

## ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์





Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
1.	Stack Air	Particulate	Dry Gas Meter/SK25	S/N 8005333	21/02/2023	February 2024
			Digital Barometer/PHB-318	S/N B011410	25/05/2023	May 2024
			Digital Thermometer/DP-52	S/N L411635	03-13/03/2023	March 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			Gas Analyzer (E-instruments)/E6000-5DS	S/N 1339	07/07/2023	July 2024
2.	Ambient Air	NO <sub>x</sub> as NO <sub>2</sub>	Gas Analyzer (E-instruments)/4400S	S/N 2763	04/07/2023	July 2024
			Gas Analyzer (E-instruments)/4400S	S/N 2763	04/07/2023	July 2024
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/09/2022	September 2023
			High Volume Air Sampler/TET	S/N TSP-37	13/07/2023	July 2024
			High Volume Air Sampler/TET	S/N TSP-26	11/07/2023	July 2024
		PM-10	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/09/2022	September 2023
			High Volume Air Sampler/TET	S/N PM10-24	05/07/2023	July 2024
			High Volume Air Sampler/TET	S/N PM10-25	11/07/2023	July 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		NO <sub>2</sub>	CERTIFICATE OF ANALYSIS:Linde	S/N A00917SK	05/07/2023	July 2026
			NO <sub>x</sub> Analyzer/API 200E	S/N 393	09/11/2023	May 2024
			NO <sub>x</sub> Analyzer/API TML-41-H-02	S/N 495	01/11/2023	May 2024
			CERTIFICATE OF ANALYSIS:Linde	S/N D636157	18/09/2023	September 2027
			SO <sub>2</sub> Analyzer/Teledyne 100E	S/N 1412	07/11/2023	May 2024
		SO <sub>2</sub>	SO <sub>2</sub> Analyzer/Teledyne 100E	S/N 062	08/11/2023	May 2024
			Wind speed and wind direction/Weather Wizard III	S/N WC91109A02	13/09/2023	September 2024





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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 20151003019	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20151003045	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20140505071	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20140705055	09/11/2023	December 2023
		Aluminium Dust (Respirable Dust)	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	29/09/2023	March 2024
			Personal Air Sampler/Gillian	S/N 20140505076	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20151003007	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20080703006	09/11/2023	December 2023
		Hydrogen Chloride	Personal Air Sampler/Gillian	S/N 11591	09/11/2023	December 2023
			ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	29/09/2023	March 2024
			Personal Air Sampler/Gillian	S/N 20151003021	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20151002111	09/11/2023	December 2023
		Hydrogen Fluoride	Personal Air Sampler/Gillian	S/N 20140605018	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20140706027	09/11/2023	December 2023
			Ion Chromatography/ICS-1100	S/N 10010987	29/09/2023	March 2024
			Personal Air Sampler/Gillian	S/N 20120103081	09/11/2023	December 2023
		Oil Mist	Personal Air Sampler/Gillian	S/N 20140705058	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20151003024	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20140705060	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20140505071	09/11/2023	December 2023
		Electronic Balance/METTLER TOLEDO	Personal Air Sampler/Gillian	S/N 20151003019	09/11/2023	December 2023
			Personal Air Sampler/Gillian	S/N 20151003045	09/11/2023	December 2023
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024





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ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์ (ต่อ)

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
4.	Sound Level	Leq 24 hr & เสียงรบกวน	Sound Level Calibrator/TENMARS TM-100	S/N 181203570	16/01/2023	January 2024
			Integrated Sound Level/ACO TYPE 6226	S/N 110102	24/10/2023	November 2023
			Integrated Sound Level/ACO TYPE 6236	S/N 152075	24/10/2023	November 2023
			Integrated Sound Level/ACO TYPE 6226	S/N 160212	24/10/2023	November 2023
			Integrated Sound Level/ACO TYPE 6226	S/N 160205	24/10/2023	November 2023
			Integrated Sound Level/ACO TYPE 6236	S/N 222037	24/10/2023	November 2023
			Integrated Sound Level/ACO TYPE 6226	S/N 130127	24/10/2023	November 2023
5.	Occupational Health and Safety	Leq 8 hr	Sound Level Calibrator/TENMARS TM-100	S/N 181203570	16/01/2023	January 2024
			Integrated Sound Level/ACO TYPE 6236	S/N 152074	24/10/2023	November 2023
			Integrated Sound Level/ACO TYPE 6236	S/N 152075	24/10/2023	November 2023
			Sound Level Calibrator/TENMARS TM-100	S/N 181203570	16/01/2023	January 2024
			Noise Dose Meter/Tenmars SOUNDTEK/ST-130	S/N 200300133	24/10/2023	November 2023
			Noise Dose Meter/Tenmars SOUNDTEK/ST-130	S/N 220100050	24/10/2023	November 2023
			Thermal Environment Monitor/QUEST QUESTTemp 34	S/N TEK 060009	12/01/2023	January 2024
6.	Wastewater	Heat pH SS TDS BOD Oil & Grease	pH Meter/Horiba F-71G	S/N V3B1F8H3	31/10/2023	October 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			BOD Incubator	ID/N TET.LAB.BOD 05	11/04/2023	April 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	29/09/2023	March 2024







THAI ENVIRONMENTAL TECHNIC LIMITED  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## CONTROL UNIT CALIBRATION

( Metric units , mm )

Date	21-Feb-23	Barometric press, Pb	Initial	Final	Average
			758.1	757.8	758.0
					mmHg
Dry Gas Meter Data		Reference Dry Gas Meter Data			
Console No.	M50-01	Serial No.	913428		
Metering System ID		Model	S-110		
DGM Number	8005333	Correction factor(Yr)	0.997		
DGM Model	SK 25	Last Calibration Data	30-May-22		

Orifice manometer setting $\Delta H$ mm H <sub>2</sub> O	Ref . DMG Volume $V_g$ Liters	DGM Volume $V_m$ Liters	Temperature ( ° C )				Time min	DGM Correction factor (Y)	$\Delta H @$ mm H <sub>2</sub> O	
			Ref DGM $T_r$	Dry Gas Meter						
				Inlet $T_i$	Outlet $T_o$	Avg $T_m$				
15.00	100.00	100.22	30.00	30.00	29.00	29.50	8.18	0.9917	46.7360	
25.00	100.00	100.25	30.00	30.00	29.00	29.50	6.32	0.99065	46.5424	
50.00	100.00	99.98	30.00	30.00	29.00	29.50	4.47	0.9907	46.6776	
80.00	100.00	99.54	30.00	30.00	29.00	29.50	3.51	0.9923	46.1832	
100.00	100.00	99.25	30.00	30.00	28.70	29.35	3.16	0.9927	46.9034	
Average									0.9916	46.6085
Dused Date of Calibrate									21-Feb-24	

Calibrated by : Y. S.  
Approved : T. B.

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  $\pm 0.02$ .  
Note: For  $\Delta H @$ , Orifice pressure differential that equates to 0.75cm (0.0312m) (mm) at standard temperature and pressure, acceptable tolerance of individual values from the average is  $\pm 0.2$  inches (5.1mm) H<sub>2</sub>O.

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Tel : +660237577990 Fax : +660237577979 E-mail : admin@tet1995.com www.tet1995.com



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 13, SUANLUANG, BANGKOK 10250  
TEL. 02717-9000-24 FAX. 02719-9484



## Certificate of Calibration

Certificate No. : 23P1687  
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

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.

Reference: 2305-0815WSC  
Ambient Temperature: ( 23  $\pm$  2 ) °C  
Relative Humidity: ( 50  $\pm$  15 ) %  
Atmospheric Pressure: 1006 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  
Standard according to in-house calibration procedure CP-P10, using \* DKO-R 6-1; Calibration of Pressure  
Gauges, Edition 03/2014 \* as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments :

1) Standard Barometer  
Instrument : DP1142  
Model : 1422505048  
Certificate No. : MP-0084-23  
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 : Sulsan Khanlaew  
Issue Date : 28 May 2023  
Approved Signatory : Attapol P.  
[ ] Phairree Prapaisal  
[ ] Sura Suwanasri  
[x] Attapol Penurach

B 0315718

Result of calibration: Without adjustment
   
 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  $\pm 0.23$  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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Altapal P.
   
 a 1163290

## Certificate of Calibration

Certificate No.: 23T437
   
 Page: 1 of 2

**Equipment:** Digital Thermometer With Sensor
   
**Manufacturer:** Digicon
   
**Model:** DP-52
   
**Serial No.:** L411635
   
**ID No.:** No.10
   
**Condition As-Received:** Used Item
   
**Received Date:** 17 February 2023
   
**Calibration Date:** 03 March 2023
   
**Reference:** to 13 March 2023
   
**Ambient Temperature:**  $(25 \pm 3) ^\circ\text{C}$ 
  
**Relative Humidity:**  $(50 \pm 20) \%$ 
  
**Submitted by:** Thai Environmental Technic Limited
   
 1/6 Soi Ramkhamhaeng 145, Khwaeng/Khoh Saphan Sung, Bangkok 10240

**Procedure used:** Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (PRT) into liquid bath temperature controller and comparison with Standard Thermocouple (Type R/S) 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) Black Stack Thermometer	1560	BC454	220616	23 May 2023
2) PRT Scanner Module	2562	A01303	220616	23 May 2023
3) Industrial PRT Probe	5627A	979442	220616	23 May 2023
4) Digital Thermometer	1529	A48760	221089	09 Sep 2023
5) Industrial Platinum Resistance Thermometer	5627	824302	221089	09 Sep 2023
6) Digital Multimeter	2700	4016315	22E3264	05 Oct 2023
7) Thermocouple Type S	TCS	TCS-002	TT-0125-22	26 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 at:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Sitthithon Poomel
   
 Issue Date: 17 March 2023

Approved Signatory:

