



ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์
(Calibration)

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
1.	Stack Air	Particulate	Dry Gas Meter/SK25	S/N 913428	14/02/2023	February 2024
			Digital Barometer/PHB-318	S/N B011412	13/03/2023	May 2024
			Digital Thermometer/DP-52	S/N I.491773	06-09/09/2022	September 2023
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	22/04/2022	April 2023
			Gas Analyzer (E-instrument)/4400-S	SN 2763	07/01/2023	January 2024
			Dry Gas Meter/SK25 EX	S/N 1173	09/03/2022	March 2023
			Digital Barometer/PHB-318	S/N B011407	11/05/2022	May 2023
			Digital Thermometer/DP-52	S/N I.491773	06-09/09/2022	September 2023
			ICP394/PerkinElmer/OPTIMA8000	S/N 07851310024C	04/10/2022	April 2023
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/05/2022	September 2023
2.	Ambient Air	TSP	High Volume Air Sampler/TET	S/N TSP-22	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N TSP-29	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N TSP-32	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N TSP-34	01/08/2022	August 2023
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	22/04/2022	April 2023
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/05/2022	September 2023
			High Volume Air Sampler/TET	S/N PM10-4	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N PM10-9	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N PM10-10	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N PM10-13	01/08/2022	August 2023
		PM-10	Electronic Balance/METTLER TOLEDO	S/N 1116392227	22/04/2022	April 2023
			CERTIFICATE OF ANALYSIS/Linds	S/N A009625K	18/08/2021	August 2023
			NO _x Analyzer/Teledyne T200	S/N 5159	20/11/2022	May 2023
			NO _x Analyzer/Teledyne T200	S/N 5160	20/11/2022	May 2023
			NO _x Analyzer/API 200A	S/N 1982	13/11/2022	May 2023
			NO _x Analyzer/API TML-41-H-02	S/N 495	13/11/2022	May 2023
		WS & WD	Wind speed and wind direction/Weather Wizard II	S/N WC50309B09	16/09/2022	September 2023



TET

Thai Environmental Technic Limited
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์ (ต่อ)

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
3.	Sound Level	Leq 24 hr	Sound Level Calibrator/TENMARS TM-100	S/N 181203570	16/01/2023	January 2024
			Integrated Sound Level/ACO 6226	S/N 110102	23/03/2023	30/04/2023
			Integrated Sound Level/ACO 6226	S/N 110097	23/03/2023	30/04/2023
			Integrated Sound Level/ACO 6226	S/N 160095	23/03/2023	30/04/2023
			Integrated Sound Level/ACO 6226	S/N 130131	23/03/2023	30/04/2023
			Integrated Sound Level/ACO 6226	S/N 160143	23/03/2023	30/04/2023
		เสียงรบกวน	Sound Level Calibrator/SCARLET ST-120	S/N ST120C0263E	22/12/2022	December 2023
			Integrated Sound Level/SCARLET-ST-11D	S/N 820877	23/03/2023	30/04/2023
			pH Meter/Horiba	S/N B06D0012	11/07/2022	July 2023
			pH Meter (Temperature)/Horiba	S/N B06D0012	11/07/2022	July 2023
4.	Water	Temperature	Turbidity Meter/EUTECH TN-100	S/N 2655003	31/10/2022	October 2023
		Color	SPECTROPHOTOMETER/Spectroquant Prove 100	S/N 1618111041	06/05/2022	May 2023
		DO	DO Meter/HORIBA	S/N D75J0012	14/01/2023	January 2024
		BOD	BOD Incubator	ID/N TET.LAB.BOD 05	11/04/2023	April 2024
		Oil & Grease	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		TDS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		TSS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		Cr ⁶⁺	Spectrophotometer/PerkinElmer	S/N 365K9042909	01/11/2022	November 2023
		Conductivity	Conductivity Meter/Horiba	S/N D64M0005	29/08/2022	August 2023
		Al, Cu, Mn	ICP394/PerkinElmer/OPTIMA8000	S/N 07851310024C	03/04/2023	October 2023
		Pb	Atomic Absorption Spectrophotometer Model/AAAnalyst 600 (Graphite)	S/N 60055070101	20/01/2023	July 2023
		As, Hg	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 04050110503	03/10/2022	April 2023
		Fecal Coliform	Incubator Model INE 500	E.505.1143	10/04/2023	April 2024
		Bacteria	Incubator Model INE 500	E.505.0595	10/04/2023	April 2024
		Total Coliform	Incubator Model INE 500	E.505.0595	10/04/2023	April 2024
		Bacteria				



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Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
5.	Working Air	Total Dust	Personal Air Sampler/Gilian	S/N 20110605018	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20140706029	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20151003019	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20140706027	30/03/2023	April 2023
		Respirable Dust	Electronic Balance/XP 205	S/N 1129273885	22/04/2022	April 2023
			Personal Air Sampler/Gilian	S/N 20140705049	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20151102093	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20031025001	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20140705056	30/03/2023	April 2023
			Electronic Balance/XP 205	S/N 1129273885	22/04/2022	April 2023
			Personal Air Sampler/Gilian	S/N 20151102097	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20151002109	30/03/2023	April 2023
		Al Fume	Personal Air Sampler/Gilian	S/N 20151102080	30/03/2023	April 2023
			ICP394/PerkinElmer/OPTIMA8000	S/N 07851310024C	04/10/2022	April 2023
			Personal Air Sampler/Gilian	S/N 14903	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20080703007	30/03/2023	April 2023
		Oil Mist	Personal Air Sampler/Gilian	S/N 20110605018	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20140706029	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20140605001	30/03/2023	April 2023
			Personal Air Sampler/Gilian	S/N 20140705059	30/03/2023	April 2023
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	22/04/2022	April 2023
			Sound Level Calibrator/TENMARS TM-100	S/N 181203570	16/01/2023	January 2024
6.	Occupational Health and Safety (Cont.)	Leq 12 hr	Integrated Sound Level/ACO TYPE 6236	S/N 152074	23/03/2023	30/04/2023
			Integrated Sound Level/ACO TYPE 6236	S/N 152076	23/03/2023	30/04/2023
			Integrated Sound Level/ACO TYPE 6236	S/N 152077	23/03/2023	30/04/2023
			Integrated Sound Level/ACO TYPE 6236	S/N 222040	23/03/2023	30/04/2023
			Noise Dosimeter/SOUNDTEK/ST-130	S/N 220100050	25/02/2023	February 2024
		Noise Dose	Noise Dosimeter/SOUNDTEK/ST-130	S/N 220100051	25/02/2023	February 2024
			Noise Dosimeter/SOUNDTEK/ST-130	S/N 220100052	25/02/2023	February 2024
			Noise Dosimeter/SOUNDTEK/ST-130	S/N 220100053	25/02/2023	February 2024

- 3/4-



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Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
6.	Occupational Health and Safety	Heat	Thermal Environment Monitor/JANTYTECH/JT2011-E2A	S/N 3522210145	09-13/03/2023	March 2024
			Thermal Environment Monitor/JANTYTECH/JT2011-E2A	S/N 3522210146	09-13/03/2023	March 2024
7.	Soil	pH	pH Meter/Horiba	S/N 806D0012	11/07/2022	July 2023
			Spectrophotometer/PerkinElmer	S/N 365K9042909	01/11/2022	November 2023
		Cr ⁶⁺	Atomic Absorption Spectrophotometer	S/N 60055070101	20/01/2023	July 2023
			Model/AAAnalyst 600 (Graphite)	S/N 04050110503	03/10/2022	April 2023
		Cd and Cd Compounds	Atomic Absorption Spectrophotometer	S/N 04050110503	03/10/2022	April 2023
			Model/AAAnalyst 100	S/N 04050110503	03/10/2022	April 2023
		As	Atomic Absorption Spectrophotometer	S/N 04050110503	03/10/2022	April 2023
			Model/AAAnalyst 100	S/N 04050110503	03/10/2022	April 2023
		Al	ICP394/PerkinElmer/OPTIMA8000	S/N 07851310024C	04/10/2022	April 2023
		Mn and Mn Compounds	ICP394/PerkinElmer/OPTIMA8000	S/N 07851310024C	04/10/2022	April 2023
		Pb	ICP394/PerkinElmer/OPTIMA8000	S/N 07851310024C	04/10/2022	April 2023



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- 4/4-



THAI ENVIRONMENTAL TECHNIC LIMITED
บริษัท เทคโนโลยีสิ่งแวดล้อม จำกัด

CONTROL UNIT CALIBRATION

(Metric units , mm)

Date **14-Feb-23**

Initial Final Average

Barometric press, Pb **758.3 758.4 758.35** mmHg

Dry Gas Meter Data

Reference Dry Gas Meter Data

Console No.

Serial No. **913428**

Metering System ID

Model **S-110**

DGM Number

8004294

Correction factor(Yr) **0.997**

DGM Model

SK 25

Last Calibration Data **30-May-22**

Orifice manometer setting ΔH mm H ₂ O	Ref . DMG Volume V _r Liters	DGM Volume V _m Liters	Temperature (° C)			Time min	DGM Correction factor (Y)	ΔH@ mm H ₂ O	
			Ref	Dry Gas Meter					
				Inlet T _i	Outlet T _o				
									Avg T _m
15.00	100.00	100.22	28.00	29.00	28.00	28.50	8.19	0.9950	46.3628
25.00	100.00	100.25	28.00	29.00	28.00	28.50	6.34	0.9938	46.3499
50.00	100.00	99.98	28.00	29.00	28.00	28.50	4.49	0.9940	46.6060
80.00	100.00	99.54	28.00	29.00	28.00	28.50	3.55	0.9955	46.7500
100.00	100.00	99.25	28.00	29.00	28.00	28.50	3.17	0.9965	46.6862
Average								0.9950	46.5510

Dued Date of Calibrate

14-Feb-24

Calibrated by : *gphs*

Approved : *Pigeeha 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 ± 0.02 .
Note: For $\Delta H @$, Orifice pressure differential that equates to 0.725 dm³ /min at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1 mm) H₂O.

Thai Environmental Technic Limited 1/6 Soi Rankhamhaeng 145 Klongkiet Saphan Sung Bangkok 10240 Thailand
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 23P792

Page : 1 of 2

Equipment :

Humidity/Barometer/Temp.

Manufacturer :

Lutron

Model :

PHB-318

Serial No. :

B011412

ID No. :

NO.5

Condition As-Received: Used Item

Received Date: 03 March 2023

Calibration Date: 13 March 2023

Reference:

2303-0118DSC

Submitted by: Thai Environmental Technic Limited

Ambient Temperature: (23 \pm 2) ° C

Relative Humidity: (50 \pm 15) %

Atmospheric Pressure: 1010 mbar

1/6 Soi Rankhamhaeng 145, Klongkiet 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 " DKD-R 6-1 ; Calibration of Pressure
Gauges, Edition 03/2014 " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument

Model

Serial No.

Certificate No.

Due Date

1) Standard Barometer

DPI142

1422505046

MP-0076-22

02 May 2023

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 instrument was installed in vertical orientation and center of the device was used as the reference level.

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankhaew

Issue Date : 14 March 2023

Approved Signatory : *Atapol P.*

[] Phalinee Prabpaipal

[] Sura Suwanmasri

[x] Atapol Panurach

B 0310699



Cert.No.: 23P792
Page: 2 of 2

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

Increasing Pressure					
Applied Pressure (mmHg)	729.90	733.90	749.89	759.89	769.89
UUC* Indication (mmHg)	730.7	740.7	750.7	760.7	770.7
Error (mmHg)	0.80	0.80	0.81	0.81	0.81

Decreasing Pressure					
Applied Pressure (mmHg)	769.89	759.89	749.89	739.90	729.90
UUC* Indication (mmHg)	770.7	760.7	750.8	740.8	730.8
Error (mmHg)	0.81	0.81	0.91	0.90	0.90

The uncertainty of measurement was ± 0.23 mmHg
• UUC = Unit Under Calibration
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

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Attestapol P.
a 1152198



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



Certificate of Calibration

Certificate No.: 22T1605
Page: 1 of 2

Equipment: Digital Thermometer With Sensor
Manufacturer: Digicon
Model: DP-52
Serial No.: I491773
ID No.: No.13
Condition As-Received: Used Item
Received Date: 26 August 2022
Calibration Date: 06 September 2022
Reference: 2208-0934DSC
Ambient Temperature: (25 \pm 3) °C
Relative Humidity: (50 \pm 20) %
Submitted by: Thai Environmental Technic Limited
1/6 Soi Rankhamthaeang 145, Khwaeng/Khet Saphan Sung, Bangkok 10240

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.

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Platinum Resistance Thermometer (PRT) and Industrial Platinum Resistance Thermometer (IPRT) 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	8C454	221616	23 May 2023
2) PRT Scanner Module	2562	A01303	221616	23 May 2023
3) Industrial Platinum Resistance Thermometer	5627	739433	221616	23 May 2023
4) Digital Thermometer	1529-R	B10520	221835	11 Jul 2023
5) Platinum Resistance Thermometer	935-14-95	261589/2	221835	11 Jul 2023
6) Digital Multimeter	2700	4016315	EE-0106-21	14 Oct 2022
7) Standard Thermocouple Probe (Type S)	TCS	TCS-001	TT-0114-21	08 Dec 2022

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: Yossapon Poljorn
Issue Date: 15 September 2022

Approved Signatory:

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

B 0296768



Cert. No.: 22T1605
Page.: 2 of 2

Result of Calibration:-
Function:

Without Adjustment
Temperature measurement for Channel T1 ID No. No.13
This equipment was connected with Thermocouple Type K
Dimension of probe : Diameter 8 mm., Length 1030 mm. Sheath material : Stainless Steel

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Uncertainty of Measurement (±°C)	
			Error (°C)	
180	200.0043	201.1	1.0957	0.73
180	400.0056	400.7	0.6944	1.4
180	599.95	602.1	2.15	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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53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22MM27
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 : 20 April 2022
Calibration Date : 22 April 2022
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Uthen Kankawi
Approved by : 
Approved Signatory
() Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai
Issue Date : 6 May 2022

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 1126037

A 0040784



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2204-0369OC-16
Cert.No.: 22MM27
Page: 2 of 3

Procedure used :

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

Condition of this result of calibration

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

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

Range capacity : 0 g to 210 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement	
			Uncertainty (± mg)	Coverage Factor (k)
100	99.9981	+0.0019	0.22	2.00
200	199.9957	+0.0043	0.35	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)	
	100	200
	0.00006	0.00007



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2204-0369OC-16
Cert.No.: 22MM27
Page: 3 of 3

Result of calibration

2. Effect of off center loading

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

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.0003	-0.0003	-0.0003	-0.0004	0.0000	
3. Departure from nominal value					0.0003

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement		Coverage Factor (k)
			Uncertainty (± mg)		
Unload	0.0000	0.0000	0.13		2.09
0.01	0.0099	+0.0001	0.13		2.09
0.1	0.0999	+0.0001	0.13		2.09
0.5	0.5000	0.0000	0.13		2.09
1	1.0001	-0.0001	0.13		2.09
5	5.0001	-0.0001	0.13		2.09
10	10.0000	0.0000	0.13		2.09
25	24.9998	+0.0002	0.15		2.06
50	49.9998	+0.0002	0.15		2.05
100	99.9998	+0.0002	0.22		2.00
200	199.9997	+0.0003	0.35		2.00

Note : This instrument was adjusted before calibration by weight of Mettler Toledo F1 200. g S/N. 11119517
Certificate No.: 21M19556

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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Wdu.

a 1105869

Wdu.

a 1105868



Thai Environmental Technic Limited
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

Portable Gas Calibration Report

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

Date of Calibration: 7-Jan-23
Ambient Condition
Temperature (23±5 °C) : 25.0 °C
Humidity (55±15 % RH) : 50.0 % RH
Barometer (mmHg) : 760.0 mmHg

Standard gas References

Standard gas	Cylinder No.	Traceability	Due date
Oxygen (O ₂)	27906	Linde	August 4, 2023
Nitric Oxide(NO)	D025806	Linde	August 18, 2023
	D824524	Linde	August 22, 2025
Sulfur Dioxide (SO ₂)	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 ₂ (%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	198.0	-1.0		
	392.0	390.0	-2.0		
SO ₂ (ppm)	0.0	0.0	0.0	±5.0 ppm 0...100 ppm ±5% measured Value 101....5000 ppm	PASS
	406.0	407.0	1.0		
	804.0	805.0	1.0		
CO (ppm)	0.0	0.0	0.0		PASS
	404.0	402.0	-2.0		
	793.0	795.0	2.0		

Calibrate by: *John S.* Approved by: *Piyada B.*

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Khwaeng/Khet Saphan Sung Bangkok 10240 Thailand
• Tel : +66(0)2373-7799(auto) Fax : +66(0)2373-79 9 • admin@tet1995.com • www.tet1995.com

WO-01865299/2022



MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

Customer : บริษัท เทคนิคสิ่งแวดล้อมไทย
Date Tested: October 4, 2022

Address : 1/6 ซอยรามคำแหง 145
แขวงสะพานสูง เขตสะพานสูง
กรุงเทพมหานคร 10240
Recommendation Recertification Period 6 Months

User Name: Khun Nattapong
Date Last Certified: April 4, 2023
Visit Number: April 5, 2022
PerkinElmer Phone: 02-719-6420 ext 203
PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED

MODEL OPTIMA 8000
SERIAL NUMBER 078N1310024C
S10

TESTED EQUIPMENT

IPV Methods

CALIBRATION NUMBER

PART NUMBER N069-1579
N930-0221

TEST STANDARD USED

Mixed standard 1/10
Mixed standard 1/100

CUSTOMER SUPPLIED

2 % HNO3
10 % HNO3

ACCESSORIES/COMPONENT NOT INCLUDED

EXPIRATION

EXPIRATION DATE May 30, 2023
November 30, 2023

CUSTOMER INITIALS

MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

SERIAL NUMBER : 078N1310024C

DATE TESTED : October 4, 2022

1. MECHANICAL CHECKS

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

2. OPTICAL CHECKS

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

3. COOLING SYSTEM CHECKS

- A. Perform preventive maintenance on chiller. ☐ OK
- B. Flush out the chiller every six months. ☐ OK

4. PERFORMANCE CHECKS

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

MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

SERIAL NUMBER : 078N1310024C

DATE TESTED : October 4, 2022

PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.009
	Ni 231.604 nm	≤ 0.011
	Ni 341.476 nm	≤ 0.015
Spectral Resolution : VIS	Ba 455.403 nm	≤ 0.020
		0.01577
Precision	Zn 206.200 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
		0.06
Detection Limits : Axial	As 193.696 nm	3(SD) ppb
	Se 196.026 nm	3(SD) ppb
	Tl 190.801 nm	3(SD) ppb
	Pb 220.353 nm	3(SD) ppb
		0.96
Detection Limits : Radial	As 193.696 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
BEC : Axial (IB X 1000)/(IS-IB)	Ba 493.408 nm	3(SD) ppb
		15.70
	Mn 257.610 nm	≤ 30 ppb
		9.01
	Mn 257.610 nm	≤ 30 ppb



WO-01865298/2022

MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078N1310024C DATE TESTED : October 4, 2022

Remarks :

Commissioning follow as commissioning performance sheets.

