

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

LHCT

LOYAL HAILANG COPPER (THAILAND) CO., LTD.

ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
1.	Stack Air	Particulate	Dry Gas Meter SK25EX	S/N 1173	14/02/2023	February 2024
			Digital Barometer/PHB-318	S/N B011410	25/05/2023	May 2024
			Digital Thermometer/DP-52	S/N L392059	06-09/09/2022	September 2023
		CO	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			Gas Analyzer (E-instrument)/4400S	S/N 4101	07/01/2023	January 2024
		Cu	Dry Gas Meter SK25EX	S/N 1173	14/02/2023	February 2024
			Digital Barometer/PHB-318	S/N B011410	25/05/2023	May 2024
			Digital Thermometer/DP-52	S/N L392059	06-09/09/2022	September 2023
		SO ₂	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
			Gas Analyzer (E-instrument)/4400S	S/N 4101	07/01/2023	January 2024
2.	Ambient Air	NO _x as NO ₂	Gas Analyzer (E-instrument)/4400S	S/N 4101	07/01/2023	January 2024
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	19/11/2021	November 2022
		TSP	High Volume Air Sampler/TET	S/N TSP-10	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N TSP-04	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N TSP-12	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-41	01/08/2022	August 2023
		PM-10	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			High Volume Air Sampler/TET	S/N PM10-4	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N PM10-15	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N PM10-23	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N PM10-24	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N PM10-26	01/08/2022	August 2023
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024

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Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
2.	Ambient Air (Count)	Cu	ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	19/11/2021	November 2022
			High Volume Air Sampler/TET	S/N TSP-10	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N TSP-04	01/08/2022	August 2023
			High Volume Air Sampler/TET	S/N TSP-12	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-41	01/08/2022	August 2023
			ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
			CERTIFICATE OF ACCURACY : Linde	S/N A00962SK	18/08/2021	November 2023
			NO _x Analyzer/API 200E	S/N 393	10/05/2023	November 2023
			NO _x Analyzer/API 200A	S/N 777	10/05/2023	November 2023
		NO ₂	NO _x Analyzer/Teledyne T200	S/N 5154	11/05/2023	November 2023
			NO _x Analyzer/ Teledyne 200	S/N 5159	11/05/2023	November 2023
			NO _x Analyzer/ Teledyne 200E	S/N 2789	12/05/2023	November 2023
			CERTIFICATE OF ACCURACY : Linde	S/N 118310	19/09/2019	September 2023
			SO _x Analyzer/API 100E	S/N 383	10/05/2023	November 2023
			SO _x Analyzer/Teledyne 100E	S/N 1341	11/05/2023	November 2023
			SO _x Analyzer/Teledyne 100E	S/N 1412	11/05/2023	November 2023
			SO _x Analyzer/Teledyne 100E	S/N 062	16/05/2023	November 2023
			SO _x Analyzer/Thermo 43C	S/N 43C73374373	11/05/2023	November 2023
			WS & WD	S/N WC60908A48	18/08/2022	August 2023

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Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
3.	Working Air	Total Dust	Personal Air Sampler/Gilian	S/N 20151002111	30/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 20151102081	30/06/2023	July 2023
			Electronic Balance/XP 205	S/N 1129273885	11/04/2023	April 2024
		Cu Dust	Personal Air Sampler/Gilian	S/N 20110101091	28/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 101150	28/06/2023	July 2023
			ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		CO	Personal Air Sampler/Gilian	S/N 20110505110	28/06/2023	July 2023
			Gas Detector/BW Technologies	S/N KA415-1047024	01/09/2022	September 2023
		NO ₂	Personal Air Sampler/Gilian	S/N 20110605104	28/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 13427	28/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 13426	28/06/2023	July 2023
		Oil Mist	Spectrophotometer/Blue Star A	S/N 1606UV1507	10/04/2023	April 2024
			Personal Air Sampler/Gilian	S/N 20080703020	28/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 13424	28/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 20110550597	28/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 13425	28/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 20080703019	28/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 101149	28/06/2023	July 2023
		Respirable Dust	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			Personal Air Sampler/Gilian	S/N 20151003003	30/06/2023	July 2023
			Personal Air Sampler/Gilian	S/N 20151102105	30/06/2023	July 2023
			Electronic Balance/XP 205	S/N 1129273885	11/04/2023	April 2024

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Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
4.	Sound Level	Calibrator	Sound Level Calibrator/ST-120	S/N ST120C0263E	22/12/2022	December 2023
			Integrated Sound Level/ST-11D	S/N 820392	15/12/2022	December 2023
		& เสียงรบกวน	Integrated Sound Level/ST-11D	S/N 820393	15/12/2022	December 2023
			Integrated Sound Level/ST-11D	S/N 820394	15/12/2022	December 2023
			Integrated Sound Level/ST-11D	S/N 820877	01/02/2023	February 2024
			Integrated Sound Level/ST-11D	S/N 820878	01/02/2023	February 2024
			Integrated Sound Level/ST-11D	S/N 820879	01/02/2023	February 2024
5.	Occupational Health and Safety	Calibrator	Sound Level Calibrator/TENMARS TM-100	S/N 181203570	16/01/2023	January 2024
			Integrated Sound Level/ACO-TYPE 6236	S/N 112029	24/06/2023	31/07/2023
		Leq 8 hr	Integrated Sound Level/ACO-TYPE 6236	S/N 152074	24/06/2023	31/07/2023
			Integrated Sound Level/ACO-TYPE 6236	S/N 152073	24/06/2023	31/07/2023
			Integrated Sound Level/ACO-TYPE 6236	S/N 152075	24/06/2023	31/07/2023
			Integrated Sound Level/ACO-TYPE 6236	S/N 152077	24/06/2023	31/07/2023
			Integrated Sound Level/ACO-TYPE 6236	S/N 222246	24/06/2023	31/07/2023
			Sound Level Calibrator/TENMARS TM-100	S/N 180501628	23/07/2022	July 2023
		Noise Dose	Noise Dose Meter/SOUNDTEK ST-130	S/N 170400163	25/02/2023	February 2024
			Noise Dose Meter/SOUNDTEK ST-130	S/N 170400165	07/03/2023	March 2024
			Noise Dose Meter/SOUNDTEK ST-130	S/N 170400177	17/01/2023	January 2024
			Noise Dose Meter/SOUNDTEK ST-130	S/N 170800191	17/01/2023	January 2024
			Noise Dose Meter/SOUNDTEK ST-130	S/N 170800193	17/01/2023	January 2024
			Noise Dose Meter/SOUNDTEK ST-130	S/N 170800201	07/03/2023	March 2024
			Noise Dose Meter/SOUNDTEK ST-130	S/N 170800201	07/03/2023	March 2024
		Heat	Heat Stress Monitor/DETAOHM HD 32.2	S/N 22004309	02/05/2023	May 2024
			Heat Stress Monitor/DETAOHM HD 32.2	S/N 22004310	02/05/2023	May 2024

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Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
6.	Water	pH	pH Meter/Horiba	S/N B06D0012	11/07/2022	July 2023
		Temperature	pH Meter (Temperature)/Horiba	S/N B06D0012	11/07/2022	July 2023
		TSS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		Conductivity	Conductivity Meter/Horiba	S/N S205087	10/04/2023	April 2024
		TDS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		BOD	BOD Incubator	S/N ID/N TET.LA8.BOD 05	11/04/2023	April 2024
		Oil & Grease	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		Total Coliform Bacteria	Incubator Model INE 500	S/N E.505.0595	10/04/2023	April 2024
		Fecal Coliform Bacteria	Incubator Model INE 500	S/N E.505.1143	10/04/2023	April 2024
		Cu	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		DO	DO Meter/HORIBA	S/N D75J0012	14/01/2023	January 2024
		Cr ⁶⁺	Spectrophotometer/Blue Star A	S/N 1606UV1507	10/04/2023	April 2024
		Hg, As, Se	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 040S0110503	30/03/2023	September 2023
		Fe, Ni	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Mn, Pb	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Cd, Zn	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Nitrate	Spectrophotometer/PerkinElmer	S/N 365K9042909	01/11/2022	November 2022
		Sulphate	Spectrophotometer/PerkinElmer	S/N 365K9042909	01/11/2022	November 2022

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Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
7.	Soil	pH	pH Meter/Horiba	S/N B06D0012	11/07/2022	July 2023
		Cu, Cd, Fe	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 040S0110503	30/03/2023	September 2023
		Electrical Conductivity	Conductivity Meter/Horiba	S/N S205087	10/04/2023	April 2024
		TDS	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		Cr ⁶⁺	Spectrophotometer/Blue Star A	S/N 1606UV1507	10/04/2023	April 2024
		Mn, Pb, Ni, Zn	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 040S0110503	30/03/2023	September 2023
		Hg, As, Se	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 040S0110503	30/03/2023	September 2023
		Fe	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
8.	Sludge	pH	pH Meter/Horiba	S/N B06D0012	11/07/2022	July 2023
		Cu	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 040S0110503	30/03/2023	September 2023