[Signature] Phalinee Prabpalpal
   
 [Signature] Chatchawan Khunpluek
   
 [Signature] Wanlop Larprukorn

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Cert. No.: 23T437  
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. 11005001 ID No. NO.10  
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	200.0068	200.0	-0.0068	0.74
180	400.0035	399.8	-0.2035	1.4
150	600.02	600.1	0.0800	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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5344 PATTANAKARN ROAD SOI 18, SIUANLIANG, SIUANLIANG BANGKOK 10250  
TEL. 0-2717-5900-29 FAX. 0-2719-9484



ISO 9001:2015  
CALIBRATION R99

Cert.No.: 23MM160  
Page.: 1 of 3

## Certificate of Calibration

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : AB204  
Serial No. : 1116392227  
ID No. : TET.LAB.BAL01  
Submitted by : Thai Environmental Technic Limited  
1/6 Soi Ramkhamhaeng 145,  
Khwaeng/Khet Saphan Sung,  
Bangkok 10240  
Location : Balance Room  
Received order : 10 April 2023  
Calibration Date : 11 April 2023  
Ambient Temperature : 15 °C to 40 °C  
Relative Humidity : 30 % to 90 %  
Calibrated by : Khit Ruttanaprapachai  
Approved by :  Approved Signatory

( ) Ponthippa Tarneyakul  
( ) Malee Bulkruea  
( ) Suwit Injai

Issue Date : 25 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

a 1152892

A 0053464



Equipment : Electronic Balance  
Condition As-Received :  
Reference :  
Procedure used :-

Electronic Balance  
Used Item  
2304-0146OC-12

Cert.No.: 23MM160  
Page: 2 of 3

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

#### Condition of this result of calibration

- Reference standard instruments:-
  - Standard Weight Set (E2) 15884
  - This certificate is valid only to the item calibrated on date and place of calibration.
  - This result of calibration was made on requested at the point specified by customer.
  - This certificate is not certified for any commercial transaction.
  - This certification is traceable to the International System of Unit.

Result of calibration ( ) Without Adjustment ( \* ) After Adjustment by 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	99.9982	+0.0018	0.18	2.00
200	199.9965	+0.0035	0.29	2.00

#### After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00007
200	0.00007



Equipment : Electronic Balance  
Condition As-Received :  
Reference :  
Result of calibration

Cert.No.: 23MM160  
Page: 3 of 3

#### 2. Effect of off center loading

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

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

#### 3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.14	2.11
0.01	0.0100	0.0000	0.14	2.11
0.1	0.1001	-0.0001	0.14	2.11
0.5	0.5000	0.0000	0.14	2.11
1	1.0001	-0.0001	0.14	2.11
5	5.0000	0.0000	0.14	2.11
10	9.9999	+0.0001	0.14	2.11
25	24.9998	+0.0002	0.15	2.07
50	49.9998	+0.0002	0.16	2.05
100	99.9999	+0.0001	0.18	2.00
200	200.0000	0.0000	0.29	2.00

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

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## Portable Gas Calibration Report

Manufacturer : B-instruments  
Instrument Model : B6000-SDS  
Instrument serial no. : 1339  
Instrument ID : 11

Date of Calibration: 7-Jul-23  
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> )	27906	Linde	August 4, 2023
Nitric Oxide(NO)	D025806	Linde	August 18, 2023
	D824524	Linde	August 22, 2025
Nitrogen Dioxide(NO <sub>2</sub> )	CC518873	Airgas	August 17, 2024
	CC518878	Airgas	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
	13.9	13.9	0.0		
NO (ppm)	0.0	0.0	0.0		PASS
	199.0	203.0	4.0		
	392.0	394.0	2.0		
NO <sub>2</sub> (ppm)	0.0	0.0	0.0	±5.0 ppm 0...100 ppm ±5% measured Value 101.....5000 ppm	PASS
	40.1	40.0	-0.1		
	82.2	83.0	0.8		
SO <sub>2</sub> (ppm)	0.0	0.0	0.0		PASS
	406.0	405.0	-1.0		
	804.0	802.0	-2.0		
CO (ppm)	0.0	0.0	0.0		PASS
	404.0	403.0	-1.0		
	793.0	792.0	-1.0		

Calibrate by: *gplw.s* Approved by: *Pravina M.*



## Portable Gas Calibration Report

Manufacturer : E-instruments  
Instrument Model : 4400S  
Instrument serial no. : 2763  
Instrument ID : 2

Date of Calibration: 4-Jul-23  
Ambient Condition  
Temperature (23±5 °C) : 25.0 °C  
Humidity (55±15 % RH) : 50.0 % RH  
Barometer (mmHg) : 759.5 mmHg

### Standard gas References

Standard gas	Cylinder No.	Traceability	Due date
Oxygen (O <sub>2</sub> )	27906	Linde	August 4, 2023
Nitric Oxide(NO)	D025806	Linde	August 18, 2023
	D824524	Linde	August 22, 2025
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
	13.9	13.9	0.0		
NO (ppm)	0.0	0.0	0.0		PASS
	199.0	197.5	-1.5		
	392.0	391.0	-1.0		
SO <sub>2</sub> (ppm)	0.0	0.0	0.0	±5.0 ppm 0...100 ppm ±5% measured Value 101.....5000 ppm	PASS
	406.0	405.0	-1.0		
	804.0	803.0	-1.0		
CO (ppm)	0.0	0.0	0.0		PASS
	404.0	403.0	-1.0		
	793.0	792.0	-1.0		

Calibrate by: *gplw.s* Approved by: *Pravina M.*





Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## High Volume TSP&PM-10 Calibration Report

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

### Site Conditions

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

### Calibration Orifice

Make : Tisch  
Model : TE-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 (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope	Linear Regression Intercept	Linear Regression Corr. Coeff
1	12.90	1.969	56.0	56.00	28.2957	2.4965	0.9783
2	9.80	1.739	52.0	52.00	28.2957	2.4965	0.9783
3	7.80	1.571	50.0	50.00	28.2957	2.4965	0.9783
4	5.00	1.294	40.0	40.00	28.2957	2.4965	0.9783
5	3.00	1.044	30.0	30.00	28.2957	2.4965	0.9783

### Calculations

$Q_{std} = 1/m[\sqrt{(Pa/Pstd)(Tstd/Ta))}] - b$   
 $IC = [(\sqrt{(Pa/Pstd)(Tstd/Ta))}] - b$   
 $m$  = sampler slope  
 $b$  = sampler intercept  
 $I$  = chart response  
 $T_{av}$  = daily average temperature  
 $P_{av}$  = daily average pressure  
 $Q_{std}$  = standard flow rate  
 $IC$  = corrected chart response  
 $I$  = actual chart response  
 $m$  = calibrator Qstd slope  
 $b$  = calibrator Qstd 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:  
 $1/m[(1/(\sqrt{(298/Tav)(Pav/760))}) - b]$   
NOTE: Ensure calibration orifice has been certified within 12 months of use

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

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



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

## High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech  
ITEM : PM10  
Site ID : Bangkok  
Serial No : (No. 24 )  
Date : 5-Jul-23  
Calibrate By : Pipat

### Site Conditions

Barometric Pressure (mm Hg) : 760.00  
Temperature (°C) : 28.0  
Corrected Pressure (mm Hg) : 760.0  
Temperature (deg K) : 301.0  
Average Press. (mm Hg) : 750.6  
Average Temp (°C) : 28.9  
Corrected Average (mm Hg) :  
Average Temp (Deg K) :

### Calibration Orifice

Make : Tisch  
Model : TE-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 (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope	Linear Regression Intercept	Linear Regression Corr. Coeff
1	12.20	1.756	60.0	60.00	34.3830	0.9890	0.9915
2	9.40	1.543	54.0	54.00	34.3830	0.9890	0.9915
3	7.20	1.353	50.0	50.00	34.3830	0.9890	0.9915
4	5.00	1.130	40.0	40.00	34.3830	0.9890	0.9915
5	3.00	0.880	30.0	30.00	34.3830	0.9890	0.9915

### Calculations

$Q_{std} = 1/m[\sqrt{(Pa/Pstd)(Tstd/Ta))}] - b$   
 $IC = [(\sqrt{(Pa/Pstd)(Tstd/Ta))}] - b$   
 $m$  = sampler slope  
 $b$  = sampler intercept  
 $I$  = chart response  
 $T_{av}$  = daily average temperature  
 $P_{av}$  = daily average pressure  
 $Q_{std}$  = standard flow rate  
 $IC$  = corrected chart response  
 $I$  = actual chart response  
 $m$  = calibrator Qstd slope  
 $b$  = calibrator Qstd 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:  
 $1/m[(1/(\sqrt{(298/Tav)(Pav/760))}) - b]$   
NOTE: Ensure calibration orifice has been certified within 12 months of use

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

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









Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

NOx Analyzer Calibration Report

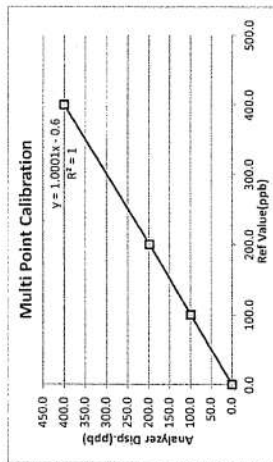
Calibrate Date : 9-Nov-23  
Analyzer Type : NOx  
Brand : API  
Model : 200 E  
Serial Number : 393 (NO.19)  
Range : 500 ppb  
Temperature (°C) : 25°C  
Barometer (mmHg) : 759.9  
Humidity (50±15 %) : 50.0%RH  
Dilutor : API M700 S/N 625  
Zero Air : API M701 S/N 1926  
Standard gas : A00917 SK

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	0.8	0.5	0.3	0.0	0.0	0.0	0.0
Span	400.0	411.0	409.0	2.0	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	0.2	0.1	0.1	0.10	0.000	0.03
100.0	100.2	99.3	0.9	-0.70	-0.007	0.70
200.0	199.5	198.2	1.3	-1.80	-0.009	0.90
400.0	400.8	400.1	0.7	0.10	0.000	0.03
Average Diff (%)						0.41