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

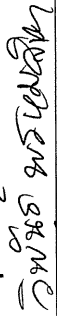
☒ meets

☐ 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 :  (Wiphon Promlunda)
Service Engineer

Method: DJEL-Cal

Page 1

Date: 4/10/2565 12:43:40

Align View XY Axial for analyte Mn 257.610

X-position	Y-position	Intensity
-2.0	15.0	511963.8
-1.6	15.0	6802430.3
-1.2	15.0	7998705.3
-0.8	15.0	8921036.6
-0.4	15.0	9415249.2
0.0	15.0	9145189.2
0.4	15.0	8561448.2
0.8	15.0	7372556.4
1.2	15.0	5801066.7
1.6	15.0	4360683.6
2.0	15.0	3277941.3
-0.4	10.0	178360.5
-0.4	10.5	270096.8
-0.4	11.0	524775.4
-0.4	11.5	1059741.4
-0.4	12.0	1947168.2
-0.4	12.5	3092168.0
-0.4	13.0	4482627.5
-0.4	13.5	6341583.3
-0.4	14.0	7903988.8
-0.4	14.5	8846944.2
-0.4	15.0	9553876.8
-0.4	15.5	9348844.1
-0.4	16.0	9062049.4
-0.4	16.5	7895237.2
-0.4	17.0	6093533.7
-0.4	17.5	4782901.6
-0.4	18.0	3580353.9
-0.4	18.5	2452502.1
-0.4	19.0	1400321.1
-0.4	19.5	799140.5
-0.4	20.0	420183.9
-1.2	15.0	8553343.7
-0.8	15.0	9414538.4
-0.4	13.0	9524088.0
0.0	13.0	9441507.0
0.4	15.0	8738064.4
-0.4	13.0	4961231.7
-0.4	13.5	6479100.6
-0.4	14.0	8079437.3
-0.4	14.5	9298868.4
-0.4	15.0	9727764.3
-0.4	15.5	9697873.4
-0.4	16.0	8956220.3
-0.4	16.5	7870834.5
-0.4	17.0	6288498.2

4/10/2565 12:38:01 aligned for analyte Mn 257.610

X viewing position set to -0.4 mm having Peak intensity 9727764.3 for Axial viewing
Y viewing position set to 15.0 mm having Peak intensity 9727764.3 for Axial viewing

Align View X Radial for analyte Mn 257.610

X-position	Y-position	Intensity
-7.0	15.0	8334.0
-6.5	15.0	11264.2
-6.0	15.0	16657.9
-5.5	15.0	26028.0
-5.0	15.0	43856.5
-4.5	15.0	74460.2
-4.0	15.0	127306.9
-3.5	15.0	182637.1
-3.0	15.0	243830.8
-2.5	15.0	382351.9
-2.0	15.0	597699.9
-1.5	15.0	874758.9
-1.0	15.0	1163200.5
-0.5	15.0	1333747.2
0.0	15.0	1422726.3
0.5	15.0	1363321.5
1.0	15.0	1228529.7

1.5 15.0 1009232.5
2.0 15.0 762103.9
2.5 15.0 679846.2
3.0 15.0 616511.7
3.5 15.0 449873.5
4.0 15.0 285408.6
4.5 15.0 190949.1
5.0 15.0 109896.6
5.5 15.0 56963.5
6.0 15.0 32251.4
6.5 15.0 22416.7
7.0 15.0 16775.4

4/10/2565 12:41:55 aligned for analyte Mn 257.610
X viewing position set to 0.0 mm having Peak intensity 1412726.3 for Radial viewing

Reprocessing Begun
Logged In Analyst: TET Technique: ICP Continuous

Results Data Set (original): PM40CT22
Results Library (original): C:\Users\Public\PerkinElmer\IPV\PM.mdb
Results Data Set (reprocessed):
Results Library (reprocessed):

Sequence No.: 1 Autosampler Location:

Sample ID: Calib Blank 1 Date Collected: 4/10/2565 13:03:09
Analyst: Data Type: Reprocessed on 4/10/2565 13:10:50
Logged In Analyst (Original): TET
Initial Sample Wt:
Dilution:
Wash Time:
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: Calib Blank 1
Analyte Back Pressure Flow
All 189.0 kPa 0.55 L/min

Mean Data: Calib Blank 1

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc. Units	Calib
Tl 190.801	-188.5			[0.00] µg/L	
As 193.696	172.3			[0.00] µg/L	
Se 196.026	118.8			[0.00] µg/L	
Pb 220.353	780.8			[0.00] µg/L	

Sequence No.: 2 Autosampler Location:

Sample ID: DL-Standard Date Collected: 4/10/2565 13:08:25
Analyst: Data Type: Reprocessed on 4/10/2565 13:10:50
Logged In Analyst (Original): TET
Initial Sample Wt:
Dilution:
Wash Time:
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: DL-Standard
Analyte Back Pressure Flow
All 189.0 kPa 0.55 L/min

Mean Data: DL-Standard

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc. Units	Calib
Tl 190.801	27521.6			[1000] µg/L	
As 193.696	25398.0			[1000] µg/L	
Se 196.026	7470.8			[1000] µg/L	
Pb 220.353	56586.9			[500] µg/L	

Calibration Summary

Analyte	Stds.	Equation	Intercept	Slope	Curvature	Corr. Coef.	Reslope
Tl 190.801	1	Lin, Calc Int	0.0	27.52	0.00000	1.000000	
As 193.696	1	Lin, Calc Int	0.0	25.40	0.00000	1.000000	
Se 196.026	1	Lin, Calc Int	0.0	14.94	0.00000	1.000000	
Pb 220.353	1	Lin, Calc Int	0.0	113.2	0.00000	1.000000	

Sequence No.: 3 Autosampler Location:

Sample ID: IDL-XL (2% HNO3) Date Collected: 4/10/2565 13:04:56
Analyst: Data Type: Reprocessed on 4/10/2565 13:10:50
Logged In Analyst (Original): TET
Initial Sample Wt:
Dilution: 3X
Wash Time:
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: IDL-XL (2% HNO3)
Analyte Back Pressure Flow
All 188.0 kPa 0.55 L/min

Mean Data: IDL-XL (2% HNO3)
Analyte Mean Corrected Conc. Units Std.Dev. RSD
Ti 190.801 10.2 0 pg/L 0.76 2.27 204.66%
As 193.696 -32.9 -1 pg/L 1.04 3.11 80.03%
Se 196.026 -47.2 -3 pg/L 1.38 4.14 93.71%
Pb 220.353 132.2 1 pg/L 0.32 0.96 27.41%

Method Loaded
Method Name: DLRL-Cal Method Last saved: 5/4/2565 10:59:28
IEC File: MSF File:
Method Description: C8000-Calibration for later test

Sequence No.: 1 Autosampler Location:
Sample ID: Calib Blank 1 Date Collected: 4/10/2565 12:54:37
Analyst: Data Type: Reprocessed on 4/10/2565 13:11:22
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: Calib Blank 1
Analyte Back Pressure Flow
All 188.0 kPa 0.55 L/min

Mean Data: Calib Blank 1
Analyte Mean Corrected Conc. Units
As 193.696 45.2 (0.00) mg/L
Zn 213.857 5597.0 (0.00) mg/L
Mn 257.610 3627.2 (0.00) mg/L
La 379.478 798.1 (0.00) mg/L
Ba 455.403 7460.0 (0.00) mg/L
Ba 493.408 8076.4 (0.00) mg/L

Sequence No.: 2 Autosampler Location:
Sample ID: Calib Std 1 Date Collected: 4/10/2565 12:45:45
Analyst: Data Type: Reprocessed on 4/10/2565 13:11:23
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: Calib Std 1
Analyte Back Pressure Flow
All 186.0 kPa 0.55 L/min

Mean Data: Calib Std 1
Analyte Mean Corrected Conc. Units
As 193.696 15741.9 (5.0) mg/L
Zn 213.857 160791.5 (1.0) mg/L
Mn 257.610 1661581.1 (1.0) mg/L
La 379.478 338793.3 (1.0) mg/L
Ba 455.403 810942.9 (0.1) mg/L
Ba 493.408 622557.7 (0.1) mg/L

Calibration Summary
Analyte Stds. Equation Intercept Slope Curvature Corr. Coef. Reslope

As 193.696 1 Lin, Calc Int -0.0 3148 0.00000 1.000000
Zn 213.857 1 Lin, Calc Int 0.0 160800 0.00000 1.000000
Mn 257.610 1 Lin, Calc Int 0.0 1662000 0.00000 1.000000
La 379.478 1 Lin, Calc Int 0.0 338600 0.00000 1.000000
Ba 455.403 1 Lin, Calc Int 0.0 8109000 0.00000 1.000000
Ba 493.408 1 Lin, Calc Int 0.0 6226000 0.00000 1.000000

Sequence No.: 3 Autosampler Location:
Sample ID: IDL-RL (2% HNO3) Date Collected: 4/10/2565 12:57:21
Analyst: Data Type: Reprocessed on 4/10/2565 13:11:23
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution: 3X
Wash Time:
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: IDL-RL (2% HNO3)
Analyte Back Pressure Flow
All 187.0 kPa 0.55 L/min

Mean Data: IDL-RL (2% HNO3)
Analyte Mean Corrected Conc. Units
As 193.696 -45.8 -0.0 mg/L 0.00 -43.6 pg/L 8.84 20.25%
Zn 213.857 -4719.6 -0.0 mg/L 0.00 -88.1 pg/L 0.13 0.15%
Mn 257.610 -3285.9 -0.0 mg/L 0.00 -5.9 pg/L 0.01 0.12%
La 379.478 -316.6 -0.0 mg/L 0.00 -2.8 pg/L 0.93 33.34%
Ba 455.403 -6917.2 -0.0 mg/L 0.00 -2.6 pg/L 0.04 1.39%
Ba 493.408 -5645.3 -0.0 mg/L 0.00 -2.7 pg/L 0.12 4.36%

Reprocessing Begun
Logged In Analyst: TET Technique: ICP Continuous

Results Data Set (original): PM40CP22
Results Library (original): C:\Users\Public\PerkinElmer\IPV\PM.mdb
Results Data Set (reprocessed):
Results Library (reprocessed):

Sequence No.: 1
Sample ID: Calib Blank 1
Autosampler Location:
Date Collected: 4/10/2565 13:03:09
Logged In Analyst (Original) : TET
Initial Sample Vol.:
Dilution: Initial Sample Vol.:
Wash Time: Sample Prep Vol.:

Nebulizer Parameters: Calib Blank 1
Analyte Back Pressure Flow
All 189.0 kPa 0.55 L/min

Mean Data: Calib Blank 1
Analyte Mean Corrected Conc. Units Calib
Intensity
Tl 190.801 -188.5 [0.00] pg/L
As 193.696 172.3 [0.00] pg/L
Se 196.026 116.8 [0.00] pg/L
Pb 220.353 780.8 [0.00] pg/L

Sequence No.: 2
Sample ID: DL-Standard
Autosampler Location:
Date Collected: 4/10/2565 13:08:25
Logged In Analyst (Original) : TET
Initial Sample Vol.:
Dilution: Initial Sample Vol.:
Wash Time: Sample Prep Vol.:

Nebulizer Parameters: DL-Standard
Analyte Back Pressure Flow
All 189.0 kPa 0.55 L/min

Mean Data: DL-Standard
Analyte Mean Corrected Conc. Units Calib
Intensity
Tl 190.801 27521.6 [1000] pg/L
As 193.696 25398.0 [1000] pg/L
Se 196.026 7470.8 [500] pg/L
Pb 220.353 56586.9 [500] pg/L

Calibration Summary
Analyte Stds. Equation Intercept Slope Curvature Corr. Coef. Reslope
Tl 190.801 1 Lin, Calc Int 0.0 27.52 0.00000 1.000000
As 193.696 1 Lin, Calc Int 0.0 25.40 0.00000 1.000000
Se 196.026 1 Lin, Calc Int 0.0 14.94 0.00000 1.000000
Pb 220.353 1 Lin, Calc Int 0.0 113.2 0.00000 1.000000

Sequence No.: 3
Sample ID: IDL-XL (2% HNO3)
Autosampler Location:
Date Collected: 4/10/2565 13:04:56
Logged In Analyst (Original) : TET
Initial Sample Vol.:
Dilution: Initial Sample Vol.:
Wash Time: Sample Prep Vol.:

Nebulizer Parameters: IDL-XL (2% HNO3)
Analyte Back Pressure Flow
All 189.0 kPa 0.55 L/min

Mean Data: IDL-XL (2% HNO3)
Analyte Mean Corrected Conc. Units Calib.
Intensity
Tl 190.801 10.2 0 pg/L
As 193.696 -32.9 -1 pg/L
Se 196.026 -47.2 -3 pg/L
Pb 220.353 132.2 1 pg/L

Std.Dev.
0.76
1.04
1.38
0.32

Sample
Conc. Units
1 pg/L
-4 pg/L
-9 pg/L
4 pg/L

Std.Dev. RSD
2.27 204.66%
3.11 80.03%
4.14 43.71%
0.96 27.41%

Method Loaded
Method Name: MnBEC
Method Last Saved: 15/10/2563 10:51:07
MSE File:
Method Description: C8000-XL and RL-Spec <or = 30 ug/L Attn:Spec<or= 50ug/L

Sequence No.: 1
Sample ID: IB (2% HNO3)
Analyst:
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:
Autosampler Location:
Date Collected: 4/10/2565 13:02:02
Data Type: Reprocessed on 4/10/2565 13:11:50
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: IB (2% HNO3)
Analyte Back Pressure Flow
All 189.0 kPa 0.55 L/min

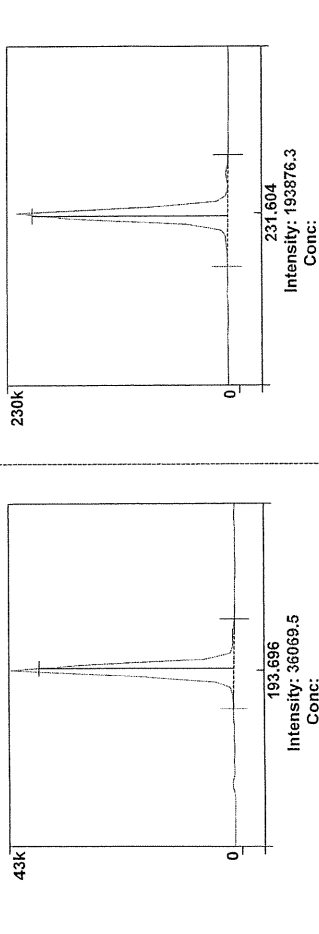
Mean Data: IB (2% HNO3)
Analyte Mean Corrected Conc. Units Calib. Sample
Mn 257 XN Intensity Conc. Units Std.Dev. RSD
Mn 257 RN 179923.9
Mn 257 RN 22857.4