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THAI ENVIRONMENTAL TECHNIC LIMITED
บริษัท เทคโนโลยีสิ่งแวดล้อม จำกัด

CONTROL UNIT CALIBRATION

(Metric units , mm)

Date **14-Feb-23**

Barometric press, Pb
Initial **758.3** Final **758.4** Average **758.4** mmHg

Dry Gas Meter Data

Console No. **M50-05**

Reference Dry Gas Meter Data
Serial No **913428**

Metering System ID

Model **S-110**

DGM Number

1173

Correction factor(Yr)

0.997

DGM Model

SK25EX

Last Calibration Date

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 (%)	$\Delta H @$ mm H ₂ O
			Ref	Dry Gas Meter		Avg T _m			
				Inlet T _i	Outlet T _o				
15.00	100.00	98.96	27.00	27.00	28.00	27.50	8.20	1.0077	46.3214
25.00	100.00	98.97	27.00	27.00	28.00	27.50	6.36	1.0066	46.4876
50.00	100.00	99.70	27.00	27.00	28.00	27.50	4.51	0.9968	46.8657
80.00	100.00	99.97	27.00	27.00	28.00	27.50	3.54	0.9913	46.3323
100.00	100.00	99.05	27.00	27.00	28.00	27.50	3.15	0.9986	45.9455
Average								1.0002	46.3905

Dued Date of Calibrate

14-Feb-24

Calibrated by

Approve

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 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 0.2 inches (5.1mmH₂O).

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)2373-7979 admin@et1995.com www.et1995.com



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
3344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



CALIBRATION 009

Certificate of Calibration

Certificate No. : 23P1667
Page : 1 of 2

Equipment : Digital Barometer

Manufacturer : Lutron

Model : PHB-318

Serial No. : B011410

ID No. : No.4

Condition As-Received: Used Item

Received Date: 24 May 2023

Calibration Date: 25 May 2023

Reference: 2305-0815WSC

Ambient Temperature: (23 \pm 2) °C

Relative Humidity: (50 \pm 15) %

Atmospheric Pressure: 1008 mbar

Submitted by: Thai Environmental Technic Limited

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

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments
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-0084-23

03 May 2024

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

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

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

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

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

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew

Issue Date : 28 May 2023

Approved Signatory :

B 0315718



Cert.No.: 23P1657
Page: 2 of 2

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

Range: 730 mmHg to 770 mmHg
Resolution: 0.1 mmHg

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

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

The uncertainty of measurement was ± 0.23 mmHg

* UUC = Unit Under Calibration

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

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Attested P.

a 1163290



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 22T1604
Page: 1 of 2

Equipment: Digital Thermometer With Sensor
Manufacturer: Digicon
Model: DP-52
Serial No.: I.392059
ID No.: No.9
Condition As-Received: Used Item
Received Date: 26 August 2022
Calibration Date: 06 September 2022
Reference: 2208-0934DSC
Ambient Temperature: $(25 \pm 3) ^\circ\text{C}$
Relative Humidity: $(50 \pm 20) \%$
Submitted by: Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet Saphan Sung, Bangkok 10240

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 Slack 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	B19520	221835	11 Jul 2023
5) Platinum Resistance Thermometer	935-14-95	261569/2	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:

[Signature]
[Signature]

B 0296767



Cert. No.: 22T1604
Page.: 2 of 2

Result of Calibration:-

Function: Temperature measurement for Channel T1

This equipment was connected with Thermocouple Type K ID No. No.9

Dimension of probe : Diameter 8 mm., Length 1030 mm. Sheath material : Stainless Steel

Without Adjustment

Immersion Depth (mm.)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
180	200.0029	200.3	0.2971	0.73
180	400.0034	399.6	-0.4034	1.4
180	599.92	600.8	0.88	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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TEL. 0-2717-5000-29 FAX. 0-2719-9454



185-TB-TS17025
CALIBRATION 0000

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 : 

Approved by :

() 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 1126038

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

1. Reference standard instruments:-
 - 1) Standard Weight Set (E2) Model 15884 Serial No. 24053 ID No. 70RC007 Test report No. MM-0010-22 Due date 20 Jan 2024
 - 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 (\pm mg)	Coverage Factor (k)
100	99.9982	+0.0018	0.18	2.00
200	199.9965	+0.0035	0.29	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)	
	100	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 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
-0.0002	-0.0002	-0.0003	-0.0003	-0.0002	
3. Departure from nominal value					0.0001

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

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

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Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Portable Gas Calibration Report

Manufacturer : E-instruments
Instrument Model : 4400S
Instrument serial no. : 4101
Instrument ID : 5

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	194.0	-5.0		
SO ₂ (ppm)	392.0	395.0	3.0		PASS
	0.0	0.0	0.0		
CO (ppm)	406.0	407.0	1.0		PASS
	804.0	805.0	1.0		
	0.0	0.0	0.0		PASS
	404.0	406.0	2.0		
	793.0	797.0	4.0		PASS

Calibrate by: [Signature]

Approved by: [Signature]

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Khwaeng/Khet Saphan Sung Bangkok 10240 Thailand
• Tel : +66(0)2373-7795(Auto) Fax : +66(0)2373-79 79 • admin@tet1995.com • www.tet1995.com



WO-02273746/2023

MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

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

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 : 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 purgebfillers. ☐ 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	≤ 0.009
	Ni 231.604 nm	≤ 0.011
	Ni 341.476 nm	≤ 0.015
Spectral Resolution : VIS	Ba 455.403 nm	≤ 0.020
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
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
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)		≤ 30 ppb
BEC : Radial (IB X 1000)/(IS-IB)		≤ 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



PerkinElmer Ltd. 280 Soi 17, Rama 9 Road, Khwang Bangkokpi, Khet Huay Kwang, Bangkok 10310, Thailand

Method: DLR-Cal

Align View XY Axial for analyte Mn 257.610

X-position Y-position Intensity

-2.0	13.0	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	8915353.6
0.0	15.5	8830206.3
0.0	16.0	8476274.2
0.0	16.5	7574239.7
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	8502714.8
0.8	15.0	8341631.7
0.4	13.0	4448485.6
0.4	13.5	5980471.5
0.4	14.0	7305087.4
0.4	14.5	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	1496400.1
1.0	15.0	1309824.4

1.5 1099234.2
2.0 784376.5
2.5 574061.3
3.0 437455.8
3.5 324105.7
4.0 264022.3
4.5 183005.6
5.0 117089.3
5.5 70743.1
6.0 40927.8
6.5 27379.1
7.0 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
IEC File:
Method Description: C8000-Calibration for later test

Method Last Saved: 5/4/2565 10:59:28
MSF File:

Sequence No.: 1
Sample ID: Calib Blank 1
Analyst:
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 Back Pressure Flow
All 197.0 kPa 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
Sample ID: Calib Std 1
Analyst:
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:
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 Back Pressure Flow
All 194.0 kPa 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
Sample ID: IDL-RL (2% HNO3)
Analyst:
Logged In Analyst (Original) : TET
Initial Sample Wt:
Autosampler Location:
Date Collected: 3/4/2566 11:19:52
Data Type: Reprocessed on 3/4/2566 11:32:52
Initial Sample Vol:

Reprocessing Begun
Logged In Analyst: TET
Technique: ICP Continuous
Results Data Set (Original): PH3APR23
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
Analyst:
Logged In Analyst (Original): TET
Initial Sample Wt:
Dilution:
Initial Sample Vol:
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	[0.00] µg/L
As 193.696	283.4			[0.00] µg/L	[0.00] µg/L
Se 196.026	99.6			[0.00] µg/L	[0.00] µg/L
Pb 220.353	1176.2			[0.00] µg/L	[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
Analyst:
Logged In Analyst (Original): TET
Initial Sample Wt:
Dilution:
Initial Sample Vol:
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	[1000] µg/L
As 193.696	17563.5			[1000] µg/L	[1000] µg/L
Se 196.026	4574.6			[500] µg/L	[500] µg/L
Pb 220.353	31327.5			[500] µg/L	[500] µg/L

Calibration Summary

Analyte	Stds.	Equation	Intercept	Slope	Curvature	Corr. Coef.	Reslopes
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	52.65	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
Analyst:
Logged In Analyst (Original): TET
Initial Sample Wt:
Dilution: 3X
Initial Sample Vol:
Sample Prep Vol:
Wash Time:

Dilution: 3X
Wash Time:
Sample Prep Vol:

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

Mean Data: IDL-XL (2% HNO3)

Analyte	Mean Corrected Intensity	Std.Dev.	RSD	Conc. Units	Sample Conc. Units
As 193.696	-32.0	2.60	7.40%	-0.0 mg/L	-35.2 µg/L
Zn 213.857	37.4	0.26	35.07%	0.0 mg/L	0.7 µg/L
Mn 257.610	475.9	1.49	168.85%	0.0 mg/L	0.9 µg/L
La 379.478	-36.3	1.12	350.35%	0.0 mg/L	-0.3 µg/L
Ba 455.403	26579.4	2.86	30.09%	0.0 mg/L	9.5 µg/L
Ba 493.408	-20698.9	9.64	98.34%	0.0 mg/L	-9.8 µg/L

Method: DLXL-Cal
Nebulizer Parameters: IDL-XL (2% HNO3)
Analyte Back Pressure 198.0 kPa Flow 0.50 L/min
All
Mean Data: IDL-XL (2% HNO3)
Analyte Mean Corrected Intensity
Tl 130.801 35.1
As 183.696 -14.0
Se 186.026 -6.5
Pb 220.353 -135.0
Std.Dev. 1.24
Conc. Units 2 ug/L
Sample Conc. 5 ug/L
Std.Dev. 3.73
Conc. 68.95%
RSD 4.26
177.97%
2.87
134.85%
11.48
177.50%

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

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

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

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

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

Mean Data: IS (N069-1579/10)
Analyte Mean Corrected Intensity
Mn 257 XN 11636268.0
Mn 257 RN 1679271.0
Std.Dev. Conc. Units Sample Std.Dev. RSD

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: 0.00769 nm
NI	231.604-Res	Rep 2	Res: 0.00790 nm
NI	231.604-Res	Rep 3	Res: 0.00790 nm
NI	341.476-Res	Rep 1	Res: 0.01188 nm
NI	341.476-Res	Rep 2	Res: 0.01192 nm
NI	341.476-Res	Rep 3	Res: 0.01169 nm
BA	455.403-Res	Rep 1	Res: 0.01495 nm
BA	455.403-Res	Rep 2	Res: 0.01495 nm
BA	455.403-Res	Rep 3	Res: 0.01500 nm

Method: Resolution
Result: PM3APR23

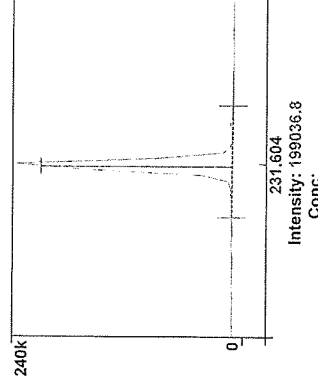
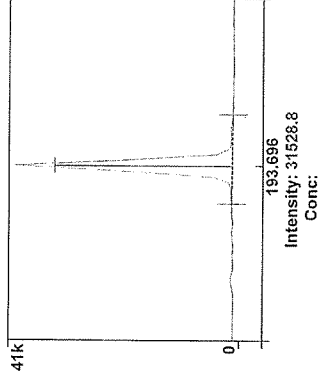
Spectra

Sample ID: Res (N069-1579/10)

As 193.696-Res

Rep: 3 NI 231.604-Res

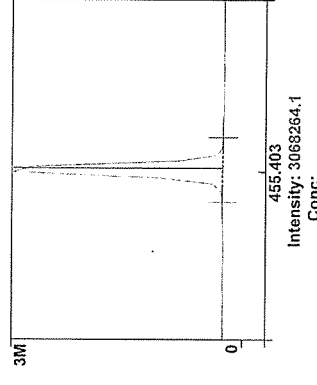
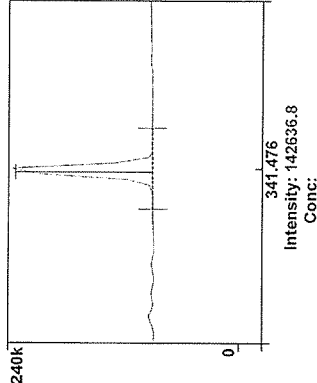
Rep: 3



1 NI 341.476-Res

Rep: 3 Ba 455.403-Res

Rep: 3



3

4

```

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: 3/4/2566 11:02:43
Data Type: Original
Initial Sample Vol:
Sample Prep Vol:
Sequence No.: 4
Sample ID: RSD STD (N069-1579/10)
Analyst:
Initial Sample Wt:
Dilution:
Rash Time:

```

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

Analyte	Back Pressure	Flow
All	195.0 kPa	0.50 L/min

Mean Data: RSD STD (N069-1579/10)				
Analyte	Mean Corrected Intensity	Calib. Conc. Units	Std.Dev.	Sample Conc. Units
Zn 206.200	493474.3			
Pg 280.271	3275340.1			
Mg 285.213	196113.7			
Ba 455.403	7794526.3			