Calibrate by: plus

Approved by: Ramwut M

แก้ไขครั้งที่ : 00

วันที่อนุมัติ : 02/09/15

เลขที่แบบฟอร์ม : QF-QP1606

Thai Environmental Technic Limited 175 Soi Ramkhamhaeng 145 Khwaeng/Pkiet Saphan Sung Bangkok 10240 Thailand  
Tel : 46601213-7739 (Auto) Fax : 46601213-7739 • admin@et1395.com • www.et1395.com



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

NOx Analyzer Calibration Report

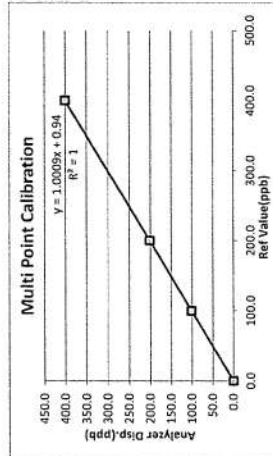
Calibrate Date : 1-Nov-23  
Analyzer Type : NOx  
Brand : API  
Model : TML-41-H-02  
Serial Number : 495 (NO.23)  
Range : 500 ppb  
Temperature (°C) : 25°C  
Barometer (mmHg) : 759.9  
Humidity (50±15 %) : 50.0%RH  
Dilutor : API M700 S/N 625  
Zero Air : API M701 S/N 1926  
Standard gas : A00917 SK

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	0.7	0.2	0.5	0.0	0.0	0.0	0.0
Span	400.0	405.0	401.0	4.0	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	0.0	0.40	0.001	0.10
100.0	102.3	101.5	0.8	1.50	0.015	1.50
200.0	201.5	201.5	0.0	1.50	0.008	0.75
400.0	402.0	401.0	1.0	1.00	0.003	0.25
Average Diff (%)						0.65



Calibrate by: plus

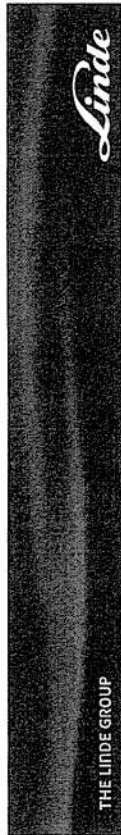
Approved by: Ramwut M

แก้ไขครั้งที่ : 00

วันที่อนุมัติ : 02/09/15

เลขที่แบบฟอร์ม : QF-QP16-06

Thai Environmental Technic Limited 175 Soi Ramkhamhaeng 145 Khwaeng/Pkiet Saphan Sung Bangkok 10240 Thailand  
Tel : 46601213-7739 (Auto) Fax : 46601213-7739 • admin@et1395.com • www.et1395.com



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: 18-Sep-2027

**Certificate Details**  
Number: 2500/23  
Material Details: 90179846  
Production Order: 5.520 M<sup>3</sup>  
Gas content: LINDE  
Cylinder Owner: LINDE  
Date of Issue: 18-Sep-2023  
Expiry date: 18-Sep-2027  
Material Code: 608400-SK-44  
Cylinder No: D636157  
Filling pressure: 145 bar  
Valve: CGA 660 SS  
Cylinder Material: Spectra seal  
Cylinder Size: 40 L

**Laboratory Report**  
Component: Sulphur Dioxide  
Nominal Concentration: 40.0 ppm  
Analysis Result: 41.1 ppm  
Uncertainty: ± 1% relative  
Method of Analysis: (6) I-PB-352  
Assay Date: 8-Sep-8 18-Sep-23

**Reference Standard used in Assay**  
Cylinder number: 80C1506295G  
Concentration: 25.35 ± 0.25 ppm  
Expiry date: 9-Jun-2024  
In Nitrogen  
Analytical Principle: FTIR-SO2  
Instrument/Make/Model: FTIR Spectrometers Nicolet 650  
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 ISO 15930-1:2015/15931 for the assay and certification of Gaseous Standards using gravimetric 6.1.  
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 on either recognized national metrology institutes.  
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzers, (3) Infrared Optical Oxygen Analyzers, (4) Infrared Optical Nitrogen Analyzers, (5) Total Hydrocarbon Analyzers, (6) Other - Specified

Page 1 of 1  
This report shall not be reproduced except in full  
Signature: Sukanya Paimyasoonit  
Signatory for and on behalf of Linde (Thailand) Co., Ltd.  
18/12/21 01 August 2023

**บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)**  
15 ถนนพหลโยธิน 2/2 หมู่ 14 แขวงจตุจักร เขตจตุจักร กรุงเทพมหานคร 10130  
โทรศัพท์: 02-250-1500 โทรสาร: 02-250-1501 แฟกซ์: 02-250-1502  
E-mail: info@linde.co.th  
Linde (Thailand) Public Company Limited  
15 ถนนพหลโยธิน 2/2 หมู่ 14 แขวงจตุจักร เขตจตุจักร กรุงเทพมหานคร 10130  
โทรศัพท์: 02-250-1500 โทรสาร: 02-250-1501 แฟกซ์: 02-250-1502  
E-mail: info@linde.co.th



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

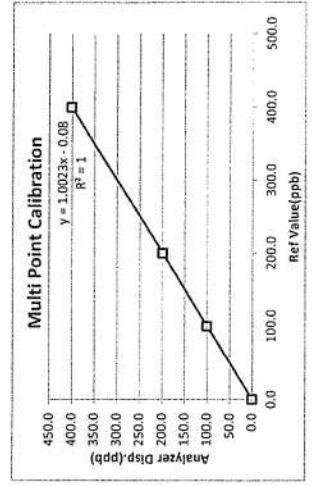
Calibrate Date: 7-Nov-23  
Analyzer Type: SO<sub>2</sub>  
Brand: Teledyne  
Model: 100 E  
Serial Number: 1412 (No. 221)  
Range: 500 ppm  
Temperature (°C): 25 °C  
Barometer (mmHg): 759.8  
Humidity (mmHg): 50.0 %RH  
Dilutor: API M700 S/N 625  
Zero Air: API M701 S/N 1926  
Standard gas: D636157

Calibration of Span

Supply Gas	Ref Value (ppb)	Before of Span (ppb)	After of Span (ppb)	Abs% diff of Span
Zero	0.0	3.4	0.0	0.0
Span	400.0	392.0	400.0	0.0

Multi Point Calibration

Ref Value (ppb)	Analyzer Disp. (ppb)	Diff (ppb)	Percent Diff	Abs Percent Diff
0.0	0.2	0.2	0.00	0.05
100.0	100.5	0.5	0.01	0.50
200.0	199.3	-0.7	0.00	0.35
400.0	401.3	1.3	0.00	0.33
Average Diff (%)				0.31



Calibrate by: [Signature]  
Approved by: [Signature]

แก้ไขวันที่: 00  
วันที่อนุมัติ: 02/09/15  
เลขที่แบบฟอร์ม: QF-QP16-06  
Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 45, Sapansoong, Bangkok 10240 Thailand  
Tel: +66(0)2373 7799 (Auto) Fax: +66(0)2373 7797 • admin@tet1995.com • www.tet1995.com



**TET**

Thai Environmental Technic Limited  
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

## Analyzer Calibration Report

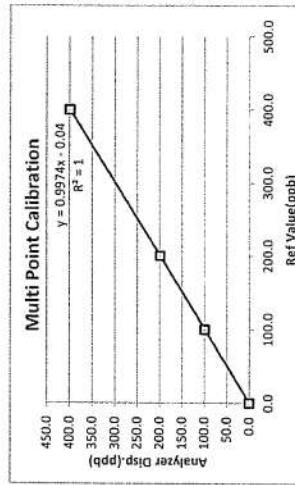
Calibrate Date : 8-Nov-23  
Analyzer Type : SO<sub>2</sub>  
Brand : Teledyne  
Model : 100 B  
Serial Number : 062 (NO. 23)  
Range : 500 ppb  
Temperature (°C) : 25°C  
Barometer (mmHg) : 758.2  
Humidity (50±15 %) : 52.0 %RH  
Dilutor : API M700 S/N 625  
Zero Air : API M701 S/N 1926  
Standard gas : D636157

### Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	1.0	0.0	0.0
Span	400.0	392.0	400.0	0.0

### Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)	Output Difference		
		Diff (ppb)	Percent Diff	Abs Percent Diff
0.0	0.3	0.3	0.00	0.08
100.0	99.4	-0.6	-0.01	0.60
200.0	199.2	-0.8	0.00	0.40
400.0	399.1	-0.9	0.00	0.22
Average Diff (%)				0.32



Calibrate by: Sekins

Approved by: วิภาดา/PM

แก้ไขครั้งที่ : 00

วันที่อนุมัติ : 02/09/15

เลขที่แบบฟอร์ม : QF-QP16-06

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Kwaeng/Khet Saphan Sung Bangkok 10240 Thailand  
• Tel : +66(0)2373-7799(Aus) Fax : +66(0)2373-7979 • admin@tet1995.com • www.tet1995.com



THAI METEOROLOGICAL DEPARTMENT

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

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 September, 2023 Certification No. 316/23

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III

Serial No. : WC91109A02 ID No. : No.24

Customer : Thai Environmental Technic Limited,  
1/6 Soi Ramkhamhaeng 145,  
Kwaeng/Khet Saphan Sung, Bangkok 10240.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.8 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800 0000 serial 9023

N.I.S.T. Test Reference Number 731/24-1480 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120625586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 30 m/sec