Sequence No.: 2
Sample ID: IS (N069-1579/10)
Analyst:
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:
Autosampler Location:
Date Collected: 4/10/2565 12:47:14
Data Type: Reprocessed on 4/10/2565 13:11:50
Initial Sample Vol:
Sample Prep Vol:

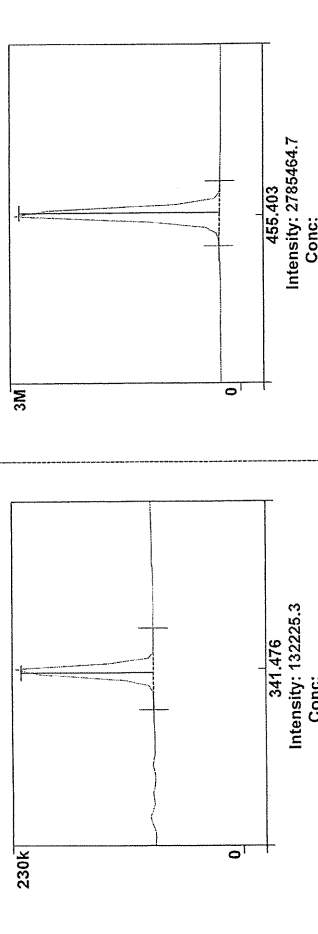
Nebulizer Parameters: IS (N069-1579/10)
Analyte Back Pressure Flow
All 187.0 kPa 0.55 L/min

Mean Data: IS (N069-1579/10)
Analyte Mean Corrected Conc. Units Calib. Sample
Mn 257 XN Intensity Conc. Units Std.Dev. RSD
Mn 257 RN 11640650.3
Mn 257 RN 1784946.6

As 193.696-Res Rep: 3 NI 231.604-Res Rep: 3



1 NI 341.476-Res Rep: 3 Ba 455.403-Res Rep: 1



Sample ID: RSD STD (N069-1579/10)

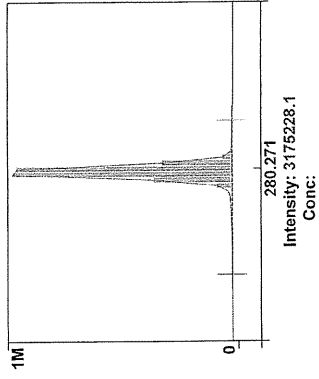
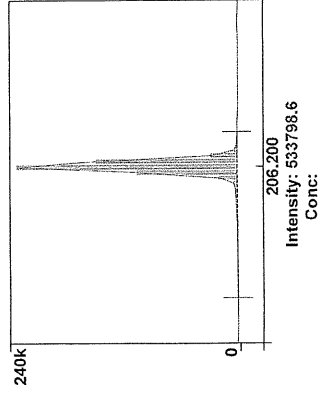
Spectra

Method: Precision
Result: PM4OCT22

Zn 206.200

Rep: 3 | Mg 280.271

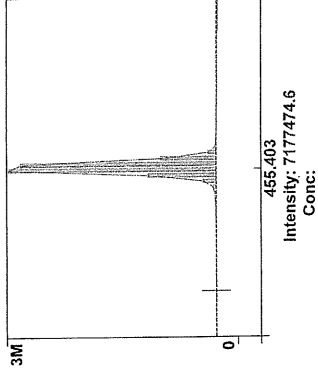
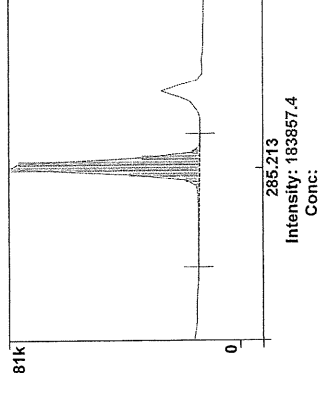
Rep: 3



1 Mg 285.213

Rep: 3 Ba 455.403 2

Rep: 3



3

4

[illegible]

Method Loaded
Method Name: Precision
IEC File:
Method Description: C8000 -N=10- 1.0% RSD

Method Last Saved: 3/5/2554 12:31:51

MSF File:

Autosampler Location:

Date Collected: 4/10/2565 12:48:29

Data Type: Original

Initial Sample Vol:

Sample Prep Vol:

Sequence No.: 4

Sample ID: RSD STD (N069-1579/10)

Analyte:

Initial Sample Wt:

Dilution:

Wash Time:

Rebubler Parameters: RSD STD (N069-1579/10)

Back Pressure Flow

187.0 kPa 0.55 L/min

Mean Data: RSD STD (N069-1579/10)

Mean Corrected

Analyte Intensity

Zn 206.200 532964.1

Mg 280.271 3182498.0

Mg 285.213 184385.3

Ba 455.403 7181766.3

Calib. Conc. Units

Std.Dev. Conc. Units

Std.Dev. RSD

953.06 0.18%

14602.29 0.46%

774.20 0.42%

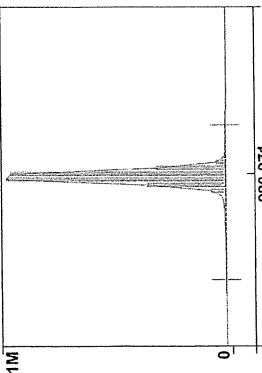
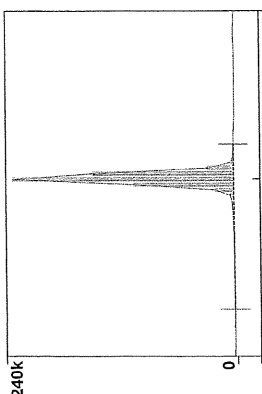
4330.85 0.06%

Spectra

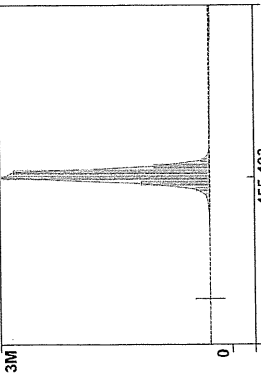
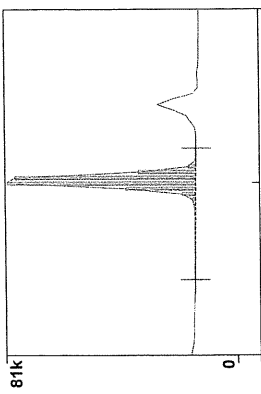
Sample ID: RSD STD (N069-1579/10)

Method: Precision
Result: PW4OCT22

Rep: 3
Zn 206.200
Rep: 3
Mg 280.271



Rep: 3
Mg 285.213
Rep: 3
Ba 455.403



PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N0691579
Description: Multi-Element Standard
Matrix: 2% HNO₃
Lot Number: 57-024CRX1

Certification Date: NOV -- 2021
Expiration Date: MAY 30 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM	Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	50.1 µg/mL	3103a*	Ni	10.0 µg/mL	10.0 µg/mL	3136*
K	50.0 µg/mL	50.3 µg/mL	3141a*	Sr	10.0 µg/mL	10.0 µg/mL	3153a*
La	10.0 µg/mL	10.0 µg/mL	3127a*	Zn	10.0 µg/mL	10.0 µg/mL	3166a*
Li	10.0 µg/mL	10.0 µg/mL	3128a*	Ba	1.00 µg/mL	1.01 µg/mL	3104a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*	Mg	1.00 µg/mL	1.01 µg/mL	3131a*

* - Indicates NIST SRM

Reference Multi: Lot# 2-84MJ, 3-168MJ, 4-39MJ

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, provided the standards are kept tightly capped and stored under normal laboratory conditions. The values are the mean of three individual determinations, and the values are the mean of three individual determinations. For these solutions we use high purity acids, ASTM Type I 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: 1-203-929-4600
U.S.A. Toll Free: 1-800-762-4000

Visit www.perkinelmer.com/isooffices for a complete listing of our global offices.



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

Geoff Cook

Date: July 20, 2012

Certified by:

Paul Selino

(Manager, Global Training Operations)



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 Site ID : Bangkok Date : 1-Aug-22
ITEM : TSP Serial No : (No.22) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0
Temperature (°C) : 25.0 Temperature (deg K) : 298.0
Average Press. (mm Hg) : 754.5 Corrected Average (mm Hg) : -
Average Temp (°C) : 31.8 Average Temp: (Deg K) : -

Calibration Orifice

Make : Tisch	Qstd Slope : 1.99331
Model : TB-5025A	Qstd Intercept : -0.00049
Serial#: 0068	Calibration Due Date : 19-Nov-22

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m ³ /min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 34.5708 Intercept : 1.0693 Corr. Coeff : 0.9926
1	12.00	1.738	60.0	60.00	
2	9.20	1.538	54.0	54.00	
3	7.20	1.346	50.0	50.00	
4	5.00	1.122	40.0	40.00	
5	3.00	0.869	30.0	30.00	# of Observations: 5

Calculations

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

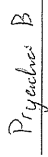
Qstd = standard flow rate
IC = corrected chart response
I = actual chart response

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

Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m[(1)[\text{Sqrt}(298/Tav)(Pav/760)]-b]$

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

Calibrate By : 

Approve By : 



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 1-Aug-22
ITEM : TSP Serial No : (No.29) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0
Temperature (°C) : 25.0 Temperature (deg K) : 298.0
Average Press. (mm Hg) : 754.5 Corrected Average (mm Hg) : -
Average Temp (°C) : 31.7 Average Temp: (Deg K) : -

Calibration Orifice

Make : Tisch	Qstd Slope : 1.99331
Model : TB-5025A	Qstd Intercept : -0.00049
Serial#: 0068	Calibration Due Date : 19-Nov-22

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m ³ /min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 34.7546 Intercept : 1.0714 Corr. Coeff : 0.9897
1	12.00	1.738	60.0	60.00	
2	9.20	1.522	54.0	54.00	
3	7.00	1.328	50.0	50.00	
4	5.00	1.122	40.0	40.00	
5	3.00	0.869	30.0	30.00	# of Observations: 5

Calculations


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

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

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

Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m[(1)[\text{Sqrt}(298/Tav)(Pav/760)]-b]$

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

Calibrate By : 

Approve By : 



TET

Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 1-Aug-22
ITEM : TSP Serial No : (No.32) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0
Temperature (°C) : 25.0 Temperature (deg K) : 298.0
Average Press. (mm Hg) : 754.5 Corrected Average (mm Hg) :
Average Temp (°C) : 32.6 Average Temp: (Deg K) :

Calibration Orifice

Make : Tisch Qstd Slope : 1.99331
Model : TB-5025A Qstd Intercept : -0.00049
Serial# : 0068 Calibration Due Date : 19-Nov-22

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.00	1.738	60.0	60.00	Slope : 34.5708 Intercept : 1.0693 Corr. Coeff : 0.9926
2	9.40	1.538	54.0	54.00	
3	7.20	1.346	50.0	50.00	
4	5.00	1.122	40.0	40.00	
5	3.00	0.869	30.0	30.00	
					# of Observations: 5

Calculations

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

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

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

Pstd = 760 mm Hg

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

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

Calibrate By : _____

Approve By : Piyechan B



TET

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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 1-Aug-22
ITEM : TSP Serial No : (No.34) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0
Temperature (°C) : 25.0 Temperature (deg K) : 298.0
Average Press. (mm Hg) : 754.5 Corrected Average (mm Hg) :
Average Temp (°C) : 31.6 Average Temp: (Deg K) :

Calibration Orifice

Make : Tisch Qstd Slope : 1.99331
Model : TB-5025A Qstd Intercept : -0.00049
Serial# : 0068 Calibration Due Date : 19-Nov-22

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.00	1.738	60.0	60.00	Slope : 34.7546 Intercept : 1.0714 Corr. Coeff : 0.9897
2	9.20	1.522	54.0	54.00	
3	7.00	1.328	50.0	50.00	
4	5.00	1.122	40.0	40.00	
5	3.00	0.869	30.0	30.00	
					# of Observations: 5

Calculations

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

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

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

Pstd = 760 mm Hg

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

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

Calibrate By : _____

Approve By : Piyechan B



High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : PM10
Site ID : Bangkok
Serial No : (No. 4)
Date : 1-Aug-22
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Average Press. (mm Hg) : 754.5
Average Temp (°C) : 29.8
Corrected Pressure (mm Hg) : 760.0
Temperature (deg K) : 298.0
Corrected Average (mm Hg) :
Average Temp: (Deg K) :

Calibration Orifice

Make : Tisich
Model : TB-5025A
Serial# : 0068
Qstd Slope : 1.99331
Qstd Intercept : -0.00049
Calibration Due Date : 19-Nov-22

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.00	1.738	60.0	60.00	Slope : 34.7546
2	9.20	1.522	54.0	54.00	Intercept : 1.0714
3	7.00	1.328	50.0	50.00	Corr. Coeff : 0.9897
4	5.00	1.122	40.0	40.00	
5	3.00	0.869	30.0	30.00	# of Observations: 5

Calculations

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

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

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

Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m(I)[\text{Sqrt}(298/Tav)(Pav/P760)]-b]$

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

Calibrate By : _____

Approve By : _____



High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : PM10
Site ID : Bangkok
Serial No : (No. 9)
Date : 1-Aug-22
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Average Press. (mm Hg) : 754.5
Average Temp (°C) : 31.2
Corrected Pressure (mm Hg) : 760.0
Temperature (deg K) : 298.0
Corrected Average (mm Hg) :
Average Temp: (Deg K) :

Calibration Orifice

Make : Tisich
Model : TB-5025A
Serial# : 0068
Qstd Slope : 1.99331
Qstd Intercept : -0.00049
Calibration Due Date : 19-Nov-22

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.00	1.738	60.0	60.00	Slope : 34.5708
2	9.40	1.538	54.0	54.00	Intercept : 1.0693
3	7.20	1.346	50.0	50.00	Corr. Coeff : 0.9926
4	5.00	1.122	40.0	40.00	
5	3.00	0.869	30.0	30.00	# of Observations: 5

Calculations

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

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

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

Pstd = 760 mm Hg
For subsequent calculation of sampler flow:
 $1/m(I)[\text{Sqrt}(298/Tav)(Pav/P760)]-b]$

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

Calibrate By : _____

Approve By : _____



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

Location : Thai Environmental Tech Site ID : Bangkok Date : 1-Aug-22
ITEM : PM10 Serial No : (No. 10) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0
Temperature (°C) : 25.0 Temperature (deg K) : 298.0
Average Press. (mm Hg) : 754.5 Corrected Average (mm Hg) : -
Average Temp (°C) : 30.8 Average Temp: (Deg K) : -

Calibration Orifice

Make : Tisch Qstd Slope : 1.99331
Model : TS-5025A Qstd Intercept : -0.00049
Serial#: 0068 Calibration Due Date : 19-Nov-22

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.20	1.760	50.0	60.00	Slope : 33.5815 Intercept : 1.1417 Corr. Coeff : 0.9997
2	9.60	1.571	54.0	54.00	
3	8.40	1.454	50.0	50.00	
4	5.20	1.144	40.0	40.00	
5	3.00	0.869	30.0	30.00	
# of Observations: 5					

Calculations

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

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

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

Pstd = 760 mm Hg

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

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 Site ID : Bangkok Date : 1-Aug-22
ITEM : PM10 Serial No : (No. 13) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.0
Temperature (°C) : 25.0 Temperature (deg K) : 298.0
Average Press. (mm Hg) : 754.5 Corrected Average (mm Hg) : -
Average Temp (°C) : 30.8 Average Temp: (Deg K) : -

Calibration Orifice

Make : Tisch Qstd Slope : 1.99331
Model : TS-5025A Qstd Intercept : -0.00049
Serial#: 0068 Calibration Due Date : 19-Nov-22

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.20	1.753	60.0	60.00	Slope : 33.8885 Intercept : 1.6379 Corr. Coeff : 0.9939
2	9.60	1.555	54.0	54.00	
3	7.40	1.365	50.0	50.00	
4	5.00	1.122	40.0	40.00	
5	3.00	0.869	30.0	30.00	
# of Observations: 5					

Calculations

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

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

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

Pstd = 760 mm Hg

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

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 : 20-Nov-22
Analyzer Type : NOx
Brand : Teledyne
Model : T200
Serial Number : 5159 (NO. 32)
Range : 500 ppb