Method Loaded
Method Name: Precision
IEC File:
Method Last Saved: 3/4/2566 11:07:51
MSF File:

```

Sequence No.: 5
Sample ID: RSD STD (N069-1579/10)
Analyst:
Initial Sample Wt:
Dilution:
Wash Time:

Autosampler Location:
Data Collected: 3/4/2566 11:08:51
Data Type: Original
Initial Sample Vol:
Sample Prep Vol:

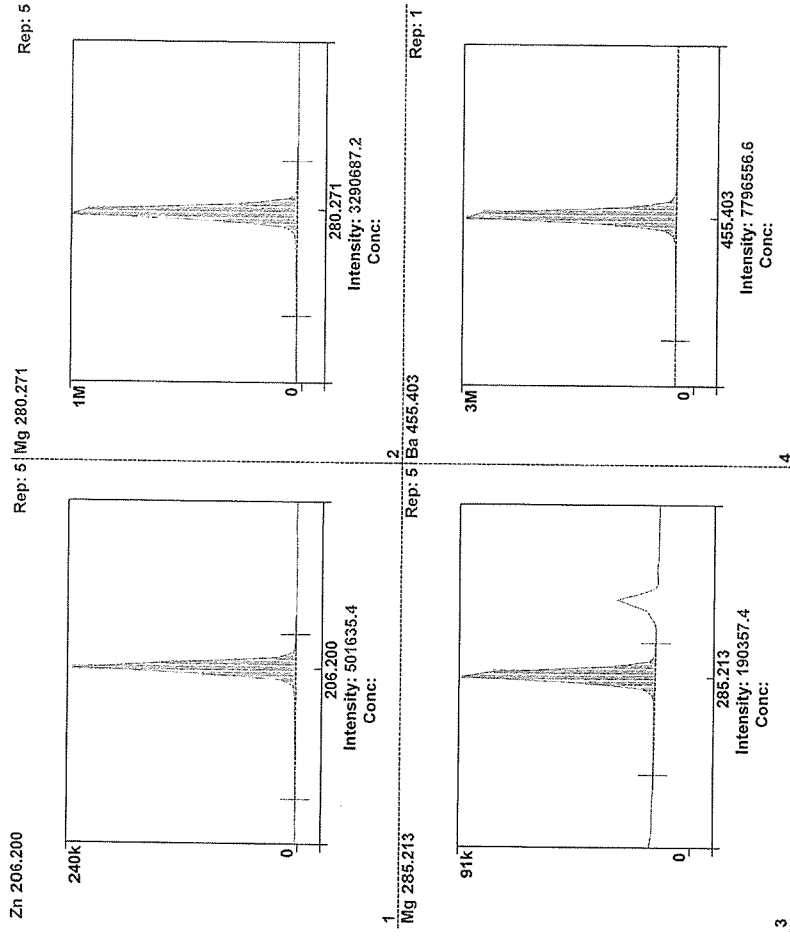
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Nebulizer Parameters: RSD STD (N069-1579/10)

Analyte	Back Pressure	Flow
All	196.0 kPa	0.50 L/min

Mean Data: RSD STD (R069-1579/10)					
Analyte	Intensity	Calib.	Std.Dev.	Conc. Units	Sample
Zn 206.200	515663.2				RSD
Mg 280.271	3404809.8				Std.dev.
Mg 285.213	197460.0				2890.08
Ba 455.403	8071203.3				43469.63
					1775.34
					0.288
					0.398
					31631.19
					0.398

Spectra



Certificate of Analysis

PerkinElmer Number: N0591579
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	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	3172a*	Zn	10.0 µg/mL	10.0 µg/mL	3168a*
Li	10.0 µg/mL	10.0 µg/mL	3179a*	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
† - Indicates CRM (when NIST SRM is not available)

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. This value is the sum of cumulative error 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.

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

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	Analyte	Labeled	Measured	SRM
As	100 µg/mL	99.8 µg/mL	3103a*	Pb	50.0 µg/mL	49.9 µg/mL	3128*
Tl	100 µg/mL	99.4 µg/mL	3158*	Se	50.0 µg/mL	49.8 µg/mL	3149*
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, 1-177YJ, 54-134CR
Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST.
We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative error 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.

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Global Service Training Department
Service Engineer Certification

Wiphan Promlunda

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

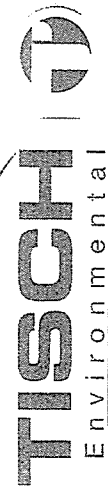
ICP220B Optima 8300 & Optima 4X/5X/7X00 Series

Instructor:

Geoff Cook

Date: July 20, 2012

Certified by
(Manager, Global Training)



Certificate of Calibration

Calibration Certification Information

Cal. Date: November 19, 2021
Operator: Jim Tisch
Calibration Model #: TE-5025A

Roots meter S/N: 438320
Pa: 763.5 mm Hg

Ta: 294 °K

Calibrator S/N: 0068

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1.4160	3.2	2.00	
2	3	4	0.9970	6.4	4.00	
3	5	6	0.8890	7.8	5.00	
4	7	8	0.8490	8.7	5.50	
5	9	10	0.6990	12.8	8.00	

Data Tabulation

Vstd (m3)	Qstd (x-axis)	$\sqrt{\frac{\Delta H(Pa)}{Pstd} \times \frac{Tstd}{Ta}}$ (y-axis)	Va	Qa (x-axis)	$\sqrt{\frac{\Delta H(Pa)}{Ta}}$ (y-axis)
1.0140	0.7161	1.4271	0.9958	0.7033	0.8776
1.0098	1.0128	2.0182	0.9916	0.9946	1.2411
1.0079	1.1337	2.2564	0.9898	1.1134	1.3875
1.0067	1.1858	2.3666	0.9886	1.1644	1.4533
1.0012	1.4324	2.8542	0.9832	1.4066	1.7551
QSTD	m= 1.99331 b= -0.00049 r= 0.99999		QA	m= 1.24818 b= -0.00030 r= 0.99999	

Calculations

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

Standard Conditions

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

RECALIBRATION

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

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

www.tisch-env.com
TOLL FREE: (877)263-7610
FAX: (513)467-9009



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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.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) : 32.6 Average Temp: (Deg K) : -

Calibration Orifice

Make : Tisich Qstd Slope : 1.99331
Model : TE-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	11.80	1.724	60.0	60.00	Slope : 35.5956
2	9.00	1.505	54.0	54.00	Intercept : 0.0527
3	7.20	1.346	50.0	50.00	Corr. Coeff : 0.9936
4	5.00	1.122	40.0	40.00	
5	3.00	0.869	30.0	30.00	# of Observations: 5

Calculations

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

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:

$$1/m(1)/\text{Sqrt}(298/Tav)(Pav/760)]-b]$$

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

Calibrate By :

Approve By :

m = sampler slope
b = sampler intercept
I = chart response

Tav = daily average temperature
Pav = daily average pressure



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 1-Aug-22
ITEM : TSP Serial No : (No.4) 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) : 32.4 Average Temp: (Deg K) : -

Calibration Orifice

Make : Tisich Qstd Slope : 1.99331
Model : TE-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	12.30	1.760	62.0	62.00	Slope : 34.6568
2	9.80	1.571	56.0	56.00	Intercept : 1.9742
3	7.60	1.383	52.0	52.00	Corr. Coeff : 0.9940
4	5.20	1.144	42.0	42.00	
5	3.20	0.898	32.0	32.00	# of Observations: 5

Calculations

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

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:

$$1/m(1)/\text{Sqrt}(298/Tav)(Pav/760)]-b]$$

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

Calibrate By :

Approve By :

m = sampler slope
b = sampler intercept
I = chart response

Tav = daily average temperature
Pav = daily average pressure



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : TSP
Site ID : Bangkok
Serial No : (No.12)
Date : 1-Aug-22
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Temperature (deg K) : 298.0
Average Press. (mm Hg) : 754.5
Corrected Average (mm Hg) :
Average Temp (°C) : 32.8
Average Temp: (Deg K) :

Calibration Orifice

Make : Tisch
Model : TE-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 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

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

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

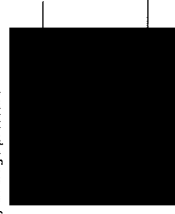
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K

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 :



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High Volume TSP&PM-10 Calibration Report

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

Site Conditions

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

Calibration Orifice

Make : Tisch
Model : TE-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 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

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

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 :





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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : TSP
Site ID : Bangkok
Serial No : (No. 41)
Date : 1-Aug-22
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Average Press. (mm Hg) : 754.5
Corrected Average (mm Hg) :
Average Temp (°C) : 31.5
Average Temp (Deg K) :

Calibration Orifice

Make : Tisch
Model : TE-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 (m ³ /min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.00	1.738	60.0	60.00	Slope : 34.8308
2	9.20	1.522	54.0	54.00	Intercept : 0.8400
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

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

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 :

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



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High Volume TSP&PM-10 Calibration Report

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

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Average Press. (mm Hg) : 754.5
Corrected Average (mm Hg) :
Average Temp (°C) : 23.0
Average Temp (Deg K) :

Calibration Orifice

Make : Tisch
Model : TE-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 (m ³ /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	7.20	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

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

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 :

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



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 1-Aug-22