Calibrated by : Witapod  
Mr. Watcharapol Subwat  
Mechanical Engineer

Signed : Mr. Pissod Thomsat  
Mr. Pissod Thomsat  
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.	20151002111	0.5	0.4988	0.4988	0.4989	0.4988	±0.0001
2.	20151003021	0.5	0.4978	0.4978	0.4979	0.4978	±0.0001
3.	20140605018	0.5	0.4973	0.4975	0.4977	0.4975	±0.0002
4.	20140706027	0.5	0.4975	0.4977	0.4979	0.4977	±0.0002
5.	20120103081	1.5	1.4960	1.4980	1.4980	1.4970	±0.0012
6.	20140705058	1.5	1.4970	1.4980	1.4990	1.4980	±0.0010
7.	20151003024	1.5	1.4980	1.4980	1.4990	1.4980	±0.0006
8.	20140705060	1.5	1.4970	1.4980	1.4990	1.4980	±0.0010
9.	20151003019	2.0	1.9980	1.9980	1.9980	1.9980	±0.0000
10.	20151003045	2.0	1.9960	1.9970	1.9970	1.9970	±0.0006
11.	20140505071	2.0	1.9970	1.9980	1.9980	1.9980	±0.0006
12.	20140705055	2.0	1.9970	1.9970	1.9980	1.9970	±0.0006
13.	20140505076	2.5	2.4970	2.4980	2.4990	2.4980	±0.0010
14.	20151003007	2.5	2.4950	2.4960	2.4970	2.4960	±0.0010
15.	20080703006	2.5	2.4970	2.4980	2.4980	2.4980	±0.0006
16.	11591	2.5	2.4960	2.4960	2.4970	2.4960	±0.0006

Calibration Date 09 / 11 / 66

Calibration By ๗๕๖๖๖

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

: SD = Standard deviation  
:  $\bar{x}$  = Mean

## THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-3804, 0-2309-0469

## The Result of Calibration

Certification No. 316/23

Page : 2 of 2

13 September, 2023

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
Ultrasonic Anemometer					
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.00	-	-	-	6.7	0.30
9.02	-	-	-	8.9	0.12
11.01	-	-	-	10.7	0.31
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.7	0.31
17.02	-	-	-	16.5	0.52
20.02	-	-	-	19.7	0.32

### Wind Aloft Plotting Board.

### U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU

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

Calibrated by :

๗๕๖๖๖

Mr. Wacharapol Subwat  
Mechanical Engineer



# MAINTENANCE REPORT AND TEST CERTIFICATE

## OPTIMA 8000

<b>Customer :</b> บริษัท เทคโนโลยีทางการแพทย์ จำกัด	<b>Date Tested:</b> September 29, 2023
<b>Address :</b> 1/6 ซอยรามคำแหง 145 แขวงคลองเตย เขตคลองเตย กรุงเทพฯ 10140	<b>Recommendation Recertification Period</b> 6 Months
<b>User Name:</b> Khum Nattapong	<b>Recertification Due:</b> March 29, 2024
<b>Phone:</b> 02-3737799	<b>Date Last Certified:</b> April 3, 2023
<b>Fax:</b>	<b>Visit Number:</b> 2 of 2
	<b>PerkinElmer Phone:</b> 02-719-6420 ext 203
	<b>PerkinElmer Fax:</b> 02-318-5597

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED	
<b>MODEL</b>	<b>SERIAL NUMBER</b>		
OPTIMA 8000	078S1310024C		
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>		
IPV Methods			
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>		
Mixed standard 1/10	N069-1579		
Mixed standard 1/100	N930-0221		
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>		
2 % HNO3			
10 % HNO3			
	<b>EXPIRATION</b>		
	<b>EXPIRATION DATE</b>		
	November 30, 2023		
	November 30, 2023		
	<b>CUSTOMER INITIALS</b>		

# MAINTENANCE REPORT AND TEST CERTIFICATE

## OPTIMA 8000

<b>SERIAL NUMBER :</b> 078S1310024C	<b>DATE TESTED :</b> September 29, 2023
<b>1. MECHANICAL CHECKS</b>	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of cracking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
<b>2. OPTICAL CHECKS</b>	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every six months.	<input type="checkbox"/> OK
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK

MAINTENANCE REPORT AND TEST CERTIFICATE  
OPTIMA 8000

SERIAL NUMBER : 078S1310024C DATE TESTED : September 29, 2023

PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV	As 193.686 nm	0.00702
	Ni 231.604 nm	0.00790
	Ni 341.476 nm	0.01192
Spectral Resolution : VIS	Ba 455.403 nm	0.01500
Precision	Zn 205.200 nm	% RSD < 1.0
	Mg 280.271 nm	% RSD < 1.0
	Mg 285.213 nm	% RSD < 1.0
	Ba 455.403 nm	% RSD < 1.0
Detection Limits : Axial	As 193.686 nm	3(SD) ppb
	Se 195.026 nm	3(SD) ppb
	Tl 190.801 nm	3(SD) ppb
	Pb 220.353 nm	3(SD) ppb
Detection Limits : Radial	As 193.686 nm	3(SD) ppb
	Zn 213.857 nm	3(SD) ppb
	Mn 257.610 nm	3(SD) ppb
	La 379.478 nm	3(SD) ppb
	Ba 455.403 nm	3(SD) ppb
	Ba 493.408 nm	3(SD) ppb
BEC : Axial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 30 ppb
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 30 ppb

Page 3 of 4

MAINTENANCE REPORT AND TEST CERTIFICATE  
OPTIMA 8000

SERIAL NUMBER : 078S1310024C DATE TESTED : September 29, 2023

Remarks : \_\_\_\_\_  
Commissioning follow as commissioning performance sheets.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

☒ meets  
☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative : Waphan Promlumda  
( Waphan Promlumda )  
Service Engineer

Page 4 of 4

# PerkinElmer TruQ

## Atomic Spectroscopy Standard



### Certificate of Analysis

PerkinElmer Number: N9300221  
 Description: Instrument Calibration Standard 4  
 Matrix: 5% HNO<sub>3</sub>  
 Lot Number: 58-169CRY1  
 Certification Date: MAY -- 2022  
 Expiration Date: NOV 30 2023

#### \* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	100 µg/mL	99.8 µg/mL	3103a*
Pb	50.0 µg/mL	49.9 µg/mL	3128*
Se	50.0 µg/mL	49.8 µg/mL	3149*
Cd	50.0 µg/mL	50.0 µg/mL	3108*

\* - indicates NIST SRM  
 1 - indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 57-156CR, 1-177YJ, 54-134CR

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST. We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are properly sealed, stored under normal laboratory conditions. This value is the sum of certified concentration and the analytical determinations, pipetting, and diluting to final volume. For these solutions are 100 µg/mL of each analyte in 10 mL of high purity acids, ASTM Type 1 water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer: Y. Parikh

**PerkinElmer**  
 PerkinElmer, Inc.  
 U.S.A. Tel: 1-203-925-4600  
 U.S.A. Toll Free: 1-800-762-4000

Visit [www.perkinelmer.com/iso001](http://www.perkinelmer.com/iso001) for a complete listing of our global offices.

# PerkinElmer TruQ

## Atomic Spectroscopy Standard



### Certificate of Analysis

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Certifying Officer: Y. Parikh

**PerkinElmer**  
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 U.S.A. Tel: 1-203-925-4600  
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# PerkinElmer TruQ

Atomic Spectroscopy Standard

## Certificate of Analysis

PerkinElmer Number: N0691579  
Description: Multi-Element Standard  
Matrix: 2% HNO<sub>3</sub>  
Lot Number: 58-146CRX1

Certification Date: APR -- 2022  
Expiration Date: OCT 30 2023

### \* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	49.3 µg/mL	3103a*
K	50.0 µg/mL	50.0 µg/mL	3141a*
La	10.0 µg/mL	9.91 µg/mL	3127a*
Li	10.0 µg/mL	9.96 µg/mL	3129a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*
Ni	10.0 µg/mL	9.89 µg/mL	3136*
Sr	10.0 µg/mL	10.0 µg/mL	3153a*
Zn	10.0 µg/mL	9.99 µg/mL	3168a*
Ba	1.00 µg/mL	0.996 µg/mL	3104a*
Mg	1.00 µg/mL	0.992 µg/mL	3131a*

\* - Indicates NIST SRM

† - Indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 57-138CR, 3-250MJ, 57-024CR, 57-208CR

Refer to side 2 for details of certification.

We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date. PerkinElmer TruQ Atomic Spectroscopy Standards are kept lightly capped and stored under normal laboratory conditions. For these solutions we use high purity acids, ASTM Type 1 water (18 megohm double deionized), and deionized, triple-rinsed bottles. All glassware used is class A.

Certifying Officer:

*Y. Pavlich*

PerkinElmer

PerkinElmer, Inc.

U.S.A. Tel: 1-203-925-4600  
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# PerkinElmer TruQ

Atomic Spectroscopy Standard

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Sr	10.0 µg/mL	10.0 µg/mL	3153a*
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\* - Indicates NIST SRM

† - Indicates CRM (when NIST SRM is not available)

Reference Multi: Lot# 57-138CR, 3-250MJ, 57-024CR, 57-208CR

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST. We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date. PerkinElmer TruQ Atomic Spectroscopy Standards are kept lightly capped and stored under normal laboratory conditions. For these solutions we use high purity acids, ASTM Type 1 water (18 megohm double deionized), and deionized, triple-rinsed bottles. All glassware used is class A.

Certifying Officer:

*Y. Pavlich*

PerkinElmer

PerkinElmer, Inc.

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**PerkinElmer®**

**Global Service Training Department  
Service Engineer Certification**

---

**Wiphan Promlunda**

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

**ICP220B Optima 8300 & Optima 4X/5X/7X00 Series**

---

**Instructor:**

**Geoff Cook**

**Date: July 20, 2012**

**Certified by:**

**(Manager, Global Training Operations)**

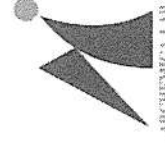


## Qualification Report

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

For

Thai Environmental Technic Co., Ltd  
(2<sup>nd</sup> Contract)



ARCHEMICA LAB CO., LTD.