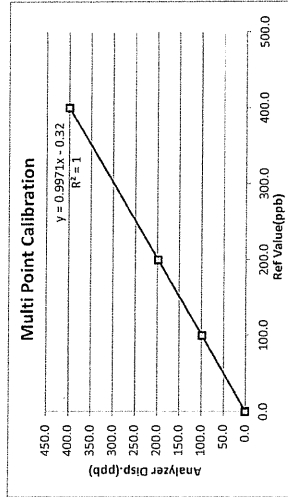
Temperature (°C) : 25°C
Barometer (mmHg) : 758.9
Humidity (50±15 %) : 52.08RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962SK

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)			After of Span(ppb)			% diff of Span
		NOx	NO	NO ₂	NOx	NO	NO ₂	
Zero	0.0	0.7	0.5	0.2	0.0	0.0	0.0	0.0
Span	400.0	381.0	381.0	0.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		
	NOx	NO	NO ₂	Diff(ppb)	% Diff	Abs (%) Diff
0.0	0.4	0.4	0.0	0.40	0.001	0.10
100.0	99.6	99.1	0.5	-0.90	-0.009	0.90
200.0	198.4	198.1	0.3	-1.90	-0.010	0.95
400.0	399.6	399.1	0.5	-0.90	-0.002	0.22
Average Diff (%)						
0.69						



Calibrate by:

Approved by:

หน้า 1 จาก 1

วันที่ออกรายงาน : 02/09/15

เลขที่รายงาน : QF-QP16-06

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Khwaeng/Khet Saphan Sung Bangkok 10240 Thailand
• Tel : +66(0)2373-7799(Auto) Fax : +66(0)2373-7799 • admin@tst1995.com • www.tst1995.com

THE LINDE GROUP

Certificate of Analysis Special Gases Mixture

Customer Details		Customer Tag No.	
Name	Thai Environmental Technic Limited	Address	1/6 Soi Ramkhamhaeng 45, Khet Saphanong, Bangkok 10240
Certificate Details		Date of Issue	
Number	3450/21	18-Aug-2021	18-Aug-2023
Material Details		Material Code	640300-SK-44
Production Order	90167125	Filling pressure	145.0 bar
Gas content	5.52 M ³	Cylinder Material	Spectra seal
Cylinder Owner	LINDE	Cylinder Size	40L
Laboratory Report		Analytical Result	
Component	Nitric Oxide	Analysis Result ¹	Uncertainty ²
	39.2 ppm	± 1% relative	Method of Analysis ³
Other NOx impurity in Nitrogen	Less than 1.9 ppm	(6) +PB-352	11-Aug & 18-Aug-21

Reference Standard
Nitric Oxide
in Nitrogen
27881156
51.58 ± 0.41 ppm
29-Oct-2022

Analytical Instruments used in Assay
Instrument/Make/Model
FTIR Spectrometers Nicolet 1550
Analytical Principle
FTIR-NO
Last Multipoint Calibration
9-Aug-2021

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 a dry/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Interim Method of EPA-821-R-12-031 for the Assay and Certification of Gaseous Standards using procedure G1.
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyser, (3) Electrochemical Oxygen Analyser, (4) Electrochemical Moisture Analyser, (5) Total Hydrocarbon Analyser, (6) Other - Specified

Page 1 of 1
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บริษัท เทคโนโลยีสิ่งแวดล้อมไทย (มหาชน)
151 หมู่ 14 แขวง/เขต คลองเตย กรุงเทพมหานคร 10110
โทร : 02-273-7799 โทรสาร : 02-273-7799
E-mail : admin@tst1995.com

Sulanya Panyasoonitorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.
Linde (Thailand) Public Company Limited
151 หมู่ 14 แขวง/เขต คลองเตย กรุงเทพมหานคร 10110
โทร : 02-273-7799 โทรสาร : 02-273-7799
E-mail : admin@tst1995.com



TET

Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

NOx Analyzer Calibration Report

Calibrate Date : 20-Nov-22
Analyzer Type : NOx
Brand : Teledyne
Model : T200
Serial Number : 5160 (No. 33)
Range : 500 ppb

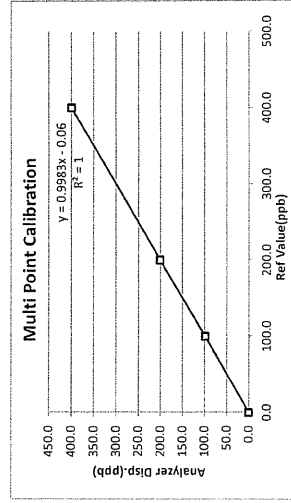
Temperature (°C) : 25°C
Barometer (mmHg) : 758.9
Humidity (50±15 %) : 52.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962SK

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)			After of Span(ppb)			% diff of Span
		NOx	NO	NO ₂	NOx	NO	NO ₂	
Zero	0.0	1.3	1.1	0.2	0.0	0.0	0.0	0.0
Span	400.0	392.0	390.0	2.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp(ppb)			Output Difference		
	NOx	NO	NO ₂	Diff(ppb)	% Diff	Abs (%) Diff
0.0	0.4	0.3	0.1	0.30	0.001	0.08
100.0	99.5	98.7	1.2	-1.30	-0.013	1.30
200.0	201.3	200.5	0.8	0.50	0.003	0.25
400.0	399.6	399.1	0.5	-0.90	-0.002	0.22
Average Diff (%)				0.59		



Calibrate by: gdlins

Approved by: Piyacha B

แก้ไขครั้งที่ : 00

วันที่อนุมัติ : 02/09/15

เลขที่แบบฟอร์ม : QF-QP-16-06

Thai Environmental Technic Limited 116 Soi Ramkhamhaeng 145 Klongkiet Saphan Sung Bangkok 10240 Thailand
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TET

Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

NOx Analyzer Calibration Report

Calibrate Date : 13-Nov-22
Analyzer Type : NOx
Brand : API
Model : 200A
Serial Number : 1982 (No. 15)
Range : 500 ppb

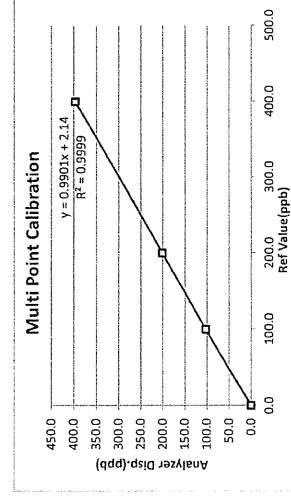
Temperature (°C) : 25°C
Barometer (mmHg) : 759.8
Humidity (50±15 %) : 52.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962SK

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)			After of Span(ppb)			% diff of Span
		NOx	NO	NO ₂	NOx	NO	NO ₂	
Zero	0.0	1.4	1.1	0.3	0.0	0.0	0.0	0.0
Span	400.0	391.0	390.0	1.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp(ppb)			Output Difference		
	NOx	NO	NO ₂	Diff(ppb)	% Diff	Abs (%) Diff
0.0	0.2	0.1	0.1	0.10	0.000	0.03
100.0	103.2	103.1	0.1	3.10	0.031	3.10
200.0	201.1	201.3	-0.2	1.30	0.007	0.65
400.0	397.3	397.1	0.2	-2.90	-0.007	0.72
Average Diff (%)				1.13		



Calibrate by: gdlins

Approved by: Piyacha B

แก้ไขครั้งที่ : 00

วันที่อนุมัติ : 02/09/15

เลขที่แบบฟอร์ม : QF-QP-16-06

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NOx Analyzer Calibration Report

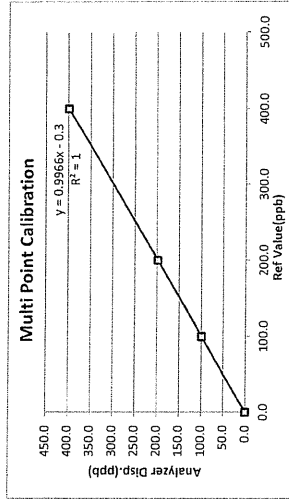
Calibrate Date : 11-Nov-22
Analyzer Type : NOx
Brand : API
Model : TMI-11-H-02
Serial Number : 495 (No. 23)
Range : 500 ppb
Temperature (°C) : 25 °C
Barometer (mmHg) : 759.0
Humidity (50±15 %) : 52.0±BH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962SK

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)			After of Span(ppb)			% diff of Span
		NO	NO	NO ₂	NO	NO	NO ₂	
Zero	0.0	0.7	0.5	0.2	0.0	0.0	0.0	0.0
Span	400.0	407.0	404.0	3.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		
	NO	NO	NO ₂	Diff(ppb)	% Diff	Abs (% Diff
0.0	0.3	0.3	0.0	0.30	0.001	0.08
100.0	99.6	99.1	0.5	-0.50	-0.009	0.90
200.0	198.4	198.2	0.2	-1.80	-0.009	0.90
400.0	399.1	398.8	0.3	-1.20	-0.003	0.30
Average Diff (%)						0.54



Calibrate by: Splir S.

Approved by: Pigade B.

แก้ไขครั้งที่ : 00
วันที่แก้ไข 02/09/15
เลขที่แบบฟอร์ม : QF-QP16-06
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THAI METEOROLOGICAL DEPARTMENT
4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469
Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau
Date of Issue : 16 September, 2022
Certification No. 338/22
Page : 1 of 2

Object : Wind speed and wind direction
Manufacturer : Davis Instruments Inc.
Type : Weather Wizard II
Serial No. : WC50309B03 ID No. : No.28
Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung, Bangkok 10240.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.5 hPa

NATIONAL STANDARD WIND TUNNEL :
: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119
: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec
: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 10 m/sec
Calibrated by : Watchapol Subwat Signed : Mr. Pisuat Promsur
Mechanical Engineer
Authorized Signatory for the Chief
Sub-Standard Instrument
THAI METEOROLOGICAL DEPARTMENT



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 33822

16 September, 2022

Page : 2 of 2

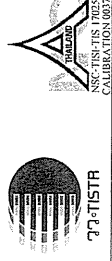
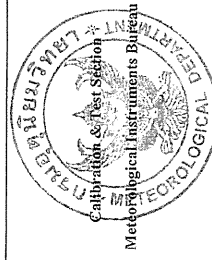
Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H ₂ O	Vacuum inches H ₂ O	Velocity m/sec	Velocity m/sec	Correction m/sec
Ultrasonic Anemometer					
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.2	0.82
5.00	-	-	-	4.5	0.50
7.00	-	-	-	6.7	0.30
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.3	0.71
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.3	0.71
17.02	-	-	-	16.1	0.92
20.02	-	-	-	19.2	0.82

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

Calibrated by :

Handwritten signature

Mr. Watcharapol Subwat
Mechanical Engineer



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197

MTC No. EEL. BP. 600166

CALIBRATION CERTIFICATE

Submitted by : THAI ENVIRONMENTAL TECHNIC LIMITED.

Address : 1/6 Soi Rangkhamhaeng 145, Khwaeng/Khet Saphansung, Bangkok 10240.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Tennars

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 Bmel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

7. Condenser Microphone Bmel&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
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Fax. (66) 0 2325 9165
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FMBL/MTC.002 Rev.4



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๓๓-TISTR

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 20 μ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	94.26	0.26	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	989.3	-10.7	± 1.5	$\pm 2.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	2.20	± 0.50	$\pm 4.0\%$

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

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๓๓-TISTR



๓๓-TISTR

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197

MTC No. EEL. BP. 60/0166

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	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&Kjaer 4180	985.1	-14.9	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	2.60	± 0.60	$\pm 4.0\%$

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 :

(Mr. Pawade Kluyap)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Jan. 2023

Date of Issue : 18 Jan. 2023

Ref : 2011266011000602001

End of Certificate

3 / 3

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FM.BLMTC.002 Rev.4



73-TISTR

73-TISTR

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 Rankhambhaeng 145, Khwaeng/Khet Saphansung, Bangkok 10240.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator
Manufacturer : Tenmars
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 Brüel&Kjær 2636 S/N 1537484.

3. Programmable Attenuator Tama-gawa 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 Brüel&Kjær 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

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73-TISTR

73-TISTR

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
1/2 inch Brüel&Kjær 4180	94.26	0.26	± 0.10	IEC60942:2003 Class 2 ±0.75 dB

2. Frequency

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

3. Total distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 16 Jan. 2023

2 / 3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197

MTC No. EEL. BP. 60/0166

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit
1/2 inch Brüel&Kjaer 4180	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&Kjaer 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&Kjaer 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 :



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

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FMBLMTC.002 Rev.4



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย 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 : 23-Mar-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25 °C
Relative Humidity(50±15 %) : 50.0 % RH
Dued Date of Calibrate : 30-Apr-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust		Deviation ±dB	Result Calibrate
	Brand	Model	Serial NO.	ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3	ครั้งที่ 1	ครั้งที่ 2		
18	ACO	6226	070046	94.1	94.1	94.1	94.0	94.1	0.1	PASS
19	ACO	6226	070047	114.0	114.0	114.0	114.0	114.0	0.1	PASS
20	ACO	6226	070048	94.0	93.7	93.7	94.0	93.7	0.3	PASS
21	ACO	6226	070049	114.0	113.8	113.8	114.0	113.8	0.1	PASS
23	RION	NL-21	00487676	94.0	93.8	93.8	94.0	93.8	0.2	PASS
25	ACO	6226	100098	114.0	113.8	113.8	114.0	113.8	0.2	PASS
26	ACO	6226	100099	94.0	94.2	94.2	94.0	94.1	0.1	PASS
28	ACO	6226	100101	114.0	114.0	114.0	114.0	114.0	0.1	PASS
29	ACO	6226	100102	94.0	93.9	93.9	94.0	93.9	0.2	PASS
30	ACO	6226	100106	114.0	114.1	114.1	114.0	114.1	0.3	PASS

Calibration By :

Approve by : Piyachai B.

Thai Environmental Technic Limited 1/6 Soi Ramkhambang 145 Khwaeng/Khet Saphan Sang Bangkok 10240 Thailand
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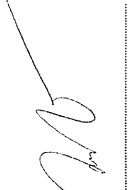


Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 23-Mar-2023
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg
Standard : IEC 60942 Temperature (23±3)°C : 25 °C
Accuracy : 94.0±0.3 dB and 114.0±0.5 dB Relative Humidity(50±15 %) : 50.0 % RH
Frequency : at 1,000 Hz ±1% Dued Date of Calibrate : 30-Apr-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			
31	ACO	6226	110088	94.2	94.2	94.2	94.0	0.2	PASS
32	ACO	6226	110105	94.2	94.2	94.2	94.0	0.2	PASS
33	ACO	6226	110086	94.1	94.1	94.1	94.0	0.1	PASS
34	ACO	6226	110099	94.2	94.2	94.2	94.0	0.2	PASS
35	ACO	6226	110097	94.1	94.1	94.1	94.0	0.1	PASS
36	ACO	6226	110102	93.9	93.9	93.9	94.0	0.1	PASS
37	ACO	6226	110101	94.1	94.1	94.1	94.0	0.1	PASS
38	ACO	6226	110106	93.9	93.9	93.9	94.0	0.1	PASS
39	ACO	6226	110104	93.9	93.9	93.9	94.0	0.1	PASS
40	ACO	6226	110100	93.8	93.8	93.8	94.0	0.2	PASS

Calibration By : 
Approve by : Piyachon B.




Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter Calibration Date : 23-Mar-2023
Calibrator : TENMARS Sound Calibrator TM-100 Barometric pressure (mmHg) : 759.0 mmHg
Standard : IEC 60942 Temperature (23±3)°C : 25 °C
Accuracy : 94.0±0.3 dB and 114.0±0.5 dB Relative Humidity(50±15 %) : 50.0 % RH
Frequency : at 1,000 Hz ±1% Dued Date of Calibrate : 30-Apr-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	94.3	94.3	94.3	94.0	0.3	PASS
43	ACO	6226	130129	93.7	93.7	93.7	94.0	0.3	PASS
44	ACO	6226	130130	93.8	93.8	93.8	94.0	0.2	PASS
45	ACO	6226	130131	93.8	93.8	93.8	94.0	0.2	PASS
46	ACO	6236	112029	94.1	94.1	94.1	94.0	0.1	PASS
47	ACO	6236	152073	94.1	94.1	94.1	94.0	0.1	PASS
48	ACO	6236	152074	94.1	94.1	94.1	94.0	0.1	PASS
49	ACO	6236	152075	94.2	94.2	94.2	94.0	0.2	PASS
50	ACO	6236	152076	94.2	94.2	94.2	94.0	0.2	PASS

Calibration By : 
Approve by : Piyachon B.