ITEM : PM10 Serial No : (No. 15) 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) : 30.6 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 Slope : 35.5956 Intercept : 0.0527 Corr. Coeff : 0.9936
1	11.80	1.724	60.0	60.00	
2	9.00	1.505	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

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

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

m = calibrator Qstd slope
b = calibrator Qstd intercept
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 :



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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. 23) 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) : 32.3 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 Slope : 35.5364 Intercept : 0.2642 Corr. Coeff : 0.9909
1	11.80	1.724	60.0	60.00	
2	9.00	1.505	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

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

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

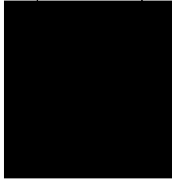
m = calibrator Qstd slope
b = calibrator Qstd intercept
Ta = actual temperature during calibration (deg K)
Pa = actual pressure during calibration (mm Hg)
Tstd = 298 deg K

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 :





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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. 24) 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 : Tisach Qstd Slope : 1.99331
Model : TE-5025A Qstd Intercept : -0.00049
Serial#: 1 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 : 34.8308 Intercept : 0.8400 Corr. Coeff : 0.9926
2	9.20	1.522	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

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

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:
 $1/m(I)[\sqrt{(298/Tav)}(Pav/760)]-b$

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. 26) 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 : Tisach Qstd Slope : 1.99331
Model : TE-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 : 34.3409 Intercept : 1.1340 Corr. Coeff : 0.9947
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

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

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:
 $1/m(I)[\sqrt{(298/Tav)}(Pav/760)]-b$

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

Calibrate By : _____

Approve By : _____



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date	: 10-May-23
Analyzer Type	: NOx
Brand	: API
Model	: 200 E
Serial Number	: 393 (No. 19)
Range	: 500 ppb

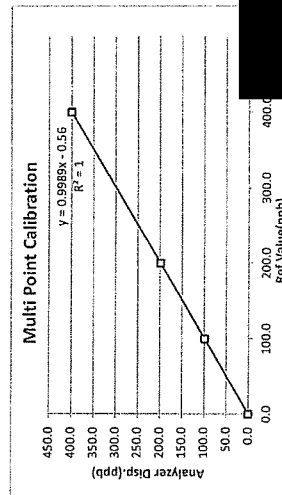
Temperature (°C) :	25 °C
Barometer (mmHg) :	759.9
Humidity (50±15 %) :	50.0%
Dilutor :	API M
Zero Air :	API M
Standard gas :	A0096

Calibration of Span

Supply Gas	Ref Value(pph)	Before of Span(ppb)			After of Span(ppb)			% diff of Span
		NOx	NO	NO ₂	NOx	NO	NO ₂	
Zero	0.0	0.5	0.1	0.4	0.0	0.0	0.0	0.0
Span	400.0	387.0	384.0	3.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		
	NOx	NO	NO ₂	Diff(ppb)	% Diff	Abs (%) Diff
0.0	0.4	0.2	0.2	0.20	0.001	0.05
100.0	99.8	98.8	1.0	-1.20	-0.012	1.20
200.0	199.7	198.5	1.2	-1.50	-0.008	0.75
400.0	401.0	399.5	1.5	-0.50	-0.001	0.13
						Average Diff (%)
						0.53



Calibrate by:

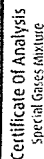
Approved by _____

๒๒:๐๐

วันที่ ๐๒/๐๙/๕๕

เลขที่แบบฟอร์ม : OF-OP16-06

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)2373-7979 • admin@tet1995.com • www.tet1995.com



Customer Testimonial:

Uthair Environmental Technic Limited
1/5 Sri Raminthong 45, Uthair
Sathasong, Bangkok 10240
Thailand

Certificate Details

Number	Date of issue	Expiry date	18-Aug-2021	18-Aug-2023
Material Details				
Production Order	90167125	Material Code	640300-SK-44	Cylinder No.
Gas content	5.52 m ³	Filling pressure	145.0 bar	Valve
Cylinder Owner	UNDE	Cylinder Material	Spectra scsl	Cylinder Size
Lab. Report				40L

Laboratory Report

Component	Nominal Concentration	Analysis Result ¹	Uncertainty ¹	Method of Analysis ³	Assay Date
Acetic Oxide	40.0 ppm	39.2 ppm	± 1% relative	(6) 1468-352	11-Aug-5 18-Aug-21
Hydrogen Sulfide	40.0 ppm	less than 1 ppm			
Ammonia	40.0 ppm				
Carbon Monoxide	40.0 ppm				
Hydrogen Cyanide	40.0 ppm				
Hydrogen Nitrogen	40.0 ppm				

Reference Standard	Reference Standard Cylinder number	Reference Standard used in Assay Concentration	Expiry date
Nitric Oxide	2786115G	51.58 ± 0.41 ppm	29-Oct-2022

Analytical Instruments used in Assay
Analytical Principle
FTIR-NO
9-Aug-2021
last Multipoint Calibration

Recommend usage condition	5% of actual content or before expire date whichever comes first.
Minimum utilization	
Storage condition	Keep in well ventilation and secure area.
Comments	

When reordering, please quote the material number

Note.

[illegible]

Page 1 of 1

บริษัท ไทยพาณิชย์ จำกัด (มหาชน)

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Sulanya Panayasoonitorn
 Signatory for and on behalf of

Linde (Thailand)

Dr. Benjamin A. Goldstein
1515 15th Floor, Bingham Tower A, 273 West 14th Street, New York, N.Y. 10011-3608
Telephone: (212) 691-1040 Fax: (212) 691-1040
E-mail: benjamin@benjamin-goldstein.com



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

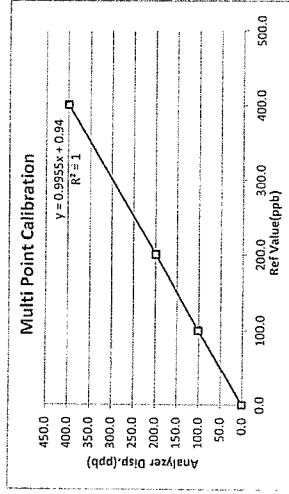
Calibrate Date : 10-May-23
Analyzer Type : NOx
Brand : API
Model : 200 A
Serial Number : 777 (No. 25)
Range : 500 ppb
Temperature (°C) : 25°C
Barometer (mmHg) : 759.9
Humidity (50±15 %) : 50.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962 SK

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	3.5	3.1	0.4	0.0	0.0	0.0	0.0
Span	400.0	387.0	382.0	5.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		Abs (%) Diff
	NOx	NO	NO ₂	Diff(ppb)	% Diff	
0.0	0.8	0.4	0.4	0.40	0.001	0.10
100.0	101.3	101.5	-0.2	1.50	0.015	1.50
200.0	199.8	199.6	0.2	-0.40	-0.002	0.20
400.0	399.4	399.1	0.3	-0.90	-0.002	0.22
Average Diff (%)						0.51



Calibrate by

Approved

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

เลขที่แบบฟอร์ม : 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@tet1995.com • www.tet1995.com



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

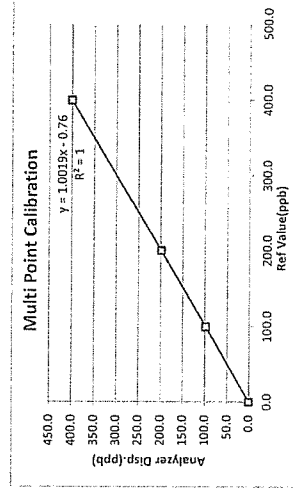
Calibrate Date : 11-May-23
Analyzer Type : NOx
Brand : Teledyne
Model : T200
Serial Number : 5154 (No. 30)
Range : 500 ppb
Temperature (°C) : 25°C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962 SK

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	395.0	392.0	3.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		Abs (%) Diff
	NOx	NO	NO ₂	Diff(ppb)	% Diff	
0.0	0.4	0.4	0.0	0.40	0.001	0.10
100.0	99.7	98.5	1.2	-1.50	-0.015	1.50
200.0	199.5	198.7	0.8	-1.30	-0.007	0.65
400.0	401.0	400.7	0.3	0.70	0.002	0.17
Average Diff (%)						0.78



Calibrate by

Approved by

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

เลขที่แบบฟอร์ม : QF-QP16-06

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

Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date : 11-May-23
Analyzer Type : NOx
Brand : Teledyne
Model : T200
Serial Number : 5159 (No. 32)
Range : 500 ppb

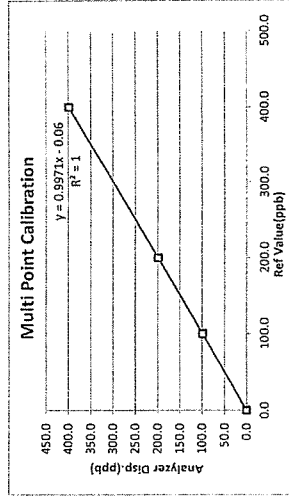
Temperature (°C) : 25°C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962 SK

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	4.3	4.1	0.2	0.0	0.0	0.0	0.0
Span	400.0	413.0	409.0	4.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		
	NOx	NO	NO ₂	Diff(ppb)	% Diff	Abs.(%) Diff
0.0	0.5	0.4	0.1	0.40	0.001	0.10
100.0	99.7	99.2	0.5	-0.80	-0.008	0.80
200.0	199.8	199.1	0.7	-0.90	-0.005	0.45
400.0	399.2	399.0	0.2	-1.00	-0.003	0.25
Average Diff (%)				0.50		



Calibrate by: [Signature]

Approved by: [Signature]

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

เลขที่แบบฟอร์ม : QF-QP16-06

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

Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date : 12-May-23
Analyzer Type : NOx
Brand : Teledyne
Model : 200 E
Serial Number : 2789 (No. 36)
Range : 500 ppb

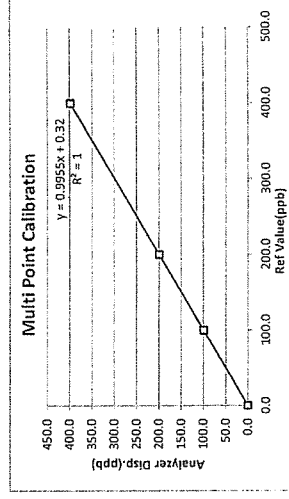