39 Soi Sukhumvit 63 (Ekamai) Sukhumvit Rd.,  
North Klongton, Wattana, Bangkok 10110  
Tel. (66)-2714-8399 (Automatic) Fax. (66)-2714-8393



## 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



Operator Signature : *K. Chanasongkhro* Date : Sep 29, 2023

(Mr. Chanasongkhro)

Test Engineer

# PM

## Preventive Maintenance Check List



Checklist ICS Preventive Maintenance

### Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
Thai Environmental Technic Co.,Ltd	Khun Ketsarin
Engineer	Date
Mr.Channarong Khiao-Un	29-Sep-2023

#### Instrument Detail

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

#### Consumable Detail

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



Perform By  
Archemica Lab Co.,Ltd

Archemica Lab  
152/11 หมู่ 11 ต.บางพลีใหญ่  
อ.บางพลี จ.สมุทรปราการ

Archemica Lab

Date

Customer

Date



General ICS Maintenance Checklist

Item	Description	Result		Recommended replacement	N.A.
		Check	Fail		
1	Power line 220 Vac	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
2	Pneumatic Line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
3	Pressure outlet 80-100 psi	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
4	Barbed fitting and tee filing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
5	Crimped and blocked tubing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
6	Check Rheodyne Valve for Leak • Stator face • Rotor Seal	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	Every 12 months Every 12 months	<input type="checkbox"/> <input type="checkbox"/>
7	Slider valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
8	Inspect slider	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
9	Inspect port face	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
10	Inspect pressure bolt	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
11	Inspect fitting and ferrule	<input type="checkbox"/>	<input type="checkbox"/>	-	<input checked="" type="checkbox"/>
12	Suppressor for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
13	Cell for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
14	Electronic cable connected	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input checked="" type="checkbox"/>
15	Column selection valve for leak	<input type="checkbox"/>	<input type="checkbox"/>	-	<input type="checkbox"/>
16	Inspect all fitting and line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
17	Check Eluent reservoir	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
18	Inspect cap o-ring	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
19	Inspect air for leak	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
20	Pump Piston Rinse Seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
21	Piston Seals	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
22	Pump Lubricate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check&Lubricate	<input type="checkbox"/>
23	Front panel test	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
24	Low limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
25	Hi limit alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
26	Conductivity electronic test 160 $\pm$ 1 uS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
27	Check noise for suppressor (pk to pk <0.005uS)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
28	Check column • Check bed support	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Every 6 months	<input type="checkbox"/>
29	Check pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
30	Check suppressor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
31	Check cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
32	Check leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
33	Flow rate	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
34	System pressure	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>
35	Detector background	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Check	<input type="checkbox"/>

CM OQ

Chromeleon  
Operation Qualification



## Chromeleon Operational Qualification

### General Information

Computer Name (Server): NS  
Computer Name (Client): TET  
Version Number: 6.80 SR8 Build 2623 (156243)  
Operator: Mr. Channarong Khiao-Un

General System Suitability Test: *Test passed*

### Comparison Formats:

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

  
Operator's Signature // Date

Reviewer's Signature // Date



## Chromeleon Operational Qualification, Part 1

### Verification of Selected Results

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

Report Variable	Peak Name	Status
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

  
Operator's Signature // Date

Reviewer's Signature // Date



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

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

Variable Category	Report Variable	Peak Name	Status
Sample	No.		ok
	Name		ok
	Sample Type		ok
	Position		ok
	Status		ok
	Inj.Vol.		ok
	Dil.Fac.		ok
	Weight		ok
	Amount		ok
	Program		ok
Chromatogram	Quantification Method		ok
	Channel		ok
	No. of Peaks		ok
	Start Time		ok
	Signal Min.		ok
Peak Results	Signal Max.		ok
	Signal Dimension		ok
	Noise 2.1-2.3		ok
	No.	Methylparabene	ok
	No.	Ethylparabene	ok
Peak Name	Peak Name	Propylparabene	ok
	Peak Name	Methylparabene	ok
	Peak Name	Ethylparabene	ok
	Peak Name	Propylparabene	ok
	Ret.Time	Methylparabene	ok
	Ret.Time	Ethylparabene	ok
Peak Width	Peak Width	Propylparabene	ok
	Peak Width	Propylparabene	ok



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Ret.Dev.(abs)	Methylparabene	ok
	Ret.Dev.(abs)	Ethylparabene	ok
	Ret.Dev.(abs)	Propylparabene	ok
	Ret.Dev.(rel)	Methylparabene	ok
	Ret.Dev.(rel)	Ethylparabene	ok
	Ret.Dev.(rel)	Propylparabene	ok
	Area	Methylparabene	ok
	Area	Ethylparabene	ok
	Area	Propylparabene	ok
	Rel.Area (Total)	Methylparabene	ok
	Rel.Area (Total)	Ethylparabene	ok
	Rel.Area (Total)	Propylparabene	ok
	Height	Methylparabene	ok
	Height	Ethylparabene	ok
	Height	Propylparabene	ok
	Rel.Height (Total)	Methylparabene	ok
	Rel.Height (Total)	Ethylparabene	ok
	Rel.Height (Total)	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
Peak Width	Concentration	Propylparabene	ok
	Concentration	Methylparabene	ok
	Concentration	Ethylparabene	ok
	Rel.Amount	Propylparabene	ok
	Rel.Amount	Ethylparabene	ok
	Rel.Amount	Propylparabene	ok
	Peak Width (0%)	Methylparabene	ok
	Peak Width (0%)	Ethylparabene	ok
	Peak Width (0%)	Propylparabene	ok
	Peak Width (5%)	Methylparabene	ok
Peak Width (5%)	Peak Width (5%)	Ethylparabene	ok
	Peak Width (5%)	Propylparabene	ok
Peak Width (10%)	Peak Width (10%)	Methylparabene	ok
	Peak Width (10%)	Ethylparabene	ok
Peak Width (10%)	Peak Width (10%)	Propylparabene	ok
	Peak Width (10%)	Propylparabene	ok





## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Methylparabene	ok
	Peak Width (50%)	Ethylparabene	ok
	Peak Width (50%)	Propylparabene	ok
	Left Width (0%)	Methylparabene	ok
	Left Width (0%)	Ethylparabene	ok
	Left Width (0%)	Propylparabene	ok
	Right Width (0%)	Methylparabene	ok
	Right Width (0%)	Ethylparabene	ok
	Right Width (0%)	Propylparabene	ok
	Peak Start	Methylparabene	ok
	Peak Start	Ethylparabene	ok
	Peak Start	Propylparabene	ok
	Peak Stop	Methylparabene	ok
	Peak Stop	Ethylparabene	ok
	Peak Stop	Propylparabene	ok
	Peak Start Value	Methylparabene	ok
	Peak Start Value	Ethylparabene	ok
	Peak Start Value	Propylparabene	ok
	Peak Stop Value	Methylparabene	ok
	Peak Stop Value	Ethylparabene	ok
Peak Calibration	Peak Stop Value	Propylparabene	ok
	BL-Value Peak Start	Methylparabene	ok
	BL-Value Peak Start	Ethylparabene	ok
	BL-Value Peak Start	Propylparabene	ok
	BL-Value Peak Stop	Methylparabene	ok
	BL-Value Peak Stop	Ethylparabene	ok
	BL-Value Peak Stop	Propylparabene	ok
	Type	Methylparabene	ok
	Type	Ethylparabene	ok
	Type	Propylparabene	ok
Resolution(EP)	Resolution(EP)	Methylparabene	ok
	Resolution(EP)	Ethylparabene	ok
	Resolution(EP)	Propylparabene	ok
	Resolution(USP)	Methylparabene	ok
	Resolution(USP)	Ethylparabene	ok
	Resolution(USP)	Propylparabene	ok
Asymmetry(EP)	Asymmetry(EP)	Methylparabene	ok
	Asymmetry(EP)	Ethylparabene	ok
No. of Points	No. of Points	Methylparabene	ok
	No. of Points	Propylparabene	ok



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Methylparabene	ok
	Asymmetry(AIA)	Ethylparabene	ok
	Asymmetry(AIA)	Propylparabene	ok
	Theoretical Plates(EP)	Methylparabene	ok
	Theoretical Plates(EP)	Ethylparabene	ok
	Theoretical Plates(EP)	Propylparabene	ok
	Theoretical Plates(USP)	Methylparabene	ok
	Theoretical Plates(USP)	Ethylparabene	ok
	Theoretical Plates(USP)	Propylparabene	ok
	Theoretical Plates(JP)	Methylparabene	ok
	Theoretical Plates(JP)	Ethylparabene	ok
	Theoretical Plates(JP)	Propylparabene	ok
Peak Calibration	Cal.Mode	Methylparabene	ok
	Cal.Mode	Ethylparabene	ok
	Cal.Mode	Propylparabene	ok
	Auto.Recal.	Methylparabene	ok
	Auto.Recal.	Ethylparabene	ok
	Auto.Recal.	Propylparabene	ok
	Cal.Type	Methylparabene	ok
	Cal.Type	Ethylparabene	ok
	Cal.Type	Propylparabene	ok
	Weights	Methylparabene	ok
	Weights	Ethylparabene	ok
	Weights	Propylparabene	ok
	Offset	Methylparabene	ok
	Offset	Ethylparabene	ok
	Offset	Propylparabene	ok
	Slope	Methylparabene	ok
	Slope	Ethylparabene	ok
	Slope	Propylparabene	ok
	RF-Value	Methylparabene	ok
	RF-Value	Ethylparabene	ok
	RF-Value	Propylparabene	ok
No. of Points	No. of Points	Methylparabene	ok
	No. of Points	Ethylparabene	ok