Thai Environmental Technic Limited
บริษัท เทคนิคสิ่งแวดล้อมไทย 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 : 23-Mar-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25 °C
Relative Humidity(50±15 %) : 50.0 % RH
Dued Date of Calibrate : 30-Apr-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
51	ACO	6236	152077	94.0	94.0	94.0	94.0	0.0	PASS
52	ACO	6226	150142	114.0	114.0	114.0	114.0	0.1	PASS
53	ACO	6226	160095	94.0	93.9	93.9	94.0	0.1	PASS
54	ACO	6226	160096	114.0	114.0	114.0	114.0	0.1	PASS
55	ACO	6226	160097	94.0	94.2	94.2	94.0	0.2	PASS
56	ACO	6226	160098	114.0	114.1	114.1	114.1	0.1	PASS
57	ACO	6226	160099	94.0	93.9	93.9	94.0	0.1	PASS
58	ACO	6226	160143	114.0	114.2	114.2	114.2	0.2	PASS
59	ACO	6226	160203	94.0	93.9	93.9	94.0	0.1	PASS
60	ACO	6226	160204	114.0	113.8	113.8	113.8	0.2	PASS

Calibration By : 

Approve by : Piyadee B




Thai Environmental Technic Limited
บริษัท เทคนิคสิ่งแวดล้อมไทย 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 : 23-Mar-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25 °C
Relative Humidity(50±15 %) : 50.0 % RH
Dued Date of Calibrate : 30-Apr-2023

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	94.0	94.0	94.0	94.0	0.0	PASS
62	ACO	6226	160211	114.0	114.0	114.0	114.0	0.0	PASS
63	ACO	6226	160212	94.0	93.9	93.9	94.0	0.1	PASS
64	ACO	6226	160213	114.0	113.9	113.9	113.9	0.1	PASS
66	ACO	6226	160215	94.0	94.1	94.1	94.0	0.1	PASS
67	ACO	6226	160216	114.0	113.9	113.9	113.9	0.1	PASS
68	ACO	6236	222036	94.0	94.1	94.1	94.0	0.1	PASS
69	ACO	6236	222037	114.0	114.1	114.1	114.1	0.2	PASS
70	ACO	6236	222038	94.0	94.1	94.1	94.1	0.1	PASS
71	ACO	6236	222039	114.0	114.1	114.1	114.1	0.1	PASS
72	ACO	6236	222040	94.0	94.1	94.1	94.1	0.1	PASS

Calibration By : 

Approve by : Piyadee B




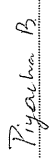
Thai Environmental Technic Limited
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

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 $\pm 1\%$
Calibrator Serial NO. : 181203570
Calibration Date : 23-Mar-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23 \pm 3) $^{\circ}$ C : 25 $^{\circ}$ C
Relative Humidity (50 \pm 15 %) : 50.0 % RH
Due Date of Calibration : 30-Apr-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust dB	Deviation dB	Result
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
73	ACO	6236	222244	94.0	94.0	94.0	94.0	0.0	PASS
				114.0	114.0	114.0	114.0		
74	ACO	6236	222245	94.0	94.0	94.0	94.0	0.0	PASS
				114.0	114.0	114.0	114.0		
75	ACO	6236	222246	94.0	94.1	94.1	94.0	0.1	PASS
				114.0	114.0	114.0	114.0		
76	ACO	6236	222247	94.0	94.0	94.0	94.0	0.0	PASS
				114.0	114.0	114.0	114.0		
77	ACO	6236	222248	94.0	94.0	94.0	94.0	0.0	PASS
				114.0	114.0	114.0	114.0		

Calibration By : 

Approve by : 



SCARLET | TECH



Certificate of Calibrator for ST-I20 Sound Calibrator

No. 20210923J143

Name of Product Sound Calibrator
Type ST-120
Serial Number ST120C0263E
Specification Class 1
Date 2022/12/22

Tested by 



1. Outside : OK
2. Sound Pressure Level : 93.97 dB ; 114.03 dB
3. Frequency : 998.30 Hz
4. Distortion : 1.15 % ; 1.35 %

Environment conditions :

Air temperature : 18 $^{\circ}$ C
Relative humidity : 62 %
Static pressure : 101.9 kPa

Scarlet Tech Co., Ltd.
4F-3, No. 347, HePing E Rd, 2nd Sec, DaAn District, Taipei City 106, Taiwan
E-mail: info@scarlet.com.tw www.scarlet-tech.com




Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter
Calibrator : SCARLET ST-120
Standard : IEC 60942:2017 CLASS I
Accuracy : 94.0 ±0.3 dB and 114.0±0.5 dB
Frequency : at 1,000 Hz ±1%
Calibrator Serial NO. : ST120C036E

Calibration Date : 23-Mar-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25 °C
Relative Humidity(50±15 %) : 50.0 % RH
Dued Date of Calibrate : 30-Apr-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result Calibrate
	Brand	Model		ครั้งที่ 1	ครั้งที่ 2	เฉลี่ย			
78	SCARLET	ST-11D	820390	94.0	94.0	94.0	94.0	0.0	PASS
79	SCARLET	ST-11D	820391	94.0	94.0	94.0	94.0	0.0	PASS
80	SCARLET	ST-11D	820392	94.0	94.0	94.0	94.0	0.0	PASS
81	SCARLET	ST-11D	820393	94.0	94.1	94.1	94.0	0.1	PASS
82	SCARLET	ST-11D	820394	94.0	94.0	94.0	94.0	0.0	PASS
83	SCARLET	ST-11D	820877	94.0	94.0	94.0	94.0	0.0	PASS
84	SCARLET	ST-11D	820878	94.0	94.0	94.0	94.0	0.0	PASS
85	SCARLET	ST-11D	820879	94.0	94.0	94.0	94.0	0.0	PASS

Calibration By : 
Approve by : Piyachon B

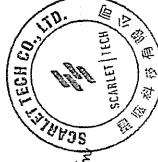


CERTIFICATE OF CALIBRATION

NO. 20230113117

Name of Product: Sound Level Meter
Model: ST-11D
Serial Number: 820877
Specification: Class 1
Conclusion: Pass
Date of calibration: 2023-02-01
Due Date: 2024-01-31

Calibrated by: 



- I. This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surplus then, and applies only to the unit identified above.
II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14425-5737Z

3. Adjustments to indicated sound levels:

Type of Calibrator: 88K 2231

Sound Pressure Level 94.0 dB

4. Measuring up limits: 140 dBA

5. Frequency weightings: (Acoustic signal tests for Z weighting, other electric signal tests.)

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.1	-14.2	-0.3	1000	0.0	0.0	-0.1
20	-50.1	-6.3	-0.1	2000	1.3	-0.1	-0.1
31.5	-39.2	-2.7	-0.1	4000	1.1	-0.8	-0.1
63	-26.2	-0.5	-0.1	8000	-1.0	-3.1	0.0
125	-16.2	-0.2	0.0	12500	-11.7	-13.7	0.0
250	-8.6	0.1	-0.1	16000	-11.6	-13.6	0.1
500	-3.2	0.0	-0.1	20000	-23.8	-25.9	-0.1



Certificate of Calibration

Certificate Number : SPR23020460-7
Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
Sung, Bangkok 10240, Thailand.

Page : 1 of 3

Equipment Name : Noise Dose Meter
Manufacturer : SOUNDTEK
Model : ST-130
Serial Number : 220100050
ID. Number : No.30

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C
Relative Humidity : 50 % ± 15 %
Location of Calibration : In-Lab
Calibration Procedure : SP-CPE-04-01
Received Date : 24 Feb 2023
Calibration Date : 25 Feb 2023
Recommend Due Date : 25 Feb 2024
Date of Issue : 26 Feb 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Karoon Pengsalung
Calibration Officer

Approved by :
(Mr. Nirut Loha)

Authorized Signatory

SP-FM-04-15 rev.0

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 คู่สาย www.สอบเทียบประเทศไทย.com

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
Leq,T	103.2	103.2	0.0
L5	110.8	110.8	0.0
L10	108.8	108.8	0.0
L50	92.9	92.8	0.1
L90	76.9	76.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.2 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 50 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

- All Scairlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SVMP004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphones which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

IEC 61672-3 Sound Level Meters Part 3: Periodic tests



Calibration Report

Certificate Number : SPR23020460-7

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23020460-7

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A	Standard Setting	UUC Reading		Error		Unit : dB
		Fast	Slow	Fast	Slow	
94		94.0	94.0	0.0	0.0	0.15
114		114.1	114.1	0.1	0.1	0.15

Select C	Standard Setting	UUC Reading		Error		Unit : dB
		Fast	Slow	Fast	Slow	
94		94.0	94.0	0.0	0.0	0.15
114		113.9	113.9	-0.1	-0.1	0.15

Select Z	Standard Setting	UUC Reading		Error		Unit : dB
		Fast	Slow	Fast	Slow	
94		94.0	94.0	0.0	0.0	0.15
114		113.9	113.9	-0.1	-0.1	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.
- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23020460-8

Page : 1 of 3

Customer : Thai Environmental Technic Limited.

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

Equipment Name : Noise Dose Meter
Manufacturer : SOUNDTEK
Model : ST-130
Serial Number : 220100051
ID. Number : No.31

Environmental Conditions
Ambient Temperature : 23 °C ± 3 °C Received Date : 24 Feb 2023
Relative Humidity : 50 % ± 15 % Calibration Date : 25 Feb 2023
Location of Calibration : In-Lab Recommend Due Date : 25 Feb 2024
Calibration Procedure : SP-CPE-04-01 Date of Issue : 26 Feb 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Karoon Pengsalung

Approved by :

Calibration Officer

(Mr. Nirut Loha)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23020460-8

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP.114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No. : SPR23020460-8

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A	Standard Setting	UUC Reading		Error		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94	94	94.0	94.0	0.0	0.0	0.15
114	114	114.1	114.1	0.1	0.1	0.15

Unit : dB

Select C	Standard Setting	UUC Reading		Error		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94	94	94.0	94.0	0.0	0.0	0.15
114	114	114.0	114.0	0.0	0.0	0.15

Unit : dB

Select Z	Standard Setting	UUC Reading		Error		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94	94	94.0	94.0	0.0	0.0	0.15
114	114	114.0	114.0	0.0	0.0	0.15

Unit : dB

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23020460-9

Page : 1 of 3

Customer

: Thai Environmental Technic Limited.

1/6 Soi Rankhamhaeng 145, Khwaeng Saphan Surg, Khet Saphan
Sung, Rangkrok 10240, Thailand

Equipment Name : Noise Dose Meter

Manufacturer : SOUNDTEK

Model : ST-130

Serial Number : 2201000052

ID. Number : No 32

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$

Received Date : 24 Feb 2023

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

Calibration Date : 25 Feb 2023

Location of Calibration : In-Lab

Recommend Due Date : 25 Feb 2024

Calibration Procedure : SP-CPE-04-01

Date of Issue : 26 Feb 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent. National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Karoon Pengsalung

Approved by :

Calibration Officer

(Mr. Nirut Loha)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23020460-9

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL-BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Certificate No.: SPR23020460-9

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A	UUC Reading		Error		Unit : dB
	Fast	Slow	Fast	Slow	
Standard Setting					Uncertainty (±)
94	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	0.1	0.1	0.15

Select C	UUC Reading		Error		Unit : dB
	Fast	Slow	Fast	Slow	
Standard Setting					Uncertainty (±)
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select Z	UUC Reading		Error		Unit : dB
	Fast	Slow	Fast	Slow	
Standard Setting					Uncertainty (±)
94	94.0	94.0	0.0	0.0	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23020460-10
Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
Sung, Bangkok 10240, Thailand.

Page : 1 of 3

Equipment Name : Noise Dose Meter
Manufacturer : SOUNDTEK
Model : ST-130
Serial Number : 220100053
ID. Number : No.33

Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 24 Feb 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 25 Feb 2023
Location of Calibration : In-Lab Recommend Due Date : 25 Feb 2024
Calibration Procedure : SP-CPE-04-01 Date of Issue : 26 Feb 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.
All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Karoon Pengsalung
Calibration Officer
Approved by :
(Mr. Nirut Loha)
Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23020460-10

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SL-120	211203773	EEL.BP. 114/0166	17 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TISTR - Thailand Institute of Scientific and Technological Research



Result of Calibration

Page : 3 of 3

Function : @1kHz

Select	A	Unit : dB				
		Standard Setting	UUC Reading		Error	Uncertainty (±)
			Fast	Slow		
94		94.0	94.0	0.0	0.15	
114		114.1	114.1	0.1	0.15	

Select	C	Unit : dB				
		Standard Setting	UUC Reading		Error	Uncertainty (±)
			Fast	Slow		
	94		94.0	0.0	0.15	
	114		114.0	0.0	0.15	

Select	Z	Unit : dB				
		Standard Setting	UUC Reading		Error	Uncertainty (±)
			Fast	Slow		
	94		94.0	0.0	0.0	0.15
	114		113.9	-0.1	-0.1	0.15

The result of calibration was found accurate as show on date and place of calibration only.

This Certificate is not certified for any commercial transaction.

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%.

- End of Certificate -



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

Certificate of Calibration

Certificate No. : 23H558
Page : 1 of 2

Equipment : Thermal Environment Monitor

Manufacturer: JANTYTECH

Model : JT2011-E2A

Serial No.: 3522210145

D No.: HD 7

Condition As-Received: Used Item

Received Date: 03 March 2023

Calibration Date: 09 March 2023

to 13 March 2023

REFERENCE: 303-0110D3C

Амплитуда температур, $^{\circ}\text{C}$

(50 ± 20) %

Relative humidity. (0.00 = 20 / 100)

Procedure used:

Calibration were conducted using in-house calibration procedure CP-H03 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 :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Handheld Thermometer With Sensor	1521	ASA339	2211251	12 Oct 2023

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Chakrit Waewanjua
Issue Date: 17 March 2023

Approved Signatory :

☐ Chakrit Waewanjua
☐ Pornthippa Tameyakul
☒ Viporn Tantiyawutti

B 0310140

SP--FM--04--15 REV.0



Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for T_a

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.025	19.9	-0.125	0.42
30.018	29.9	-0.118	0.42
40.007	39.7	-0.307	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for T_{rw}

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.025	20.0	-0.025	0.42
30.018	29.9	-0.118	0.42
40.007	39.7	-0.307	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for T_g

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.025	19.9	-0.125	0.42
29.990	29.9	-0.090	0.42
40.012	39.7	-0.312	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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a 1153230



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



Certificate of Calibration

Certificate No. : 23H6559
Page : 1 of 2

Equipment : Thermal Environment Monitor
Manufacturer : JANTYTECH
Model : JT2011-E2A
Serial No. : 3522210146
ID No. : HD 8
Condition As-Received: Used Item
Received Date: 03 March 2023
Calibration Date: 09 March 2023
Reference: 2303-0118DSC
Ambient Temperature: (25 ± 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 was conducted using in-house calibration procedure CP-H03 according to comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	ASA339	2211251	12 Oct 2023
2) The certificate is valid only to the item calibrated on date and place of calibration.				
3) This Certificate is traceable to the International System of Unit maintained at:-				

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Chakrit Waewanjua
Issue Date : 17 March 2023

Approved Signatory :

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

B 0310139



Cert. No.: 23H559
Page.: 2 of 2

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for Ta

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.025	19.9	-0.125	0.42
30.018	29.9	-0.118	0.42
40.007	39.7	-0.307	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for Tnw

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.025	19.9	-0.125	0.42
30.018	29.9	-0.118	0.42
40.007	39.7	-0.307	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for Tg

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.025	20.0	-0.025	0.42
29.990	29.9	-0.090	0.42
40.012	39.6	-0.412	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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a 1153229



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 22CHO410
Page.: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH1300
Serial No. : B08D0012
ID No. : -
Condition As-Received: Used Item
Received Date : 11 July 2022
Calibration Date : 11 July 2022
Reference : 2207-0243OC-7
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Calibration Place : Laboratory (Thai Environment Technic Limited)
Ambient Temperature : (25.2 - 25.4) °C
Relative Humidity : (50.8 - 51.3) %
Calibration Procedure : In - house method :
- CP-OCH2 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by : Krisda Malee

Approved by : 
Malee Buikruea
Sathip Meangmai

Issue Date : 19 July 2022
The Uncertainties are for a confidence probability of approximately 95 %

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

A 0042417



Cert. No.: 22CHO410
Page.: 2 of 2

Condition of this calibration result

- Reference Standard Instrument :

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	46530031	130RC098	21E3245	07 Oct 2022
2) Digital Thermometer	-	130RC112	21T2118	16 Nov 2022

This certification is traceable to the International System of Unit maintained at:-
- Traceable to National Institute of Metrology (Thailand), NIMT
- 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 1.681	CPA chem	754027	28 Jun 2023
pH 4.008	CPA chem	794120	14 Feb 2024
pH 6.866	CPA chem	754029	28 Jun 2023
pH 9.181	CPA chem	766823	04 Sep 2022
*pH 12.44	Hach Lange GmbH	C02796	15 Dec 2022