Temperature (°C) : 25°C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962 SK

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	0.3	0.1	0.2	0.0	0.0	0.0	0.0
Span	400.0	387.0	382.0	5.0	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	0.5	0.4	0.1	0.40	0.001	0.10
100.0	99.8	99.7	0.1	-0.30	-0.003	0.30
200.0	199.8	199.5	0.2	-0.50	-0.003	0.25
400.0	398.7	398.5	0.2	-1.50	-0.004	0.38
Average Diff (%)				0.26		



Calibrate by: [Signature]

Approved by: [Signature]

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

เลขที่แบบฟอร์ม : 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)2373-7979 • admin@et11995.com • www.et11995.com



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date : 10-May-23
Analyzer Type : SO₂
Brand : API
Model : 100E
Serial Number : 383 (No. 12)
Range : 500 ppb

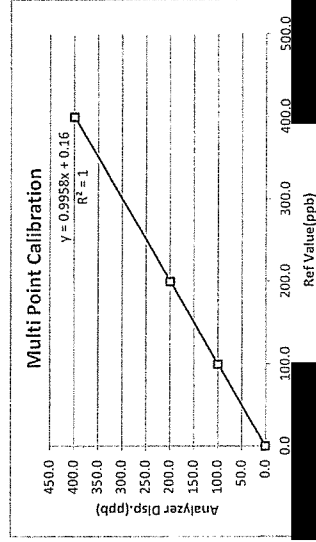
Temperature (°C) : 25 °C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 118310

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	2.3	0.0	0.0
Span	400.0	397.0	400.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)	Output Difference		
		Diff (ppb)	Percent Diff	Abs Percent Diff
0.0	0.4	0.4	0.00	0.10
100.0	99.7	-0.3	0.00	0.30
200.0	198.9	-1.1	-0.01	0.55
400.0	398.7	-1.3	0.00	0.33
		Average Diff (%)		
		0.32		



Calibrate by: [Signature]
Approved: [Signature]

วันที่ทำ : 00
วันที่ออก : 02/09/15
เลขที่แบบฟอร์ม : QF-QP16-06

Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145 (Khaeng/Khet Saphan Sung Bangkok 10240 Thailand
• Tel : +66(0)2373-7799(Auto) Fax : +66(0)2373-7799 • admin@tct1995.com • www.tct1995.com

THE LINDE GROUP

Certificate of Analysis Special Gases Mixture

Customer Details		Customer Tag No.:	
Name:	Thai Environmental Technic Ltd.	Address:	1/6 Soi Ramkhamhaeng 145, Saphansong, Saphansong, Bangkok 10240
Certificate Details		Date of Issue:	19-Sep-2019
Number:	3367/19	Expiry date:	18-Sep-2023
Material Details		Material Code:	608400-SK-44
Production Order:	90155812	Cylinder No.:	118310
Gas content:	5.520 M ³	Filling pressure:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal
		Cylinder Size:	40.0 L

Laboratory Report

Analytical Result			
Component	Nominal Concentration	Analysis Result ¹	Uncertainty ²
Sulphur Dioxide In Nitrogen	40.0 ppm	41.4 ppm	± 1% relative
		Method of Analysis ³	(6) I-PB-352
		Assay Date	10-Sep & 19-Sep-19

Reference Standard used in Assay			
Reference Standard	Cylinder number	Concentration	Expiry date
Sulphur Dioxide in Nitrogen	11882356	25.50±0.25 ppm	7-Mar-2021

Instrument / Make / Model
FTIR Spectrometers Nicolet 1550

Analytical Instruments used in Assay
FTIR-SO2

Last Multipoint Calibration
10-Sep-2019

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:

- All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Methodology Protocol EPA-600/R-17/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1.
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.
- The measurement of this material is traceable to the SI through the reference gas standard which is traceable to the Swiss National Standard of Mass or other recognised external metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyser, (3) Electrochemical Oxygen Analyser, (4) Electrochemical Nitrogen Analyser, (5) Gas Chromatography, (6) Other - Specified

Page 1 of 1
This report shall not be reproduced except in full

บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด (มหาชน)
เลขที่ 15 ถนนรามคำแหง 145 แขวง/เขต สaphan Sung กรุงเทพฯ 10240

เบอร์โทร : 02-373-7799 โทรสาร : 02-373-7799 E-mail : admin@tct1995.com

เว็บไซต์ : www.tct1995.com

ใบอนุญาตประกอบกิจการ : 105 มล 5 กรุงเทพมหานคร 24180

ใบอนุญาตประกอบกิจการ : 105 มล 5 กรุงเทพมหานคร 24180

ใบอนุญาตประกอบกิจการ : 105 มล 5 กรุงเทพมหานคร 24180

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ใบอนุญาตประกอบกิจการ : 105 มล 5 กรุงเทพมหานคร 24180



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date : 11-May-23
Analyzer Type : SO₂
Brand : Teledyne
Model : 100 E
Serial Number : 1341 (No. 20)
Range : 500 ppm

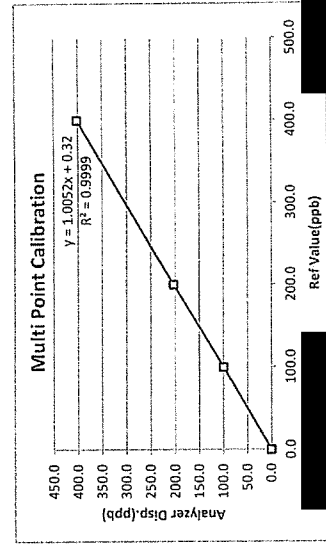
Temperature (°C) : 25 °C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 118310

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	2.3	0.0	0.0
Span	400.0	411.0	400.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp (ppb)	Output Difference		
		Diff (ppb)	Percent Diff	Abs Percent Diff
0.0	0.3	0.3	0.00	0.08
100.0	99.7	-0.3	0.00	0.30
200.0	203.1	3.1	0.02	1.55
400.0	401.8	1.8	0.00	0.45
Average Diff (%)		0.59		



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



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date : 11-May-23
Analyzer Type : SO₂
Brand : Teledyne
Model : 100 E
Serial Number : 1412 (No. 22)
Range : 500 ppm

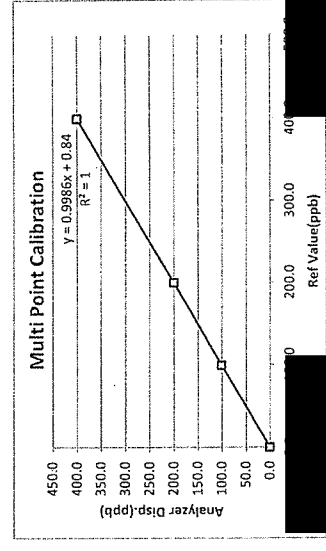
Temperature (°C) : 25 °C
Barometer (mmHg) : 759.8
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 118310

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	4.1	0.0	0.0
Span	400.0	415.0	400.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp (ppb)	Diff (ppb)	Output Difference	
			Percent Diff	Abs Percent Diff
0.0	0.4	0.4	0.00	0.10
100.0	101.2	1.2	0.01	1.20
200.0	200.7	0.7	0.00	0.35
400.0	400.1	0.1	0.00	0.03
Average Diff (%)		0.42		



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



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date : 16-May-23
Analyzer Type : SO₂
Brand : Teledyne
Model : 100 E
Serial Number : 062 (No.23)
Range : 500 ppm

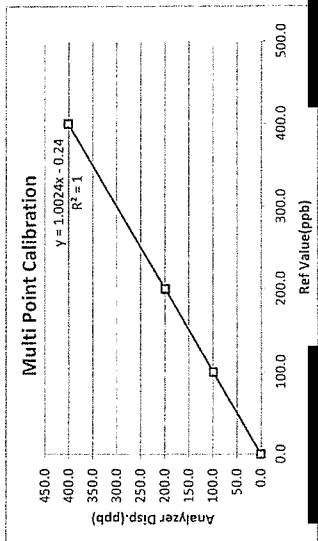
Temperature (°C) : 25 °C
Barometer (mmHg) : 758.2
Humidity (50±15 %) : 52.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 118310

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	0.8	0.0	0.0
Span	400.0	391.0	400.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)	Output Difference		
		Diff (ppb)	Percent Diff	Abs Percent Diff
0.0	0.4	0.4	0.00	0.10
100.0	99.7	-0.3	0.00	0.30
200.0	199.4	-0.6	0.00	0.30
400.0	401.2	1.2	0.00	0.30
Average Diff (%)				0.25



Calibrate by: [Signature]

Approved by: [Signature]

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

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



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date : 11-May-23
Analyzer Type : SO₂
Brand : Thermo
Model : 43C
Serial Number : 43C73374373 (No.10)
Range : 500 ppb

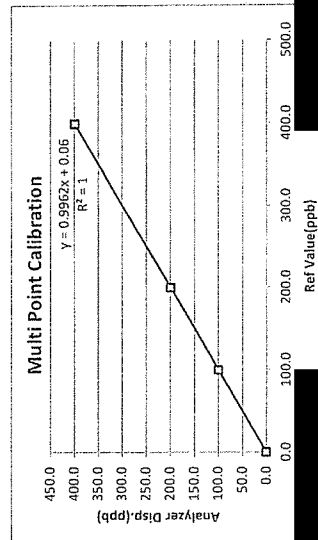
Temperature (°C) : 25 °C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 118310

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	0.7	0.0	0.0
Span	400.0	391.0	400.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)	Output Difference		
		Diff (ppb)	Percent Diff	Abs Percent Diff
0.0	0.4	0.4	0.00	0.10
100.0	99.5	-0.5	-0.01	0.50
200.0	198.9	-1.1	-0.01	0.55
400.0	398.8	-1.2	0.00	0.30
Average Diff (%)				0.36



Calibrate by: [Signature]

Approved by: [Signature]

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

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



THE

Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อม 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

[illegible]

Calibration Date 28 / 06 / 66

Calibration By aflop

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

: SD	= Standard deviation
: \bar{X}	= Mean

1/2



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 18 August 2022
Certification No. 295/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III

Serial No. : WC60908A48 ID No. : No.19

Customer : Thai Environmental Technic Limited.

1/6 Soi Ramkhamhaeng 145,

Khwaeng/Khet Saphan Sung. Bangkok 10240.

Calibration Condition :	Temperature	25.1 °C	Barometric Pressure	1006.2 hPa
-------------------------	-------------	---------	---------------------	------------

NATIONAL STANDARD WIND TUNNEL :

Thermal Anemometer 642 S/N 91563

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

NIST Test Reference Number 731/241460
: Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

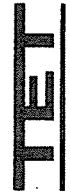
JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by

Mr. Watchara

Mechanical Engineer





Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Personal Pump Calib134ration Report

<i>Equipment Type</i>	:	Personal Pump/Parameter
<i>Equipment Range</i>	:	0.1-7.0 U/min
<i>Calibration Range</i>	:	0.1-4.0 U/min
<i>Calibration Type</i>	:	Drycal
<i>Calibration S/N</i>	:	4491

[illegible]

Calibration Date 30 / 06 / 66

Calibration By _____

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

: SD = Standard deviation

: SD = Standard deviation

$$\therefore \bar{X} = \text{Mean}$$

212



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



Cert.No.: 23MM161
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 : 10 April 2023

Calibration Date: 11 April 2023

Ambient Temperature: 15°C to 40°C

Relative Humidity: 30 % to 90 %

Calibrated by : Khit Ruttanaprapachai

Approved by :

() Pornthippa Tameyakul

(✓) Malee Butkruea

() Suvit 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 0053465



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0146OC-13

Cert.No.: 23MM161
Page: 2 of 3

Procedure used :-

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

Condition of this result of calibration

1. Reference standard instruments:-

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

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 (k)
80	79.99946	+0.00054	0.15	2.00
200	199.99984	+0.00016	0.30	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000023
200	0.00008

Valu.

a 1158497



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0146OC-13

Cert.No.: 23MM161
Page: 3 of 3

Result of calibration

2. Effect of off center loading

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

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
-0.0001	-0.0001	-0.0002	-0.0001	0.0000

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.038	2.28
0.01	0.01000	0.00000	0.039	2.28
0.05	0.05000	0.00000	0.039	2.28
1	1.00001	-0.00001	0.040	2.23
2	2.00001	-0.00001	0.040	2.23
5	5.00001	-0.00001	0.042	2.17
10	10.00001	-0.00001	0.045	2.13
20	20.00001	-0.00001	0.051	2.06
50	49.99998	+0.00002	0.085	2.00
80	80.00002	-0.00002	0.15	2.00
200	199.9999	+0.0001	0.30	2.00

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

-000-

Valu.

a 1158496

Gas Detector Certificate

Issued By
Owner Name
Reference Number
Product Brand
Type Systematic
Battery Type

Sithiporn Associates Company Limited
Thai Environmental Technic Ltd.
3HON650050
BW Technologies
Rechargeable Lithium Polymer

Calibration Date
Calibration Due
Calibration Temp.
Calibration Humidity

01-Sep-22
01-Sep-23
25°C
65%RH

Product Model	Gas Alert	Micro Clip XT	Serial Number	K4415-1047024
Detection Gases	Measuring Range			
H ₂ S (Hydrogen sulfide)	0-100 ppm in 1 ppm increments			
CO (Carbon Monoxide)	0-500 ppm in 1 ppm increments			
LEL (Methane)	0-100% LEL of CH ₄ in 1% LEL			
O ₂ (Oxygen)	0-30% in 0.1 vol. increments			
	Electrochemical cell			
	Electrochemical cell			
	Electrochemical cell			

Calibration Standard equipment : Std Gas Mixtures Cylinder Number 1438107 Expired Date 01-Feb-23
Ultra High Purity Nitrogen Cyl No. M5281014 Expired Date 12-Dec-24

Components	Concentration
Methane (CH ₄)	50.0 %LEL (2.5 %vol.)
Hydrogen Sulfide(H ₂ S)	25.0 ppm
Carbon Monoxide(CO)	100.0 ppm
Oxygen (O ₂)	19.0 %Vol.


Calibration Result		Fresh Air		Standard Gas		90%T		Standard	
Item Calibration	Before	After	Before	Calibration	After	(second)	Drift	Unit	
Gas Detection	0	0	0	24	25	16	0	ppm	
Hydrogen Sulfide(H ₂ S)	0	0	0	97	100	100	14	0	ppm
Carbon Monoxide(CO)	0	0	0	48	50	50	15	0	%LEL
Combustion(CH ₄)	0	0	0	17.8	18	18.0	14	0.0	%Vol.
Oxygen (O ₂)	20.9	20.9	20.9	17.8	18	18.0	14	0.0	%Vol.

Result of test the zero oxygen detect by Measurement Nitrogen (N₂) 99.99%

** O₂ Detector is set up Auto-Calibration on Startup, 20.9%vol.
* 90%T is respond time reading to 90% of standard gas

Gas Alarm Preset	Low Alarm	High Alarm	TWA	STEL
Hydrogen Sulfide(H ₂ S)	10	15	10	15
Carbon Monoxide(CO)	30	200	30	200
Combustion(CH ₄)	10	20	N/A	N/A
Oxygen (O ₂)	19.5	23.5	N/A	N/A

Operation Test		Sampling		Self-Test		Gas Display		Alarm Report		PC/Data		Alarm Functional	
Function	Battery Indicate	Module	N/A	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Audible	Visual
Judgement	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

Remarks : 

Signature

บริษัท สิทธีปอร์น แอสโซซิเอต จำกัด Sithiporn Associates Co., Ltd.

451-451/1 ถนนสีลม แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10700 โทร. 0-2433-8331, 0-2435-8800, 0-2434-9191 แฟกซ์: 0-2433-1679, 0-2434-9510
451-451/1 Sirinthorn Road, Banglumru, Bangkok 10700 Thailand Tel. (662) 433-8331, 435-8800, 434-9191 Fax: (662) 433-1679, 434-9510

EMAIL:center@sithiphorn.com www.sithiphorn.com

ANALYSIS CERTIFICATION

METHOD OF PREPARATION : GRAVIMETRIC / PRESSURE TRANSMISSION

METHOD OF ANALYSIS : ELECTROCHEMICAL CELL, PARAMAGNETIC OXYGEN CELL,
GC (FID)

ACCURACY : $\pm 5\%$ RELATIVE (H₂S), $\pm 2\%$ RELATIVE (CO, CH₄, O₂)

LOT NO.	COMP. 1	COMP. 2	COMP. 3	COMP. 4	COMP. 5	COMP. 6	Exp. Dat.
& QTY.	H ₂ S	CO	CH ₄	O ₂	N ₂		
1438107 (2)	25PPM	100PPM	2.50%	18.00%	BALANCE		02/01/2

Gas mixtures manufactured with balances calibrated by an ISO 17025 accredited company using NIST traceable weights and meets or exceeds the requirements of NIST Handbook 44.
Calibration test 121088, 121097, 121091, or 121100 dated, 18th January 2019 applies.
WEIGHT SETS USED: Kit #92231, Test #2740564, Kit # 03610, Test # VA-19-11350F, VA-19-11350E, VA-19-11350F, T5 Test # VA-19-11350B, T5 Test # VA-19-11350F, VA-19-11350E, VA-19-11350F, IM1966 Test VA-18-11340H

No affecting environmental conditions during analysis.

REQUESTED BY : AIR LIQUIDE

CUSTOMER PURCHASE ORDER NUMBER : PO19379/SO27165

PACKING LIST NUMBER : 20327317

CERTIFICATION

ANALYSIS BY

We certify that all the cylinders for the Lot numbers identified herein are manufactured and tested within the requirements of CFR 49 part 178.65 and that physical and chemical test reports are on file and copies will be furnished upon request.

CALGAS, a division of Airgas USA, LLC
821 Chesapeake Drive, Cambridge, MD 21613-0149
Phone: (410) 228-6400 Fax: (410) 228-4251

BANGKOK INDUSTRIAL GAS CO.,LTD.

11th Floor, Rajapark Building

3 South Sathorn Rd, Yanawa, Sathorn

Bangkok 10120, Thailand

Tel : (662) 696-6788 Fax : (662) 696-6790-1

BIG
Industrial Gas

CERTIFICATE OF CONFORMITY (For Package Gases)

Customer Name : Sithiporn Associates Co.,Ltd.
Product Name : Nitrogen
Date of Issue : 12 DEC'21
Lot No. : 171215N201/DO3300016068
Page no. : 1/1
Certificate No. : QC15B3-4298
Gas Content : 7 M³
Shelf Life : 36 months
Cylinder Valve Type : CGA 580

Components	Specification
Oxygen	< 2 ppm
Moisture	< 3 ppm
Carbon Dioxide	< 1 ppm
Carbon Monoxide	< 1 ppm
Total Hydrocarbon as CH ₄	< 1 ppm
Nitrogen	> 99.999 %

Cylinder Number

M62B1014 13D007140

บริษัท สิทธีปอร์น แอสโซซิเอตส์ จำกัด
SITHIPORN ASSOCIATES CO.,LTD.

Form No. BG-F-SO-01(01)

Effective Date: July 30,2012



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 16, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23CHO262
Page: 1 of 3

Certificate of Calibration

Equipment : Spectrophotometer
Manufacturer : Lablech
Model : Blue Star A
Serial No. : 1606UV1507
ID No. :
Condition As-Received:
Received Date : 10 April 2023
Calibration Date : 10 April 2023
Reference : 2304-0146OC-16
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 : (30.8 - 31.1) °C (On-Site)
Relative Humidity : (50.2 - 50.7) % (On-Site)
Calibration Procedure : In - house method :
CP-OCH4 based on ASTM E 275-01
Calibrated by : Sathip Meangmai

Approved by :

(✓) Malee Butkruea

() Sathip Meangmai

() Warakorn Lengagrakul

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 0053467



Cert. No. : 23CHO262

Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

Material	Serial No.	Certificate No.	Due date
1. Absorbance Standard set	32593	100581	30 Mar 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 : 2 nm