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propylparabene	ok
	No. of Points(disabled)	Methylparabene	ok
	No. of Points(disabled)	Ethylparabene	ok
	No. of Points(disabled)	Propylparabene	ok
	Variance	Methylparabene	ok
	Variance	Ethylparabene	ok
	Variance	Propylparabene	ok
	Var.Coeff	Methylparabene	ok
	Var.Coeff	Ethylparabene	ok
	Var.Coeff	Propylparabene	ok
	Std.Dev.	Methylparabene	ok
	Std.Dev.	Ethylparabene	ok
	Std.Dev.	Propylparabene	ok
	Rel.Std.Dev.	Methylparabene	ok
	Rel.Std.Dev.	Ethylparabene	ok
	Rel.Std.Dev.	Propylparabene	ok
	Corr.Coeff.	Methylparabene	ok
	Corr.Coeff.	Ethylparabene	ok
	Corr.Coeff.	Propylparabene	ok
	Coeff.Det.	Methylparabene	ok
	Coeff.Det.	Ethylparabene	ok
	Coeff.Det.	Propylparabene	ok
	Adj. Coeff.Det.	Methylparabene	ok
	Adj. Coeff.Det.	Ethylparabene	ok
	Adj. Coeff.Det.	Propylparabene	ok
	X	Methylparabene	ok
	X	Ethylparabene	ok
	X	Propylparabene	ok
	Y	Methylparabene	ok
	Y	Ethylparabene	ok
	Y	Propylparabene	ok
	W	Methylparabene	ok
	W	Ethylparabene	ok
	W	Propylparabene	ok
	F(X)	Methylparabene	ok
	F(X)	Ethylparabene	ok
	F(X)	Propylparabene	ok



## Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Methylparabene	ok
	Residual for Cal.Point X	Ethylparabene	ok
	Residual for Cal.Point X	Propylparabene	ok
	Calibration Point Status	Methylparabene	ok
	Calibration Point Status	Ethylparabene	ok
	Calibration Point Status	Propylparabene	ok
	Amount	Methylparabene	ok
	Amount	Ethylparabene	ok
	Amount	Propylparabene	ok
	Amount	Propylparabene	ok
Peak Table	Peak Tab. Cal.Type	Methylparabene	ok
	Peak Tab. Peak Type	Methylparabene	ok
	Peak Tab. Left Limit	Methylparabene	ok
	Peak Tab. Right Limit	Methylparabene	ok
	Peak Tab. Group	Methylparabene	ok
	Peak Tab. Resp.Factor	Methylparabene	ok
	Peak Tab. Amnt.Dim	Methylparabene	ok



### Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Methylparabene	ok
	PPI	Ethylparabene	ok
	PPI	Propylparabene	ok
	RSD PPI	Methylparabene	ok
	RSD PPI	Ethylparabene	ok
	RSD PPI	Propylparabene	ok
	Match	Methylparabene	ok
	Match	Ethylparabene	ok
	Match	Propylparabene	ok
	RSD Match	Methylparabene	ok
	RSD Match	Ethylparabene	ok
	RSD Match	Propylparabene	ok
	Rel.Max at	Methylparabene	ok
	Rel.Max at	Ethylparabene	ok
	Rel.Max at	Propylparabene	ok

Test Result:

Passed

Signature of the Operator  
Operator's Signature // Date

Reviewer's Signature // Date



### Chromeleon Operational Qualification, Part 3

Post-Acquisition Steps: Comparison with Expected Results

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

Channel Name	Report Variable	Peak Name	Status
Extract UV Channel: EXT230NM	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
	Area	Methylparabene	ok
	Area	Ethylparabene	ok
Smooth Data: UV_VIS_1_MA_005_001 UV_VIS_1_OL_051_001 EXT290NM_SG_005_010	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok
	Noise (1.9-2.4 min)		ok



### 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

Operator's Signature // Date

  
ACQUINTELLA  
SMP-ELU-100-150  
APPROVED FOR TESTING



### Chromeleon Operational Qualification, Part 4

System Suitability Test: Comparison with Expected Results

Calibration Type: LOF  
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

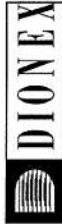
Test Result: Passed

Reviewer's Signature // Date

Operator's Signature // Date

  
ACQUINTELLA  
SMP-ELU-100-150  
APPROVED FOR TESTING





## 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
Chromeleon	6.80 SR8 Build 2623 (156243)	Dionex	16347	n.a.

### • Accessories

Name	Description	Lot / Serial	Exp. Date
Backpressure Tubing	0.13 mm (0.005") ID PEEK, 13 m	n.a.	n.a.
Blank	Water	n.a.	n.a.
Sample 1	Nitrate, 5 ppm	Thermo 230301	Mar-2024
Sample 2	Nitrate, 10 ppm	Thermo 230301	Mar-2024
Sample 3	Nitrate, 25 ppm	Thermo 230301	Mar-2024
Sample 4	Nitrate, 50 ppm	Thermo 230301	Mar-2024
Sample 5	Nitrate, 100 ppm	Thermo 230301	Mar-2024
Sample 6	Nitrate, 1000 ppm	Thermo 230301	Mar-2024
Eluent	Water	n.a.	n.a.
Autosampler Reservoir A	Water	n.a.	n.a.
Balance	Mettler Toledo AB204	1116392227	n.a.
Temperature Probe	-	-	-
	-	-	-
	-	-	-

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromeleon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)

Customer 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 FlowRate Accuracy(mL/min)	<= 0.05	<= 0.05
ICS-1100 Pump FlowRate Precision (%RSD)	<= 2.0	<= 2.0

### • Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date: 29-Sep-2023
Qualification	Mr. Channarong / Archemica	Period between Qualifications: 6 months
Executor/Company:		Next Qualification: Mar-2024



Khun.Ketsarin  
29/9/2023

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromeleon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
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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: 29-Sep-2023
Qualification	Mr. Channarong / Archemica	Next Qualification: Mar-2024

• Test Results Summary

Test	Result
n.a. Conductivity Noise (nS)	PASS
n.a. Conductivity Drift (nS/hr)	PASS



Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelcon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)  
OO\_PQ\_Integrated\_Validation / Detector Noise and Drift  
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• Data for detector noise

Segment number	Noise, nS
1	0.23
2	0.27
3	0.25
4	0.27
5	0.31
6	0.20
7	0.27
8	0.23
9	0.28
10	0.22
11	0.36
12	0.54
13	0.61
14	0.58
15	0.44
16	1.67
17	1.14
18	0.42
19	0.59
20	1.63
Average, nS	0.5
Limit, nS	2.0
Result	PASS

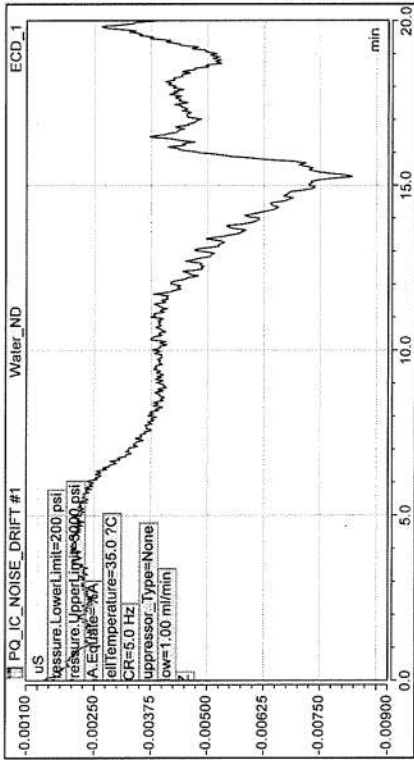
• Data for detector drift

20 Minute drift, nS	Drift, nS/hr	Limit, nS/hr	Result
-3.8	11.4	20.0	PASS



Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelcon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)  
OO\_PQ\_Integrated\_Validation / Detector Noise and Drift  
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Chromatogram of Detector Noise and Drift



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	230301
Eluent	Water	n.a.

Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date:	29-Sep-2023
Qualification Executor/Company:	Mr. Channarong / Archemica	Next Qualification:	Mar-2024

Test Results Summary

Test	Result
Injector Precision (Area %RSD)	PASS





• Data for Injector Precision test

Name	Area uS*min ECD_1 Nitrate
Inj Precision_1	2.872
Inj Precision_2	2.875
Inj Precision_3	2.882
Inj Precision_4	2.880
Inj Precision_5	2.876
Inj Precision_6	2.887
Inj Precision_7	2.873
Inj Precision_8	2.858
Inj Precision_9	2.857
Inj Precision_10	2.817
Average:	2.868
Std. Dev:	0.020
% RSD:	0.7
Limit (%)	1.0
Result:	PASS



Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelcon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)  
OO\_PQ\_Integrated\_Validation / Injector Precision  
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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	230301
Blank	Water	n.a.
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date:	29-Sep-2023
Qualification	Mr. Channarong / Archimex	Next Qualification:	Mar-2024

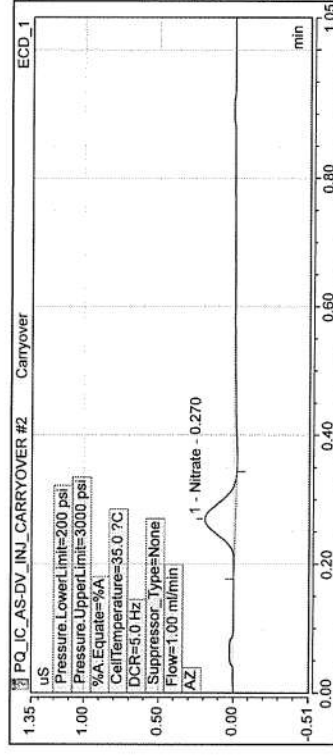
• Test Results Summary

Test	Result
Injector Carryover (Area %)	PASS



Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelcon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)  
OO\_PQ\_Integrated\_Validation / Injector Carryover  
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• Chromatogram for Carryover test



• Data for Carryover test

Name	Ret. Time (detected) min	Area uS*min
High Level	0.27	50.362
Carryover	0.27	0.012
Water	0.27	0.011
Carryover (%):		0.001
Limit (%):		0.100
Result:		PASS

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelcon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)

OQ\_PQ\_Integrated\_Validation / Injector Carryover  
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Signature: *[Handwritten Signature]*  
Date: *[Handwritten Date]*



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	230301
Sample 2	Nitrate, 10 ppm	230301
Sample 3	Nitrate, 25 ppm	230301
Sample 4	Nitrate, 50 ppm	230301
Sample 5	Nitrate, 100 ppm	230301
Eluent	Water	n.a.