- 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 (1.68,4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: B06D0012	pH	314.73	314.7	1.694	0.058	2.00
	4.000	177.48	177.5	4.008	0.058	2.00
	6.860	8.28	8.3	6.860	0.058	2.00
	7.000	0.0	0.0	7.000	0.058	2.00
	9.180	-128.97	-128.9	9.188	0.058	2.00
	10.000	-177.48	-177.4	10.011	0.058	2.00

Function : pH Measurement

Performing four buffers standard curve by using buffer nominal pH (1.68,4,7,9)

Unit Under Calibration	Standard Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 9X9M0055	1.681	1.681	295.6	0.0050	2.00
	4.008	4.007	159.9	0.0047	2.00
	6.866	6.866	-6.9	0.0084	2.00
	9.181	9.181	-139.9	0.014	2.00
	*12.44	12.440	-314.5	0.056	2.00

Remark: * : Not NSC-ONSC Accredited

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)
CALIBRATION AND TESTING EQUIPMENT SERVICES
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3800-24 FAX. 0-2719-9484

Cert.No.: 22CH1490
Page.: 1 of 2

Certificate of Calibration

Equipment : Turbidity Meter
Manufacturer : Thermo Scientific
Model : EUTECH TN-100
Serial No. : 26550003
ID. No. :
Condition As-Received: Used Item
Received Date : 27 October 2022
Calibration Date : 31 October 2022
Reference : 2210-0875WSC-3
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung, Bangkok 10240
Ambient Temperature : (25 \pm 2.5) $^{\circ}$ C
Relative Humidity : (50 \pm 20) %
Calibration Procedure : In - house method : CP-CH11
based on direct measurement by
using Formazin standard solution

Calibrated by : Walalak Sirithean

Approved by :
Approved Signatory

(☒) Melee Butkrua
() Saitip Meangnai
() Warakorn Lemgatrakul

Issue Date : 1 November 2022

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 0009939

A 1090860



Cert.No. : 22CH1490
Page : 2 of 2

Condition of this calibration result

- Reference Standard Instruments :
This certification is traceable to the International System of unit (SI unit) through Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygraph	1103328	130EC010	22H1313	12 June 2023
2) Electronic Balance	B134206712	140RC007	22MM181	22 Feb 2023

- Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

Calibration result

Performing three - Formazin suspension standard curve by using 20,100,800 NTU
Turbidity Meter Serial Number : 2655003

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
0.1	0.18	0.026	2.06
20	20.1	0.39	2.00
100	100	0.74	2.00
800	799	2.1	2.00

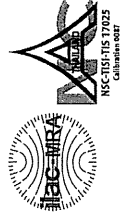
Remark
- UUC* = Unit Under Calibration
- NTU = Nephelometric Turbidity Units

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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หน้า 2 จาก 2

22CH1490



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: Spectroquant Prove 100
Serial No. (or ID.): 1618111041
Manufacturer: Merck
Condition: In Condition
Certificate No.: C06220212
Issued Date: 06 May 2022
Job No.: KSPR2205458
Page: 1 of 3

Customer: Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sug,
Khet Saphan Sung, Bangkok 10240 Thailand

Environment Condition: Temperature 26.4 °C ± 0.2 °C
Humidity 58.2 %RH ± 1.1 %RH

Calibration Place: Thai Environmental Technic Limited (Laboratory)
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sug,
Khet Saphan Sung, Bangkok 10240 Thailand

Calibration By: Mr. Atachai Ngamchanat
Calibration Date: 06 May 2022
The Method used: In house method, SPCC-WI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Stama Scientific Limited.
The standard for Wavelength Certificate No. 85283 and 85282
The standard for Photometric Certificate No. 107642
The standard for Stray light Certificate No. 85761

(Mr. Atachai Ngamchanat)

Person in charge

SFC RT Co., Ltd.

(Mr. Dumrong Boonsopon)
Authorized signatory

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

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 4 nm and UUC at 4 nm			
Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.48	418.8	-0.32	0.13
536.90	536.8	0.10	0.13
637.94	637.7	0.24	0.13
748.28	748.1	0.18	0.13
807.16	806.9	0.26	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2878	0.290	-0.0022	0.0045
	0.5157	0.519	-0.0033	0.0045
	1.0258	1.029	-0.0032	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2816	0.284	-0.0024	0.0045
	0.5059	0.508	-0.0021	0.0045
	1.0044	1.006	-0.0016	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2467	0.250	-0.0033	0.0045
	0.4579	0.461	-0.0031	0.0045
	0.9301	0.933	-0.0029	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2419	0.245	-0.0031	0.0045
	0.4646	0.466	-0.0014	0.0045
	0.9453	0.946	-0.0007	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2560	0.259	-0.0030	0.0045
	0.5036	0.505	-0.0014	0.0045
	1.0022	1.003	-0.0008	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2553	0.258	-0.0027	0.0045
	0.4971	0.498	-0.0009	0.0045
	0.9717	0.972	-0.0003	0.0045

Calibration Results:
Without Adjustment

Stray light *	Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
	391.96 +/- 0.11 nm	392.0	1.03	1.987

* Calibration Marked "Not TISI Accredited" in this Certificate have been included for completeness.

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

ชนิดเครื่องมือ: SPECTROPHOTOMETER รุ่น: Spectroquant Prove 100 เลขที่ใบงาน: KSPR2206458
หมายเลขเครื่อง: 1618111041

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

เพิ่มเติม/ข้อแนะนำ :

Mr. Atachai Ngamchanat
Service Engineer



Certificate of Calibration

Certificate Number : SPR23010143-5 Page : 1 of 3


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

Equipment Name : DO Meter
Manufacturer : Horiba
Model : OM-71G
Serial Number : D75J0012
ID. Number : No.07

Environmental Conditions
Ambient Temperature : 23 °C ± 2 °C Received Date : 13 Jan 2023
Relative Humidity : 50 % ± 15 % Calibration Date : 14 Jan 2023
Location of Calibration : In-Lab Recommend Due Date : 14 Jan 2024
Calibration Procedure : In-House Method Date of Issue : 15 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.
All calibrations are performed within manufacturer's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Kijja Visitslip
Approved by : 
(Ms. Bussakorn Chaikaew)
Authorized Signatory

Calibration Officer



Calibration Report

Certificate Number : SPR23010143-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Zero Oxygen Solution	HI7040L	Lot. 90066/21	01B24	31 Jan 2027
Electronic Balance	N/A	14246789	SPR22110015-7	10 Nov 2023
Standard Weight Set	Class E2	B746971965	C02221902	16 Sep 2023

Traceability

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

HANNA - Hanna Instruments (Thailand) Ltd.

SP Metrology - SP Metrology system (Thailand) Co.Ltd.

SPC - SPC Calibration Center Co.Ltd.



Result of Calibration

Certificate No.: SPR23010143-5

Page : 3 of 3

Function : Dissolved Oxygen Permanence Test

Unit : mg/L

Range	Actual Standard	UUC, Heading	Error	Uncertainty (±)
0-40	0.3	0.22	-0.08	0.13
	8.3	8.19	-0.11	0.13

Note:

The result of calibration was found accurate as show on date and place of calibration only.

This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2.00$, providing a level of confidence approximately 95%

- End of Certificate -



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-20 FAX. 0-2719-9484



NSC-TSI-17187025
CALIBRATION 0008

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.BOD05

Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Location : Laboratory (Thai Environmental Technic Limited)

Received Order : 10 April 2023
Calibration Date : 11 April 2023
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Khit Rutanaprapachai

Approved by : 
Approved Signatory

() Pornthippa Tameyakul
() Malee Butkruea
() Suwit Imjai

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 0053455



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-01460C-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.

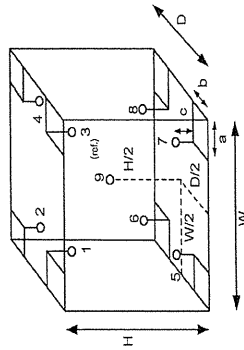
3. This certification is traceable to the International System of Unit.

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
D = 0.48 m
W = 0.50 m
H = 1.1 m
Capacity = 0.26 m³

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



a 1158205



Equipment: BOD Incubator
Condition As-Received: Used Item
Reference: 2304-0146OC-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		9 (ref.)
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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a 1158204



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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: Khil Rutnanapapachai
Approved by: *Wdu.* Approved Signatory
() Ponthippa Tameyakul
(✓) Malee Butkruea
() 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 0053464



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0146OC-12
Cert.No.: 23MM160
Page: 2 of 3

Procedure used :-

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

Condition of this result of calibration

- Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024
- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

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

Range capacity : 0 g to 210 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance		Measurement		Coverage Factor (k)
	Reading (g)	Correction (g)	Uncertainty (± mg)		
100	99.9982	+0.0018	0.18	2.00	2.00
200	199.9965	+0.0035	0.29	2.00	2.00

After Adjustment :

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

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

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0146OC-12
Cert.No.: 23MM160
Page: 3 of 3

Result of calibration

2. Effect of off center loading

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

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

3. Departure from nominal value

Applied Weight (g)	Balance		Measurement		Coverage Factor (k)
	Reading (g)	Correction (g)	Uncertainty (± mg)		
Unload	0.0000	0.0000	0.14	2.11	2.11
0.01	0.0100	0.0000	0.14	2.11	2.11
0.1	0.1001	-0.0001	0.14	2.11	2.11
0.5	0.5000	0.0000	0.14	2.11	2.11
1	1.0001	-0.0001	0.14	2.11	2.11
5	5.0000	0.0000	0.14	2.11	2.11
10	9.9999	+0.0001	0.14	2.11	2.11
25	24.9998	+0.0002	0.15	2.07	2.07
50	49.9998	+0.0002	0.16	2.05	2.05
100	99.9999	+0.0001	0.18	2.00	2.00
200	200.0000	0.0000	0.29	2.00	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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TEL: 0-2717-3000-27 FAX: 0-2719-9484



Cert.No.: 22CH0625
Page.: 1 of 3

Certificate of Calibration

Equipment : Spectrophotometer
Manufacturer : PerkinElmer
Model : Lambda 365
Serial No. : 365K9042909
ID No. :
Condition As-Received:
Received Date : 01 November 2022
Calibration Date : 01 November 2022
Reference : 2211-0001OC-5
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240

Calibration Place : Laboratory (Thai Environment Technic Limited)
Ambient Temperature : (24.9 - 24.4) °C (On-Site)
Relative Humidity : (54 - 52) % (On-Site)
Calibration Procedure : In - house method :
CP-0CH4 based on ASTM E 275-01

Calibrated by : Uthen Kankawi

Approved by :
Approved Signatory

() Malee Butkruea
() Saithip Meangmai
() Warakorn Lengagtrakul

Issue Date : 10 November 2022
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 0047052



Cert. No. : 22CH0625
Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

Material	Serial No.	Certificate No.	Due date
1. Absorbance Standard set	39130	106269	10 Oct 2024
2. Wavelength Standard set	29829	94776	02 Sep 2023
3. Wavelength Standard set	29829	94777	02 Sep 2023
4. Stray Light Standard set	32629	9112980	03 Aug 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certificate is traceable to the International System of Unit maintained at :
- National Physical Laboratory (NPL), The United Kingdom of Great Britain and Northern Ireland
- National Institute of Standards and Technology (NIST), The United States of America

4. Spectral Bandwidth : 1 nm
Scan Speed : 30 nm/min

Calibration Results : without adjustment
Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (± nm)	Coverage Factor k
418.53	418.32	0.12	2.00
536.52	536.61	0.12	2.00
638.00	637.96	0.12	2.00
684.50	684.48	0.12	2.00
879.41	879.39	0.12	2.00

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Cert. No.: 22CHO625
Page : 3 of 3

Calibration Results : without adjustment
Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (\pm Abs)	Coverage Factor <i>k</i>
420.0	Zero	0.0000	0.0028	2.00
	0.5796	0.5788	0.0028	2.00
	0.7105	0.7095	0.0028	2.00
	1.0186	1.0179	0.0028	2.00
546.1	Zero	0.0000	0.0028	2.00
	0.5281	0.5258	0.0028	2.00
	0.6962	0.6945	0.0028	2.00
	0.9984	0.9956	0.0028	2.00
635.0	Zero	0.0000	0.0028	2.00
	0.5699	0.5684	0.0028	2.00
	0.7606	0.7590	0.0028	2.00
	1.0927	1.0904	0.0028	2.00

Stray Light

* Straylight at 280.05 nm \pm 0.11 nm	Reading at 280.05 nm \pm 0.11 nm
Abs	2.0728
%T	0.8299

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- Cut-off wavelength of stray light reference material (Potassium Iodide) at wavelength 280.05 nm \pm 0.11 nm
- Result = Pass. If Absorbance $>$ 2.00 Abs and Transmission $<$ 1.0 %T at Wavelength 280.05 nm \pm 0.11 nm
- * : Not NSC-ONSC Accredited

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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Wala.

a 1134410



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CALIBRATION AND TESTING EQUIPMENT SERVICES
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TEL. 0-2717-3000/24 FAX. 0-2719-9484

Cert.No.: 22CH1138
Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : ES-71G
Serial No. : D64M0005
ID No. : No.2
Condition As-Received: Used Item
Received Date : 26 August 2022
Calibration Date : 29 August 2022
Reference : 2208-0934DSC-5
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Ambient Temperature : (25 \pm 2.5) $^{\circ}$ C
Relative Humidity : (50 \pm 15) %
Calibration Procedure : In-house method :
- CP-CH6 : based on direct measurement by
using reference material (RM)
Calibrated by : Uthen Kankawi

Approved by : *Wala.*
Approved Signatory
(☒) Malee Buikrua
() Saithip Meangmai
() Warakorn Lengagatrakul
Issue Date : 2 September 2022

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

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A 0009492



Cert.No.: 22CH1138

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

Serial No.	ID No.	Certificate No.	Due date
9549224	130RC003	221484	17 Apr 2023

1)

Thermometer

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 μ S/cm	Thermo Scientific	152/02	14 Apr 2023
1.413 mS/cm	Thermo Scientific	081/02	26 Feb 2024
12.88 mS/cm	Thermo Scientific	041/01	29 Jan 2024

- Control Conductivity calibration solution temperature by Water bath (25 \pm 0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1.413 mS/cm

Conductivity Electrode Serial No.: 9C5A0262

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
84 μ S/cm	81.3 μ S/cm	89.2 μ S/cm	4.3 μ S/cm	2.00
1.413 mS/cm	1.299 mS/cm	1.411 mS/cm	0.015 mS/cm	2.00
12.88 mS/cm	11.56 mS/cm	12.82 mS/cm	0.14 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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WO-02273746/2023

MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

Customer : บริษัท เทคโนโลยีการแพทย์ จำกัด	Date Tested: April 3, 2023
Address : 1/6 ซอยรามคำแหง 145 แขวงสะพานสูง เขตสะพานสูง กรุงเทพมหานคร 10240	Recommendation Recertification Period 6 Months
User Name: Khun Natapong	Recertification Due: October 3, 2023
Phone: 02-3737799	Date Last Certified: October 4, 2022
Fax: 02-318-5597	Visit Number: 1 of 2
	PerkinElmer Phone: 02-719-6420 ext 203
	PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED	ACCESSORIES/COMPONENT NOT INCLUDED
MODEL OPTIMA 8000	SERIAL NUMBER 078N1310024C
S10	
TESTED EQUIPMENT IPV Methods	CALIBRATION NUMBER
	EXPIRATION
TEST STANDARD USED Mixed standard 1/10	PART NUMBER N069-1579
Mixed standard 1/100	N930-0221
CUSTOMER SUPPLIED 2 % HNO3	COMMENTS
10 % HNO3	CUSTOMER INITIALS

MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078N1310024C DATE TESTED : April 3, 2023

1. MECHANICAL CHECKS

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

2. OPTICAL CHECKS

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

3. COOLING SYSTEM CHECKS

- A. Perform preventive maintenance on chiller. ☐ OK
- B. Flush out the chiller every six months. ☐ OK

4. PERFORMANCE CHECKS

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

MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078N1310024C DATE TESTED : April 3, 2023

PARAMETER	SPECIFICATION	FINAL VALUE
Spectral Resolution : UV	As 193.696 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 193.696 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 193.696 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



WO-02273746/2023

MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

SERIAL NUMBER : 078N1310024C DATE TESTED : April 3, 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: Wiphan Promlunda
(Wiphan Promlunda)
Service Engineer

