatory

(✓) Saithip Meangmai  
( ) Warakorn Lengagrakul  
( ) Ponpan Palpim

Issue Date : 10 November 2023

The Uncertainties are for a confidence probability of approximately 95%

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Cert. No.: 23CHO641

Page: 2 of 2

#### Condition of this calibration result

##### 1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	43160066	130RC092	23E1284	10 Apr 2024
2) Digital Thermometer	-	130RC018	23T1595	13 Sep 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	931958	01 Oct 2025
pH 6.865	CPA chem	788996	01 Jan 2024
pH 9.181	CPA chem	931960	01 Oct 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 (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: V3B1F8H3	4.000	177.48	177.5	4.000	0.058	2.00
	6.860	8.28	8.3	6.860	0.058	2.00
	7.000	0.00	0.0	7.000	0.058	2.00
	9.180	-128.97	-128.9	9.180	0.058	2.00
	10.000	-177.48	-177.4	10.000	0.058	2.00

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,9)

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.: 9X2E0223	4.008	4.031	160.0	0.0052	2.00
	6.865	6.870	-7.4	0.0087	2.00
	9.181	9.186	-142.0	0.014	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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
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53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23T1M704

Page : 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator  
Manufacturer : Accuplus  
Model : i250-DS  
Serial No. : 2059-1017-0029  
ID No. : LAB BOD 06  
Submitted by : Thai Environmental Technic Limited  
1/6 Soi Ramkhamhaeng 145,  
Khwaeng/Khet Saphan Sung,  
Bangkok 10240  
Location : Laboratory (Thai Environmental Technic Limited)

Received Order : 29 June 2023  
Calibration Date : 29 June 2023  
Ambient Temperature : (26  $\pm$  10)  $^{\circ}$ C  
Relative Humidity : (50  $\pm$  30) %

Calibrated by : Suwit Imjai

Approved by :   
( ) Ponthippa Taneyakul  
( ) Malee Butkruea  
Approved Signatory

Issue Date : 5 July 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 0053593





Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2306-07120C-8

Cert. No.: 23TM704  
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 ).  
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	MY57013823	23LM66	TPA	25 Mar 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 )

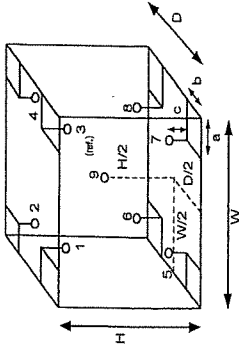
Result of Calibration :-

Function of UUC\* : ( \* ) Without Adjustment

Fresh air setting : Temperature Source

Not Available

Environment during calibration	
Temp. ( °C )	24
REL.Humid. ( % )	67
AC Supply ( Volt )	229
Finished	227



Probe Installation Details :

Dimension of Chamber :	
a =	10 cm
b =	10 cm
c =	10 cm
D =	0.48 m
W =	0.50 m
H =	1.1 m
Capacity =	0.26 m <sup>3</sup>

Wala.

a 1168975



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2306-07120C-8  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 23TM704  
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	0.38	0.36	1.1	2

Calibration Point ( °C )	Measured Temperature ( °C )								Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	
20.0	20.244	20.180	20.158	20.066	20.002	19.974	19.712	19.822	0.58

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

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

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

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

UUC\* : Unit Under Calibration

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

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

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