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,Ltd	Date:	29-Sep-2023
Qualification	Mr. Channarong / Archimetrica	Next Qualification:	Mar-2024

• Test Results Summary

Test	Result
n.a. Detector Linearity (Corr.)	PASS
n.a. Detector Linearity (%RSD)	PASS

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromelcon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)

OQ\_PQ\_Integrated\_Validation / Validation / Detector Linearity  
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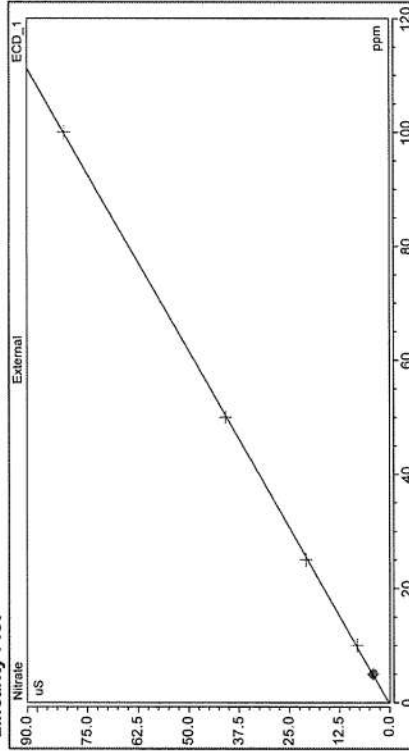


Signature: *[Handwritten Signature]*  
Date: *[Handwritten Date]*

• Data for Detector Linearity

Name	Amount ppm ECD_1 Nitrate	Height uS ECD_1 Nitrate
Detector linearity_1	5.000	4.101
Detector linearity_2	10.000	8.075
Detector linearity_3	25.000	20.845
Detector linearity_4	50.000	40.788
Detector linearity_5	100.000	80.714

• Linearity Plot



Calibration Type	Number of Points	Offset	Slope
Lin, WithOffset	5	0.269	0.806

Linearity:	Correlation Coefficient	% RSD
Limit:	1.000	1.1
Result:	0.999	5.0
	PASS	PASS

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromleon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromleon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)



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	1116392227

• Additional Information

Customer/Company:	Khun.Ketsarin/Thai Environmental Technic Co.,L	Date:	29-Sep-2023
Qualification	Mr. Channarong / Arche mica	Next Qualification:	Mar-2024

• Test Results Summary

Test	Result
n.a. Pump Flow Rate Accuracy (mL/min)	PASS
n.a. Pump Flow Rate Precision (%RSD)	PASS



Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromleon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)

Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromleon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)



Customer Signature \_\_\_\_\_ Date \_\_\_\_\_  
Chromleon (c) DIONEX 2011  
Version 6.80 SR8 Build 2623 (156243)

• Data for Pump Flow Rate Accuracy and Precision Test

Ambient Temperature (°C)	25
--------------------------	----

Segment	Measured Eluent Weight (g)	Calculated Eluent Flow Rate (mL/min)	Deviation from 1.00 mL/min	Limit (mL/min)	Result
0	33.875	-	-	-	-
1	36.707	0.969	0.031	0.05	PASS
2	43.514	0.964	0.036	0.05	PASS
3	48.320	0.964	0.036	0.05	PASS
4	53.133	0.965	0.035	0.05	PASS
5	57.936	0.963	0.037	0.05	PASS
Average					Overall
Standard Deviation					PASS

% RSD	0.2
Limit (%)	2.0
Result	PASS

# Certificate

## Certificate of Standards and Instruments for Qualification

# 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 230301

Expiration of Certification  
March 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	4.98 $\pm$ 0.01
2	10.10 $\pm$ 0.02
3	25.17 $\pm$ 0.02
4	50.05 $\pm$ 0.05
5	100.6 $\pm$ 1
6	1000 $\pm$ 2



The concentration value is based 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. 078659-01

20-Dec-2011

[thermoscientific.com/dionex](http://thermoscientific.com/dionex)

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XX21149-EN-0215S 031318-10

Thermo Fisher Scientific  
1228 Tian Way  
PO Box 3803  
Sunnyvale, CA 94089-3803  
(408) 731-0700

thermo  
scientific

# Certificate of Completion

This certifies that

Channarong Khiao-Un

Has successfully completed

eLearn: RPG IC-Specific Qualification Se

Valid for 3 years from:

Nov/19/2021



The world leader in serving science

Important note: The certificate is o  
Scientific including its subsidiaries





TISTR

NMITS-ITS 1003  
CALIBRATION 007

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197 MTC No. EEL. BP. 60/0166

### CALIBRATION CERTIFICATE

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

#### Instrument Calibrated :

Description : Sound Calibrator  
Manufacturer : Tannars  
Model : TM-100  
Serial No. : 181203570  
Ambient Environment  
Temperature : (23 ± 3) °C  
Relative Humidity : (50 ± 15) %  
Ambient Pressure : (101.325 ± 1.500) kPa

#### Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tannagawa 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 Keithley 2015-P S/N 4106495.
7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

**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 Jan. 2023

Date of Calibration : 16 Jan. 2023

1 / 3

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 : tnmpt@tistr.or.th Website: www.tistr.or.th

**Office/Laboratory**  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax (66) 0 2323 9165  
E-mail : mtg@tistr.or.th

**Office**  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax (66) 0 2579 8592  
E-mail : sura@tistr.or.th

FMIL.MTC.002 Rev.4



TISTR

NMITS-ITS 1003  
CALIBRATION 007

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197 MTC No. EEL. BP. 60/0166

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 Bruel&Kjaer 4180	94.26	0.26	± 0.10	±0.75 dB

#### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	989.3	-10.7	± 1.5	±2.0%

#### 3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	2.20	± 0.50	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 16 Jan. 2023

2 / 3

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.

**Head Office**  
35 Mu. 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax (66) 0 2577 9009  
E-mail : tnmpt@tistr.or.th Website: www.tistr.or.th

**Office/Laboratory**  
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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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Fax (66) 0 2323 9165  
E-mail : mtg@tistr.or.th

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

FMIL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197 MTC No. EEL, BP. 600166

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&Kjær 4180	113.96	-0.04	± 0.10	±0.75 dB

### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch Brüel&Kjær 4180	985.1	-14.9	± 1.5	±2.0%

### 3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjær 4180	2.60	± 0.60	±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 Deechaiyae)

Approved by :   
(Director)

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Jan. 2023

Date of Issue : 18 Jan. 2023

Ref : 2011266011000062001

End of Certificate

3 / 3

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

**Head Office**  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Chaochao, Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : rumpas@tistr.or.th Website: www.tistr.or.th

**Office/Laboratory**  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
Amphoe Bang Chalong, Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

**Office**  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sample@tistr.or.th




Thai Environmental Technic Limited  
บริษัท เทคนิสิ่งแวดล้อมสยามไทย จำกัด

### Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter  
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. : 181203570  
Calibration Date : 24-Oct-2023  
Barometric pressure (mmHg) : 759.0 mmHg  
Temperature (23±3)°C : 25.60 °C  
Relative Humidity(50±5 %) : 50.0 %RH  
Dated Date of Calibrate : 30-Nov-2023

Item	Instrument Calibrated	Reference	Before Adjust			After Adjust	Deviation	Result
			ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
31	ACO 6226	Acoustic dB	94.2	94.2	94.2	94.0	0.2	PASS
32	ACO 6226	Acoustic dB	114.1	114.1	114.1	114.1	0.1	PASS
33	ACO 6226	Acoustic dB	93.9	93.9	93.9	94.0	0.1	PASS
34	ACO 6226	Acoustic dB	113.8	113.8	113.8	113.8	0.1	PASS
35	ACO 6226	Acoustic dB	94.1	94.1	94.1	94.0	0.1	PASS
36	ACO 6226	Acoustic dB	114.0	114.0	114.0	114.0	0.1	PASS
37	ACO 6226	Acoustic dB	93.9	93.9	93.9	94.0	0.1	PASS
38	ACO 6226	Acoustic dB	113.8	113.8	113.8	113.8	0.2	PASS
39	ACO 6226	Acoustic dB	94.1	94.1	94.1	94.0	0.1	PASS
40	ACO 6226	Acoustic dB	114.0	114.0	114.0	114.0	0.1	PASS

Calibration By : 

Approve by : Pannalini

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Khwaeng/Thot Saphan Sung Bangkok 10240 Thailand  
Tel : +66(0)2373-2799(Aut) Fax : +66(0)2373-2799 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 : 24-Oct-2023  
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg  
Standard : IEC 60942 Temperature (23±3)°C : 25.60 °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% Due Date of Calibrate : 30-Nov-2023  
Calibrator Serial NO. : 181203570

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
41	ACO	6226	130127	94.1	94.1	94.1	94.0	0.1	PASS
42	ACO	6226	130128	94.2	94.2	94.2	94.0	0.2	PASS
43	ACO	6226	130129	94.3	94.3	94.3	94.0	0.3	PASS
44	ACO	6226	130130	94.1	94.1	94.1	94.0	0.1	PASS
45	ACO	6226	130131	93.9	93.9	93.9	94.0	0.1	PASS
46	ACO	6236	112029	94.1	94.1	94.1	94.0	0.1	PASS
47	ACO	6236	152073	93.9	93.9	93.9	94.0	0.1	PASS
48	ACO	6236	152074	94.2	94.2	94.2	94.0	0.2	PASS
49	ACO	6236	152075	93.9	93.9	93.9	94.0	0.1	PASS
50	ACO	6236	152076	94.0	94.0	94.0	94.0	0.0	PASS

Calibration By :   
Approve by : 



Thai Environmental Technic Limited  
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 24-Oct-2023  
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg  
Standard : IEC 60942 Temperature (23±3)°C : 25.60 °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% Due Date of Calibrate : 30-Nov-2023  
Calibrator Serial NO. : 181203570