Align View XY Axial for analyte Mn 257.610

X-position	Y-position	Intensity
-2.0	15.0	2920926.2
-1.6	15.0	4117205.6
-1.2	15.0	5581541.7
-0.8	15.0	6990827.7
-0.4	15.0	8176328.5
0.0	15.0	9075098.4
0.4	15.0	8960265.5
0.8	15.0	8360445.5
1.2	15.0	7467099.0
1.6	15.0	6255831.1
2.0	15.0	5030853.2
0.0	10.0	159365.9
0.0	10.5	241214.9
0.0	11.0	446309.1
0.0	11.5	964275.3
0.0	12.0	1659518.8
0.0	12.5	2781326.3
0.0	13.0	4117574.4
0.0	13.5	5863526.6
0.0	14.0	7007618.7
0.0	14.5	8248882.5
0.0	15.0	8913553.6
0.0	16.0	8830206.3
0.0	16.5	8476274.2
0.0	17.0	5916533.5
0.0	17.5	4806692.1
0.0	18.0	3470213.6
0.0	18.5	2459999.5
0.0	19.0	1409798.3
0.0	19.5	836888.1
0.0	20.0	457127.2
-0.8	15.0	7399406.7
-0.4	15.0	8255530.6
0.0	15.0	8767341.7
0.4	15.0	8902714.8
0.8	15.0	8341631.7
1.2	15.0	4448485.6
1.6	15.0	5980471.5
2.0	15.0	7305087.4
0.4	14.0	8079824.9
0.4	15.0	9038053.5
0.4	15.5	8965644.2
0.4	16.0	8519954.3
0.4	16.5	7478375.8
0.4	17.0	5956440.9

3/4/2566 10:51:07 aligned for analyte Mn 257.610

X viewing position set to 0.4 mm having Peak intensity 9038053.5 for Axial viewing
Y viewing position set to 15.0 mm having Peak intensity 9038053.5 for Axial viewing

Align View X Radial for analyte Mn 257.610

X-position	Y-position	Intensity
-7.0	15.0	23032.5
-6.5	15.0	27006.7
-6.0	15.0	35560.5
-5.5	15.0	57821.4
-5.0	15.0	90935.9
-4.5	15.0	136105.4
-4.0	15.0	206645.2
-3.5	15.0	299882.1
-3.0	15.0	428877.1
-2.5	15.0	589771.2
-2.0	15.0	706184.3
-1.5	15.0	841150.2
-1.0	15.0	1019788.8
-0.5	15.0	1329407.6
0.0	15.0	1381151.1
0.5	15.0	1426400.1
1.0	15.0	1309824.4

1.5 15.0 1099234.2
2.0 15.0 784376.5
2.5 15.0 574061.3
3.0 15.0 437455.8
3.5 15.0 324105.7
4.0 15.0 264022.3
4.5 15.0 183005.6
5.0 15.0 117089.3
5.5 15.0 70743.1
6.0 15.0 40927.8
6.5 15.0 27379.1
7.0 15.0 20863.3

3/4/2566 10:54:00 aligned for analyte Mn 257.610

X viewing position set to 0.5 mm having Peak intensity 1426400.1 for Radial viewing

Method Loaded
Method Name: DLRL-Cal
TEC File:
Method Description: C8000-Calibration for later test

Sequence No.: 1
Sample ID: Calib Blank 1
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:

Autosampler Location:

Date Collected: 3/4/2566 11:18:12

Data Type: Reprocessed on 3/4/2566 11:32:52

Initial Sample Vol:

Sample Prep Vol:

Nebulizer Parameters: Calib Blank 1
Analyte
All
Back Pressure
197.0 kPa
Flow
0.50 L/min

Mean Data: Calib Blank 1

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc. Units	Calib
As 193.696	96.5			[0.00] mg/L	
Zn 213.857	584.3			[0.00] mg/L	
Mn 257.610	1401.8			[0.00] mg/L	
La 379.478	352.7			[0.00] mg/L	
Ba 455.403	25802.4			[0.00] mg/L	
Ba 493.408	45750.3			[0.00] mg/L	

Sequence No.: 2

Autosampler Location:

Date Collected: 3/4/2566 10:55:27

Data Type: Reprocessed on 3/4/2566 11:32:52

Initial Sample Vol:

Sample Prep Vol:

Nebulizer Parameters: Calib Std 1

Analyte
All
Back Pressure
194.0 kPa
Flow
0.50 L/min

Mean Data: Calib Std 1

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc. Units	Calib
As 193.696	13655.9			[5.0] mg/L	
Zn 213.857	149844.9			[1.0] mg/L	
Mn 257.610	1615840.4			[1.0] mg/L	
La 379.478	340770.3			[1.0] mg/L	
Ba 455.403	839940.7			[0.1] mg/L	
Ba 493.408	633243.6			[0.1] mg/L	

Calibration Summary

Analyte	Stds.	Equation	Intercept	Slope	Curvature	Corr. Coef.	Reslope
As 193.696	1	Lin, Calc Int	0.0	2731	0.00000	1.000000	
Zn 213.857	1	Lin, Calc Int	0.0	149800	0.00000	1.000000	
Mn 257.610	1	Lin, Calc Int	0.0	1616000	0.00000	1.000000	
La 379.478	1	Lin, Calc Int	0.0	340800	0.00000	1.000000	
Ba 455.403	1	Lin, Calc Int	0.0	8399000	0.00000	1.000000	
Ba 493.408	1	Lin, Calc Int	0.0	6332000	0.00000	1.000000	

Sequence No.: 3

Autosampler Location:

Date Collected: 3/4/2566 11:19:52

Data Type: Reprocessed on 3/4/2566 11:32:52

Initial Sample Vol:

Sample Prep Vol:

Dilution: 3X
Wash Time: Sample Prep Vol:

Nebulizer Parameters: IDL-RL (2% HNO3)
Analyte Back Pressure Flow
All 198.0 kPa 0.50 L/min

Mean Data: IDL-RL (2% HNO3)

Analyte	Mean Corrected Intensity	Conc. Units	Std. Dev.	Sample Conc. Units	RSD
As 193.696	-32.0	-0.0 mg/L	0.00	-35.2 µg/L	2.60 7.40%
Zn 213.657	37.4	0.0 mg/L	0.00	0.7 µg/L	0.26 35.07%
Mn 257.610	475.9	0.0 mg/L	0.00	0.9 µg/L	1.49 168.85%
La 379.478	-36.3	-0.0 mg/L	0.00	-0.3 µg/L	1.12 350.55%
Ba 455.403	26579.4	0.0 mg/L	0.00	9.5 µg/L	2.86 30.09%
Ba 493.408	-20698.9	-0.0 mg/L	0.00	-9.8 µg/L	9.64 98.34%

Reprocessing Begun
Logged In Analyst: TET
Technique: ICP ContinuousResults Data Set (original): PM3APR23
Results Library (original): C:\Users\Public\PerkinElmer\IPV\Results.mdb
Results Data Set (reprocessed):
Results Library (reprocessed):

Sequence No.: 1
Sample ID: Calib Blank 1
Autosampler Location:
Date Collected: 3/4/2566 11:23:46
Data Type: Reprocessed on 3/4/2566 11:32:04
Logged In Analyst (Original) : TET
Initial Sample Wt:
Initial Sample Vol:
Dilution:
Sample Prep Vol:
Wash Time:

Nebulizer Parameters: Calib Blank 1
Analyte Back Pressure Flow
All 198.0 kPa 0.50 L/min

Mean Data: Calib Blank 1

Analyte	Mean Corrected Intensity	Std. Dev.	RSD	Conc. Units	Calib Conc. Units
Tl 190.801	-113.3			[0.00] µg/L	
As 193.696	285.4			[0.00] µg/L	
Se 196.026	99.6			[0.00] µg/L	
Pb 220.353	1176.2			[0.00] µg/L	

Sequence No.: 2
Sample ID: DL-Standard
Autosampler Location:
Date Collected: 3/4/2566 11:29:24
Data Type: Reprocessed on 3/4/2566 11:32:04
Logged In Analyst (Original) : TET
Initial Sample Wt:
Initial Sample Vol:
Dilution:
Sample Prep Vol:
Wash Time:

Nebulizer Parameters: DL-Standard
Analyte Back Pressure Flow
All 199.0 kPa 0.50 L/min

Mean Data: DL-Standard

Analyte	Mean Corrected Intensity	Std. Dev.	RSD	Conc. Units	Calib Conc. Units
Tl 190.801	19454.6			[1000] µg/L	
As 193.696	17563.5			[1000] µg/L	
Se 196.026	4574.6			[500] µg/L	
Pb 220.353	31327.5			[500] µg/L	

Calibration Summary

Analyte	Stds.	Equation	Intercept	Slope	Curvature	Corr. Coef.	Reslope
Tl 190.801	1	Lin, Calc Int	0.0	19.45	0.00000	1.000000	
As 193.696	1	Lin, Calc Int	-0.0	17.56	0.00000	1.000000	
Se 196.026	1	Lin, Calc Int	0.0	9.149	0.00000	1.000000	
Pb 220.353	1	Lin, Calc Int	0.0	62.65	0.00000	1.000000	

Sequence No.: 3
Sample ID: IDL-XL (2% HNO3)
Autosampler Location:
Date Collected: 3/4/2566 11:25:37
Data Type: Reprocessed on 3/4/2566 11:32:04
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution: 3X
Wash Time:
Initial Sample Vol:
Sample Prep Vol:

Nebulizer Parameters: IDL-XL (2% HNO3)
Analyte Back Pressure 198.0 kPa Flow 0.50 L/min

Mean Data: IDL-XL (2% HNO3)				
Analyte	Mean Corrected Intensity	Conc. Units	Std. Dev.	RSD
Tl 190.801	35.1	2 µg/L	1.24	3.73 68.95%
As 193.696	-14.0	-1 µg/L	1.42	4.26 177.97%
Se 196.026	-6.5	-1 µg/L	0.96	2.87 134.85%
Pb 220.353	-135.0	-2 µg/L	3.83	11.48 177.50%

Nebulizer Parameters: IDL-XL (2% HNO3)
Analyte Back Pressure 198.0 kPa Flow 0.50 L/min

Mean Data: IDL-XL (2% HNO3)				
Analyte	Mean Corrected Intensity	Conc. Units	Std. Dev.	RSD
Tl 190.801	35.1	2 µg/L	1.24	3.73 68.95%
As 193.696	-14.0	-1 µg/L	1.42	4.26 177.97%
Se 196.026	-6.5	-1 µg/L	0.96	2.87 134.85%
Pb 220.353	-135.0	-2 µg/L	3.83	11.48 177.50%

Method Loaded
Method Name: MnBEC
ISC File:
Method Description: C8000-XL and RL-Spec <or = 30 µg/L Attn:Spec<or= 50µg/L
Sequence No.: 1
Sample ID: IB (2% HNO3)
Autosampler Location:
Date Collected: 3/4/2566 11:17:14
Data Type: Reprocessed on 3/4/2566 11:32:27
Logged In Analyst (Original) : TET
Initial Sample Vol:
Dilution:
Wash Time:

Nebulizer Parameters: IB (2% HNO3)
Analyte Back Pressure 197.0 kPa Flow 0.50 L/min

Mean Data: IB (2% HNO3)				
Analyte	Mean Corrected Intensity	Conc. Units	Std. Dev.	RSD
Mn 257 XN	185358.1			
Mn 257 RN	39181.6			

Sequence No.: 2
Sample ID: IS (N069-1579/10)
Autosampler Location:
Date Collected: 3/4/2566 10:57:10
Data Type: Reprocessed on 3/4/2566 11:32:27
Logged In Analyst (Original) : TET
Initial Sample Vol:
Dilution:
Wash Time:

Nebulizer Parameters: IS (N069-1579/10)
Analyte Back Pressure 194.0 kPa Flow 0.50 L/min

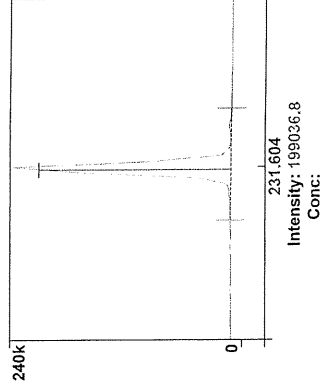
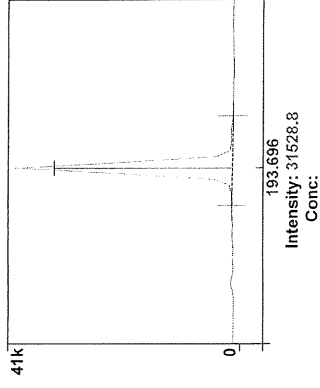
Mean Data: IS (N069-1579/10)				
Analyte	Mean Corrected Intensity	Conc. Units	Std. Dev.	RSD
Mn 257 XN	11536268.0			
Mn 257 RN	1679271.0			

As	193.696-Res	Rep 1	Res: 0.00701 nm
As	193.696-Res	Rep 2	Res: 0.00702 nm
As	193.696-Res	Rep 3	Res: 0.00702 nm
Ni	231.604-Res	Rep 1	Res: 0.00789 nm
Ni	231.604-Res	Rep 2	Res: 0.00790 nm
Ni	231.604-Res	Rep 3	Res: 0.00790 nm
As	193.696-Res	Rep 1	Res: 0.01192 nm
As	193.696-Res	Rep 2	Res: 0.01188 nm
As	193.696-Res	Rep 3	Res: 0.01169 nm
Ni	341.476-Res	Rep 1	Res: 0.01499 nm
Ni	341.476-Res	Rep 2	Res: 0.01499 nm
Ni	341.476-Res	Rep 3	Res: 0.01500 nm
As	455.403-Res	Rep 1	Res: 0.01500 nm
As	455.403-Res	Rep 2	Res: 0.01500 nm
As	455.403-Res	Rep 3	Res: 0.01500 nm

As 193.696-Res

Rep: 3 Ni 231.604-Res

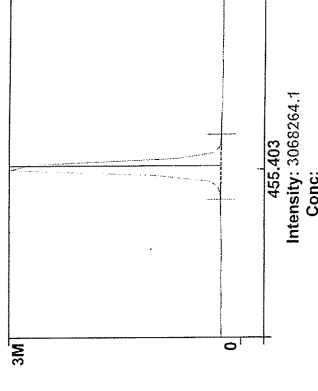
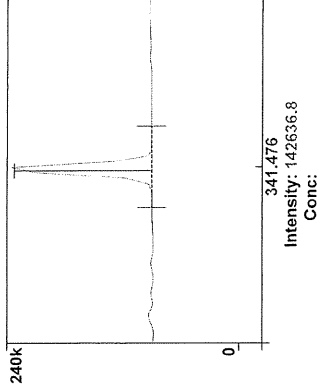
Rep: 3



Ni 341.476-Res

Rep: 3 Ba 455.403-Res

Rep: 3



Method Loaded
Method Name: Precision
IEC File:
Method Description: C8000 -N=10- 1.0% RSD
Sequence No.: 4
Sample ID: RSD STD (N069-1579/10)
Analyst:
Initial Sample Wt.:
Dilution:
Wash Time:
Autosampler Location:
Date Collected: 3/4/2566 11:02:43
Data Type: Original
Initial Sample Vol.:
Sample Prep Vol.:

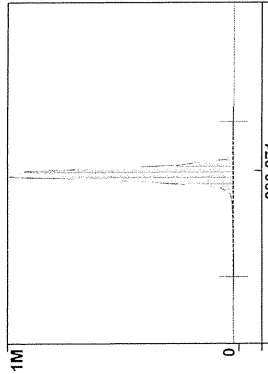
Nebulizer Parameters: RSD STD (N069-1579/10)
Back Pressure 195.0 kPa
Flow 0.50 L/min

Analyte	Mean Corrected Intensity	Conc. Units	Calib.	Std. Dev.	Conc. Units	Sample	Std. Dev.	RSD
Zn 206.200	323663.7			17093.12		3.46%		
Mg 285.213	323663.7			23266.88		0.71%		
Mg 285.213	196113.7			11109.46		5.66%		
Ba 455.403	7794526.3			80474.48		1.03%		

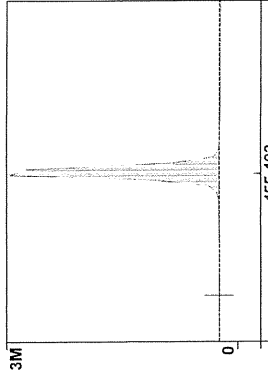
Method Loaded
Method Name: Precision
IEC File:
Method Description: C8000 -N=10- 1.0% RSD
Sequence No.: 5
Sample ID: RSD STD (N069-1579/10)
Analyst:
Initial Sample Wt.:
Dilution:
Wash Time:
Autosampler Location:
Date Collected: 3/4/2566 11:08:51
Data Type: Original
Initial Sample Vol.:
Sample Prep Vol.:

Nebulizer Parameters: RSD STD (N069-1579/10)
Back Pressure 196.0 kPa
Flow 0.50 L/min

Analyte	Mean Corrected Intensity	Conc. Units	Calib.	Std. Dev.	Conc. Units	Sample	Std. Dev.	RSD
Zn 206.200	323663.7			17093.12		2890.08		0.56%
Mg 285.213	323663.7			23266.88		43469.63		0.28%
Mg 285.213	197460.0			11109.46		775.34		0.39%
Ba 455.403	8071203.3			80474.48		31631.19		0.39%



Intensity: 501635.4
Conc: 3.46%



Intensity: 190357.4
Conc: 5.66%



Intensity: 7796566.6
Conc: 1.03%

PerkinElmer TruQ
Atomic Spectroscopy Standard



Certificate of Analysis

PerkinElmer Number: N0691579
Description: Multi-Element Standard
Matrix: 2% HNO₃
Lot Number: 57-024CRX1
Certification Date: NOV -- 2021
Expiration Date: MAY 3 0 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	50.1 µg/mL	3103a*
K	50.0 µg/mL	50.3 µg/mL	3141a*
La	10.0 µg/mL	10.0 µg/mL	3127a*
Li	10.0 µg/mL	10.0 µg/mL	3128a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*
Ni	10.0 µg/mL	10.0 µg/mL	3136*
Sr	10.0 µg/mL	10.0 µg/mL	3153a*
Zn	10.0 µg/mL	10.0 µg/mL	3168a*
Ba	1.00 µg/mL	1.01 µg/mL	3104a*
Mg	1.00 µg/mL	1.01 µg/mL	3131a*

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

Reference Multi: Lot# 2-64MJ, 3-168MJ, 4-39MJ

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 $\pm 0.5\%$ of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer:

Y. Pavith

Certifying Officer:

Y. Pavith



PerkinElmer

PerkinElmer

PerkinElmer, Inc.

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

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U.S.A. Toll Free: 1-800-762-4000

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PerkinElmer TruQ
Atomic Spectroscopy Standard



Certificate of Analysis

PerkinElmer Number: N9300221
Description: Instrument Calibration Standard 4
Matrix: 5% HNO₃
Lot Number: 58-169CRY1
Certification Date: MAY -- 2022
Expiration Date: NOV 3 0 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	100 µg/mL	99.8 µg/mL	3103a*
Ti	100 µg/mL	99.4 µg/mL	3158*
Cd	50.0 µg/mL	50.0 µg/mL	3108*

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

Reference Multi: Lot# 57-156CR, 1-177Y-1, 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 $\pm 0.5\%$ of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer:

Y. Pavith

Certifying Officer:

Y. Pavith



PerkinElmer

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PerkinElmer, Inc.

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

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ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 600

Customer :	THAI ENVIRONMENTAL	Date Tested:	20-ก.ค.-66
	TECHNIC LIMITED.	Recommendation Recertification	
Address :	1/6 Soi Ramkhamheang 145,	Period	6 Months
	Khwaeng/Khet Saphan Sung,	Recertification Due:	20-ก.ค.-66
	Bangkok 10240	Date Last Certified:	22-ก.ค.-65
User Name:	คุณ กนกวรรณ เริ่มประจักษ์ไพไล	Visit Number:	1 Of 2
Phone:	02-7353101-3, 02-3737799	TH One Source Phone:	081-7316733
E-mail:	ketsarin.c@tet1995.com	E-mail	thonecource@gmail.com
	admin@tet1995.com		

CONFIGURATION TESTED		SOFTWARE	
MODEL	SERIAL NUMBER		
AAAnalyst 600	600S5070101		
AS 800	801S5070102		
FIAS-100	2288		
TEST STANDARD USED	PART NUMBER		
GF AAS Mixed standard	N9300244		



PerkinElmer

Global Service Training Department

Service Engineer Certification

Wipac Promunda

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

ICP220B Optima S300 & Optima 4X/5X/7X00 Series

Instructions:

Date: July 20, 2012

Geoff Cook

Certified by:

Manager, Global Training Operations)



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAnalyst 600

SERIAL NUMBER	600S5070101	DATE TESTED	20-11-66
1. INSTRUMENT CHECKS			
A. The Mirror and Lenses Condition			
<input type="checkbox"/> OK			
B. Grating Condition			
<input type="checkbox"/> OK			
C. Replace or Clean Dust Filter			
<input type="checkbox"/> OK			
D. Cleaning the Contact Cylinders			
<input type="checkbox"/> OK			
E. Cleaning the Furnace Windows			
<input type="checkbox"/> OK			
2. AUTOSAMPLE CHECK			
A. Sampling and Arm			
<input type="checkbox"/> OK			
B. Sampling & Rinse Pump			
<input type="checkbox"/> OK			
C. Sample Position & Clean			
<input type="checkbox"/> OK			
D. Clean or Replace the Hall Sensor			
<input type="checkbox"/> OK			
3. COOLING SYSTEM CHECKS			
A. Clean and Change Distill water			
<input type="checkbox"/> OK			
B. Thermosensor			
<input type="checkbox"/> OK			
4. FIAS CHECKS			
A. Pump and 5 Port Valve			
<input type="checkbox"/> OK			
B. Chemifold and Tubing			
<input type="checkbox"/> OK			
C. Power Supply			
<input type="checkbox"/> OK			
D. Flow meter and Gas system			
<input type="checkbox"/> OK			



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAnalyst 600

SERIAL NUMBER	600S5070101	DATE TESTED	20-11-66
PARAMETER	SPECIFICATION		ACTUAL VAULE
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	235	mL/min
External Flow	100 ± 10 mL/min	110	mL/min
2. Chromium Baseline Noise (measure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0002	Int.Abs
	SD ≤ 0.005 Int.Abs	0.0002	Int.Abs
3. Chromium Characteristic Mass(m ₀) and Precition (measure 5 furnace firing using 20 ul sample injections of 10 ug/L Cr standard)			
	m ₀ Results 6.5 pg ± 1.5 pg	5.7	pg
	Precision ≤ 2.0%	1.41	%
4. Copper Characteristic Mass(m ₀) and Zeeman Ratio (measure 5 furnace firing using 20 ul sample injections of 25 ug/L Cu standard)			
	m ₀ Results 17.0 pg ± 3.5 pg	14.2	pg
	Zeeman Ratio 0.58 ± 0.04	0.560	



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 600

SERIAL NUMBER 600S5070101 **DATE TESTED** 20-11-66

Remarks :

Changed The Controller Bd. Atomizer (4 May 2015)

Replace The Contact Cylinder (27 July 2021)

Zeeman Ratio = $\frac{\text{Atomic Signal (peak area)}}{\text{Atomic Signal (peak area)} + \text{Background Signal (peak area)}}$

= $\frac{\text{Atomic Signal (peak area)}}{\text{Atomic Signal (peak area)} + \text{Background Signal (peak area)}}$

= $\frac{\text{Atomic Signal (peak area)}}{\text{Atomic Signal (peak area)} + \text{Background Signal (peak area)}}$

= $\frac{\text{Atomic Signal (peak area)}}{\text{Atomic Signal (peak area)} + \text{Background Signal (peak area)}}$

Copper blank = 0.0015

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 TH ONE SOURCE CO., LTD.

Krungchai T.

(Krungchai Treevichien)

Customer Support Engineer



Certificate of Training

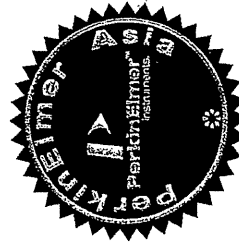
This is to certify that

Krungchai Treevichien

has successfully completed

Analyst 600/700/800 Service Training

09 to 13 February 2004



C.S. Lim

C.S. Lim
Service Specialist

13 Feb 2004



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 100

SERIAL NUMBER	040S0110503	DATE TESTED	3-๑๑-65
5. PERFORMANCE TESTS		SPEC.	RESULTS
* A. Neutral density filter checks with Copper (324.8 nm) Neutral Density Filter 0.2 ± 10%		0.180	0.173 Abs.
B. AA Baseline noise test with Copper (324.8 nm) Integration time = 0.5 seconds Replicates = 99 times Standard Deviation		≤ 0.001	0.000
C. Flame sensitivity with Copper (324.8nm) (5 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner) Stainless steel nebulizer		≥ 0.25	0.285 Abs.
%RSD		≤ 0.3	0.14 %

Page 3 of 4



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 100

SERIAL NUMBER	040S0110503	DATE TESTED	3-๑๑-65
Remarks :			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets			
<input type="checkbox"/> does not meet			
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.			
Service Department TH ONE SOURCE CO., LTD.			
<i>Krungsai J.</i>			
(Krungsai Treevichien)			
Customer Support Engineer			

Page 4 of 4



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/44 PATTANAKARN ROAD SOI 18, SIJANLIANG, SIJANLIANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-5484



Cert. No.: 23TM605
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : INE 500
Serial No. : E505.1143
ID No. : TET.LAB.INC 02
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Location : Laboratory (Thai Environmental Technic Limited)
Received Order : 10 April 2023
Calibration Date : 10 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpalboon

Approved by :
() Ponthippa Tamayakul
(x) Malee Butkruea
() 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.

A 0053458



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0146OC-5

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 34970A MY41021843 22LM172 27 Dec 2023

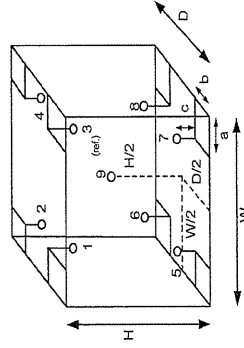
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration	
Beginning	Finished
Temp. (°C)	25 25
REL Humid. (%)	54 57
AC Supply (Volt)	223 219



Probe Installation Details :
a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
Dimension of Chamber :
D = 0.40 m
W = 0.56 m
H = 0.48 m
Capacity = 0.11 m³

Position :	Ref. Std. ID No.:
1	21-04RTD-11
2	21-04RTD-12
3	21-04RTD-13
4	21-04RTD-14
5	21-04RTD-15
6	21-04RTD-16
7	21-04RTD-17
8	21-04RTD-18
9 (ref.)	21-04RTD-19

a 1158195



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0148OC-5
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 23TM605
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.021	0.69	0.70	2
37.0	37.0	37.0	0.077	0.61	0.73	2
44.5	44.5	44.5	0.049	0.94	0.99	2

Calibration Point (°C)	Measured Temperature (°C)								Uncertainty (± °C)
	1	2	3	4	5	6	7	8	
35.0	34.998	34.998	34.900	34.866	35.143	35.446	35.083	35.362	0.30
37.0	36.978	36.975	36.972	36.971	37.390	37.559	37.437	37.010	0.30
44.5	44.631	44.502	44.429	44.412	44.752	45.106	44.600	45.021	0.32

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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Mdu.

a 1158194



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



Cert. No.: 23TM604
Page : 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : Memmert
Model : INE 500
Serial No. : E505.0595
ID No. : TET.LAB.INC 01
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Location : Laboratory (Thai Environmental Technic Limited)
Received Order : 10 April 2023
Calibration Date : 10 April 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon

Approved by : *Mdu.*
Approved Signatory

(/) Pornthippa Tameyakul
(/) Malee Buikrua
() Suwit Imjai

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.

A 0053457



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0146OC-4
Page : 2 of 3

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date
1) Data Acquisition 34970A MY41021843 22LM172 27 Dec 2023

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

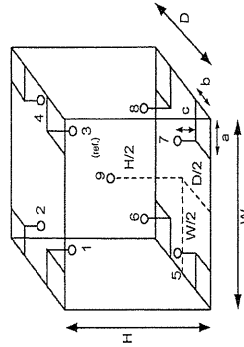
3. This certification is traceable to the International System of Unit.

Result of Calibration :-

Function of UUC* : (*) Without Adjustment

Fresh air setting : Temperature Source

Close



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm
Dimension of Chamber :
D = 0.40 m
W = 0.56 m
H = 0.48 m
Capacity = 0.11 m³

Valu.

a 1158197



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0146OC-4
Page : 3 of 3

Result of Calibration :-

Function of UUC* : (*) Without Adjustment

Fresh air setting : Temperature Source

Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.065	0.32	0.67	2
41.5	41.5	41.5	0.032	0.49	0.63	2
44.5	44.5	44.5	0.086	0.60	0.86	2

Calibration Point (°C)	Measured Temperature (°C)	Position	Uncertainty (± °C)
35.0	34.870	1	9 (ref.)
35.0	34.870	2	35.026
35.0	34.870	3	35.026
35.0	34.870	4	35.026
35.0	34.870	5	35.026
35.0	34.870	6	35.026
35.0	34.870	7	35.026
35.0	34.870	8	35.026
35.0	34.870	9	35.026
41.5	41.625	1	41.874
41.5	41.625	2	41.874
41.5	41.625	3	41.874
41.5	41.625	4	41.874
41.5	41.625	5	41.874
41.5	41.625	6	41.874
41.5	41.625	7	41.874
41.5	41.625	8	41.874
41.5	41.625	9	41.874
44.5	44.744	1	44.931
44.5	44.744	2	44.931
44.5	44.744	3	44.931
44.5	44.744	4	44.931
44.5	44.744	5	44.931
44.5	44.744	6	44.931
44.5	44.744	7	44.931
44.5	44.744	8	44.931
44.5	44.744	9	44.931

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 line 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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Valu.

a 1158196



Thai Environmental Technic Limited
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

Personal Pump Calibration Report

Equipment Type : Personal Pump/Parameter
Equipment Range : 0.1-7.0 U/min
Calibration Range : 0.1-4.0 U/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.	20140705049	2.5	2.4960	2.4950	2.4960	2.4950	±0.0006
2.	20151102093	2.5	2.4910	2.4930	2.4920	2.4920	±0.0010
3.	20031025001	2.5	2.4950	2.4950	2.4960	2.4950	±0.0006
4.	20140705056	2.5	2.4970	2.4960	2.4970	2.4970	±0.0006
5.	20110605018	2.0	1.9980	1.9990	1.9990	1.9990	±0.0006
6.	20151102097	2.0	1.9940	1.9960	1.9980	1.9960	±0.0020
7.	20140706029	2.0	1.9980	1.9960	1.9970	1.9970	±0.0010
8.	20151002109	2.0	1.9970	1.9970	1.9970	1.9970	±0.0000
9.	20151003019	2.0	1.9950	1.9950	1.9960	1.9950	±0.0006
10.	20151102080	2.0	1.9940	1.9930	1.9930	1.9930	±0.0006
11.	20140706027	2.0	1.9960	1.9960	1.9950	1.9960	±0.0006
12.	20151003007	2.0	1.9960	1.9960	1.9960	1.9960	±0.0000
13.	20140605001	2.0	1.9940	1.9940	1.9950	1.9940	±0.0006
14.	20140705059	2.0	1.9930	1.9930	1.9940	1.9930	±0.0006
15.	14903	2.0	1.9960	1.9970	1.9970	1.9970	±0.0006
16.	20080703007	2.0	1.9980	1.9980	1.9980	1.9980	±0.0000

Calibration Date 30 / 03 / 66

Calibration By เชิดมรรค

Remark : Uncertainty Type A = $\sigma = SD$

: SD = \sqrt{n} Standard deviation

: \bar{X} = Mean



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-217-3000-27 FAX. 0-219-9484



Cert.No.: 22MM28
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : XP205DR
Serial No. : 1129273885
ID No. :
Submitted by : Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Location : Balance Room
Received order : 20 April 2022
Calibration Date : 22 April 2022
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Ulhen Kankawi
Approved by : เชิดมรรค
Approved Signatory
(/) Ponthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai
Issue Date : 6 May 2022

The Uncertainties are for a confidence probability of approximately 95%

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



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

Cert.No.: 22MM28
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

1. Reference standard instruments:-

- | Instruments | Model | Serial No. | ID No. | Test report No. | Due date |
|-----------------------------|-------|------------|---------|-----------------|------------|
| 1) Standard Weight Set (E2) | 15884 | - | 70RC138 | MM-0009-21 | 3 Feb 2023 |
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This result of calibration was made on requested at the point specified by customer.
4. This certificate is not certified for any commercial transaction.
5. This certification is traceable to the International System of Unit.

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

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

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor
80	79.99911	+0.00089	0.15	2.00
200	199.9997	+0.0003	0.35	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000008
200	0.00004



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

Cert.No.: 22MM28
Page: 3 of 3

2. Effect of off center loading

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

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
-0.0002	-0.0001	-0.0002	-0.0001	-0.0001

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor
Unload	0.00000	0.00000	0.016	2.13
0.01	0.01000	0.00000	0.016	2.13
0.05	0.05001	-0.00001	0.016	2.13
1	1.00001	-0.00001	0.019	2.05
2	2.00001	-0.00001	0.020	2.04
5	5.00001	-0.00001	0.026	2.00
10	10.00001	-0.00001	0.033	2.00
20	20.00001	-0.00001	0.049	2.00
50	49.99999	+0.00001	0.080	2.00
80	79.99999	+0.00001	0.15	2.00
200	199.9997	+0.0003	0.35	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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