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
61	ACO	6226	160205	94.2	94.2	94.2	94.0	0.2	PASS
62	ACO	6226	160211	94.2	94.2	94.2	94.0	0.2	PASS
63	ACO	6226	160212	94.1	94.1	94.1	94.0	0.1	PASS
64	ACO	6226	160213	94.1	94.1	94.1	94.0	0.1	PASS
66	ACO	6226	160215	93.9	93.9	93.9	94.0	0.1	PASS
67	ACO	6226	160216	94.1	94.1	94.1	94.0	0.1	PASS
68	ACO	6236	222036	94.0	94.0	94.0	94.0	0.0	PASS
69	ACO	6236	222037	94.0	94.0	94.0	94.0	0.0	PASS
70	ACO	6236	222038	93.9	93.9	93.9	94.0	0.1	PASS
71	ACO	6236	222039	94.0	94.0	94.0	94.0	0.0	PASS
72	ACO	6236	222040	94.0	94.0	94.0	94.0	0.0	PASS

Calibration By :   
Approve by : 



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. : 181203570

Calibration Date : 24-Oct-2023  
Barometric pressure (mmHg) : 759.0 mmHg  
Temperature (23±3)°C : 25 °C  
Relative Humidity(50±15 %) : 50 % RH  
Dued Date of Calibrate : 30-Nov-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3		
20	Tennmars	ST-130	94.0	93.9	93.9	93.9	94.0 0.1	PASS
21	Tennmars	ST-130	94.0	93.9	93.9	93.9	94.0 0.1	PASS
22	Tennmars	ST-130	94.0	94.2	94.2	94.2	94.0 0.2	PASS
23	Tennmars	ST-130	94.0	93.9	93.9	93.9	94.0 0.1	PASS
24	Tennmars	ST-130	94.0	94.1	94.1	94.1	94.0 0.1	PASS
25	Tennmars	ST-130	94.0	94.2	94.2	94.2	94.0 0.2	PASS
26	Tennmars	ST-130	94.0	93.8	93.8	93.8	94.0 0.2	PASS
27	Tennmars	ST-130	94.0	94.1	94.1	94.1	94.0 0.1	PASS
28	Tennmars	ST-130	94.0	94.0	94.0	94.0	94.0 0.0	PASS
29	Tennmars	ST-130	94.0	94.0	94.0	94.0	94.0 0.0	PASS

Calibration By : 

Approve by : Pannakorn M.



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. : 181203570

Calibration Date : 24-Oct-2023  
Barometric pressure (mmHg) : 759.0 mmHg  
Temperature (23±3)°C : 25 °C  
Relative Humidity(50±15 %) : 50 % RH  
Dued Date of Calibrate : 30-Nov-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3		
30	Tennmars	ST-130	94.0	94.1	94.1	94.1	94.0 0.1	PASS
31	Tennmars	ST-130	94.0	94.0	94.0	94.0	94.0 0.0	PASS
32	Tennmars	ST-130	94.0	94.0	94.0	94.0	94.0 0.0	PASS
33	Tennmars	ST-130	94.0	94.1	94.1	94.1	94.0 0.1	PASS
34	Tennmars	ST-130	94.0	93.9	93.9	93.9	94.0 0.1	PASS
35	Tennmars	ST-130	94.0	94.0	94.0	94.0	94.0 0.0	PASS
36	Tennmars	ST-130	94.0	94.0	94.0	94.0	94.0 0.0	PASS
37	Tennmars	ST-130	94.0	93.9	93.9	93.9	94.0 0.1	PASS

Calibration By : 

Approve by : Pannakorn M.



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



## Certificate of Calibration

Certificate No.: 23H56  
Page: 1 of 2

Equipment: Thermal Environment Monitor  
Manufacturer: Quest  
Model: QUESTemp 34  
Serial No.: 1EKUR0039  
ID No.: No. 1  
Condition As-Received: Used Item  
Received Date: 10 January 2023  
Calibration Date: 12 January 2023  
Reference: 2301-0236DSC  
Ambient Temperature: ( 26 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %  
Submitted by: Thai Environmental Technic Limited  
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:  
1) Handheld Thermometer With Sensor  
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 at:-  
-National Institute of Metrology Thailand (NIMT)

### Condition of this result of calibration

1. Reference standards instruments:

Model Serial No. Certificate No. Due Date  
1523 3240076 22/249 02 Mar 2023  
1) Handheld Thermometer With Sensor  
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 at:-  
-National Institute of Metrology Thailand (NIMT)

Calibrated by: Surasil Phansudnoi  
Issue Date: 17 January 2023

Approved Signatory:

[✓] Chakrit Waewanjua  
[ ] Pornthippa Tameyakul  
[ ] Viporn Tantiyawutti

B 0305573



Cert. No.: 23H56  
Page: 2 of 2

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

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.997	20.3	0.3	0.42
29.994	30.5	0.5	0.42
40.024	40.6	0.6	0.42

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

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.997	20.2	0.2	0.42
29.994	30.3	0.3	0.42
40.024	40.5	0.5	0.42

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

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.997	20.1	0.1	0.42
29.994	30.2	0.2	0.42
40.024	40.3	0.3	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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-3717-3900-29 FAX. 0-2716-9484

Cert.No.: 23CH44  
Page.: 1 of 2

## Certificate of Calibration

Equipment : Conductivity Meter  
Manufacturer : Horiba  
Model : ES-71  
Serial No. : D66G0003  
ID No. : No.3  
Condition As-Received: Used Item  
Received Date : 10 January 2023  
Calibration Date : 11 January 2023  
Reference : 2301-0236DSC-1  
Submitted by : Thai Environmental Technic Limited  
1/6 Soi Ramkhamhaeng 145,  
Khwae/Khet Saphan Sung, Bangkok 10240

Ambient Temperature :  $(25 \pm 2.5) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 15) \%$   
Calibration Procedure : In-house method :  
- CP-CH6 : based on direct measurement by  
using reference material (RM)

Calibrated by : Warakorn Lemgagrakul

Approved by :   
Approved Signatory

(☒) Malee Bulkrua  
( ) Sathip Meangmai  
( ) Warakorn Lemgagrakul

Issue Date : 16 January 2023

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

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

A 0010357



Cert.No.: 23CH44  
Page.: 2 of 2

### Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument Serial No. ID No. Certificate No. Due date  
1) Thermometer 1963878 130RC095 2211140 12 Sep 2023

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution, Thermo Scientific (traceable to NIST)

Conductivity Solution	Manufacturer	Lot No.	Exp. date
84 $\mu\text{S/cm}$	Thermo Scientific	152/02	14 Apr 2023
1.413 $\text{mS/cm}$	Thermo Scientific	132/02	01 Apr 2025
12.88 $\text{mS/cm}$	Thermo Scientific	041/01	29 Jan 2024

3. This certificate is valid only to the item calibrated on date and place of calibration.  
- Control Conductivity calibration solution temperature by Water bath  $(25 \pm 0.1) ^\circ\text{C}$

### Calibration results

Function : Conductivity Measurement

(\*) After Adjustment at 1.413  $\text{mS/cm}$

Conductivity Electrode Serial No.: 9C6E0212

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
84 $\mu\text{S/cm}$	86.7 $\mu\text{S/cm}$	87.6 $\mu\text{S/cm}$	4.3 $\mu\text{S/cm}$	2.00
1.413 $\text{mS/cm}$	1.395 $\text{mS/cm}$	1.413 $\text{mS/cm}$	0.015 $\text{mS/cm}$	2.00
12.88 $\text{mS/cm}$	12.30 $\text{mS/cm}$	12.59 $\text{mS/cm}$	0.14 $\text{mS/cm}$	2.00

Remark - UUC\* = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/43 PATTANAKARN ROAD 501 18, SUANLIANG, SUANLIANG BANGKOK 10250  
TEL 0-2717-3000-29 FAX 0-2719-9484



Cert.No.: 23CHO641  
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 Environment Technic Limited  
1/6 Soi Ramkhamhaeng 145,  
Khwaeng/Khrot Saphan Sung,  
Bangkok 10240  
Laboratory (Thai Environment Technic Limited)  
(25.8 - 24.6) °C  
(69.3 - 65.6) %  
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 :   
Approved Signatory

(✓) Sathip Meangmai  
( ) Warakorn Lenggrakul  
( ) Ponpan Paichim

Issue Date : 10 November 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

A 0060437



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		Uncertainty of pH measurement ( $\pm$ )	Coverage factor k
		mV	pH		
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)  
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-5854



Cert. No.: 23TM673  
Page : 1 of 3

## Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Accuplus

Model : i250

Serial No. : 0408-0115-0008

ID No. : TET.LAB.BOD005

Submitted by : Thai Environmental Technic Limited  
1/6 Soi Ramkhamhaeng 145,  
Khwang/Khet Saphan Sung,  
Bangkok 10240

Location : Laboratory (Thai Environmental Technic Limited)

Received Order : 10 April 2023

Calibration Date : 11 April 2023

Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Khit Ruttanaprapachai

Approved by :   
Approved Signatory

( ) Ponthippa Tameyakul  
(x) Malee Bulkruea  
( ) Suwit Injai

Issue Date : 25 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2304-01480C-2  
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 Model Serial No. Cert. No. Due Date  
1 ) Data Acquisition 34972A MY57013711 22LM93 02 Jul 2023

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

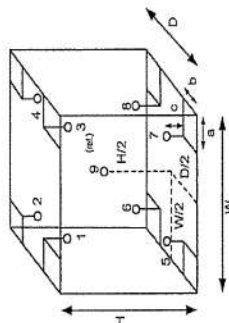
3. This certification is traceable to the International System of Unit.

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	26
REL.Humid. ( % )	51	54
AC Supply ( Volt )	221	221



Probe Installation Details :

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

Dimension of Chamber :  
D = 0.48 m  
W = 0.50 m  
H = 1.1 m  
Capacity = 0.26 m<sup>3</sup>

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

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Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2304-01460C-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 23TM673  
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	19.8	19.7	0.54	0.37	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								Uncertainty (±°C)
	Position								
	1	2	3	4	5	6	7	8	
20.0	20.121	20.227	19.983	20.098	19.992	19.953	19.936	19.914	20.048
									0.72

**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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