Scan Speed : Slow

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (\pm nm)	Coverage Factor k
361.00	360.6	0.16	2.00
472.47	471.8	0.16	2.00
536.66	536.3	0.18	2.00
748.48	748.5	0.18	2.00
879.27	878.9	0.18	2.00

Wala

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Cert. No. : 23CHO262

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 k
420.0	Zero 0.5701 0.7147 1.0031	0.0001 0.5680 0.7110 0.9974	0.0028 0.0028 0.0029 0.0029	2.00 2.00 2.00 2.00
546.1	Zero 0.5195 0.7007 0.9833	0.0001 0.5185 0.6973 0.9786	0.0028 0.0030 0.0029 0.0028	2.00 2.00 2.00 2.00
635.0	Zero 0.5615 0.7659 1.0763	0.0001 0.5588 0.7612 1.0701	0.0028 0.0028 0.0030 0.0028	2.00 2.00 2.00 2.00

Stray Light

* Straylight at 280.05 nm \pm 0.11 nm	Reading at 280.05 nm \pm 0.11 nm
Abs	1.8711
%T	1.35

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- The Potassium Dichromate filled cells are measured against a Perchloric acid blank.
- 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 %.

-00-

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SCARLET | TECH



Certificate of Calibrator

for ST-120 Sound Calibrator

No. 20210923J143

Name of Product Sound Calibrator

Type ST-120

Serial Number ST120C0263E

Specification Class 1

Date 2022/12/22

Tested



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 °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



SCARLET | TECH



CERTIFICATE OF CALIBRATION

NO. 20221215060

Name of Product: Sound Level Meter

Model: ST-11D

Serial Number: 820392

Specification: Class 1

Conclusion: Pass

Date of calibration: 2022-12-15

Due Date: 2023-12-14



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 Manuals(s) or respectively surpass them, 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: AWA16425-52235
3. Adjustments to indicated sound levels: 4. Measuring up limit: 160 dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Type of Calibrator B&K 4231

Sound Pressure Level 94.0 dB

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	-14.6	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.3	2000	0.1	0.0	0.0
315	-39.4	-2.1	0.1	4000	1.2	-0.1	0.0
63	-26.1	-0.7	-0.1	8000	1.2	-0.8	0.0
125	-16.4	-0.1	-0.1	12500	-5.6	-7.2	0.1
250	-8.6	0.1	0.0	16000	-11.5	-13.3	0.2
500	-3.1	0.1	0.1	20000	-23.4	-25.8	-0.3

6. Self-generated noise

Microphone replaced by electrical input signal device

10.5 dB(A)	9.5 dB(C)	14.1 dB(Z)
------------	-----------	------------

7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.2
Rate of the S weighting decrease (dB/s)	4.3
Deviation of F&S	-0.1

8. Level Linearity (A-weighting at frequency 1 kHz)

Reference sound level 90.0 dB
Max error at 10dB steps upper reference sound level -0.1 dB
Max error at 1dB steps within 5dB of the upper limit linear operating range 0.0 dB
Max error at 10dB steps below reference sound level 0.1 dB
Max error at 1dB steps within 5dB upper the lower limit linear operating range 0.1 dB

9. Tone burst response (A Weighting) :

Single Toneburst duration /ms	Toneburst response /dB			
	L _{lower} -L _a	L _{lower} -L _a	L _c -L _a	L _{ref} -L _a
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-18.1	-26.9	-26.9	-7.0
10	-27.3	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
L _{Cpeak-LC} (dB)	3.5	3.5	2.4	2.4	2.3	2.4

11. Overload indication, Pass

12. Statistical analysis function

Sweep signal maximum indicated sound level: 112.8 dB
Sweep amplitude: 40 dB
Scan cycle time: 60 S; Measurement period: 180 S.

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L _{Aeq,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	74.9	74.8	0.1
L95	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 60 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929/05	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGIS-NEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

- All Scalet's Sound Level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMT004-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone 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



CERTIFICATE OF CALIBRATION

NO. 20221215061

Name of Product:	Sound Level Meter
Model	ST-11D
Serial Number:	820393
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2022-12-15
Due Date:	2023-12-14



- 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 Manuals) or respectively surpass them, and applies only to the unit identified above.
- This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- 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: AWA14425-52174
3. Adjustments to indicated sound levels: 4. Measuring up limit: 140.dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Type of Calibrator: B&K 4231

Sound Pressure Level: 94.0 dB

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	-14.4	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.3	2000	0.1	0.0	0.0
315	-39.4	-2.1	0.1	4000	1.2	-0.1	0.0
63	-26.1	-0.4	-0.1	8000	1.2	-0.8	0.0
125	-16.4	-0.1	-0.1	12500	-5.2	-7.2	0.1
250	-8.6	0.1	0.0	16000	-11.5	-13.3	0.2
500	-3.1	0.1	0.1	20000	-23.4	-25.8	-0.3

L5	110.8	110.8	110.8	0.0
L10	108.8	108.8	108.8	0.0
L50	92.9	92.9	92.8	0.1
L90	76.9	76.9	76.8	0.1
L95	75.0	75.0	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 60 %
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	299405	2024-12-15	NVL
Multi function sound calibrator	B&K 4226	2286444	2024-10-15	CBSMEC
Signal generator	DS 360	33873	2024-10-15	CEPREI

Test specifications:

- All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMTPO4-CA-152.
- The electrical tests were performed using an electrical signal substituted for the microphone 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



CERTIFICATE OF CALIBRATION

NO. 20221215062



Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820394
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2022-12-15
Due Date:	2023-12-14



- 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 Manuals or respectively surpasses them, 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: AMVA14235-52756
3. Adjustments to indicated sound levels:
- Type of Calibrator: B&K 4231
- Sound Pressure Level 94.0 dB
- Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB
4. Measuring up limit: 140 dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests,)

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.1	-14.4	0.2	1000	0.0	0.0	-0.1
20	-50.3	-6.4	-0.3	2000	0.1	0.0	0.0
315	-39.4	-2.2	0.1	4000	1.2	-0.1	0.0
63	-26.1	-0.3	-0.1	8000	1.2	-0.8	0.0
125	-16.1	-0.1	-0.1	12500	-5.2	-7.2	0.1
250	-8.5	0.1	0.0	16000	-11.5	-13.4	0.2
500	-3.2	0.1	0.1	20000	-23.4	-25.8	-0.3

L5	110.8	110.8	110.8	0.0
L10	108.8	108.8	108.8	0.0
L50	92.9	92.8	92.8	0.1
L90	76.9	76.8	76.8	0.1
L95	75.0	74.9	74.9	0.1

Uncertainty of measurement results: 0.4 dB (k=2)

Environment conditions:

Air temperature: 20 °C
Relative humidity: 60 %
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
Mutli function sound calibrator	B&K 4226	2288444	2024-10-15	CIGSMEC
Signal generator	DS 340	33873	2024-10-15	CEPREI

Test specifications:

1. All Scarlet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMP004-CA-152.
2. The electrical tests were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitance within a tolerance of ±20%.
3. 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

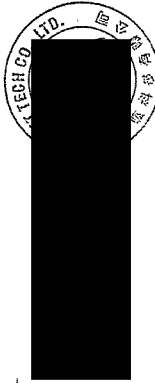


SCARLET TAF

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



- 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 surpass 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-S7377
3. Adjustments to indicated sound levels:
Type of Calibrator: B&K 4231
Sound Pressure Level: 94.0 dB
4. Measuring up limit: 140 dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

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



SCARLET TAF

CERTIFICATE OF CALIBRATION

NO. 20230113118

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820878
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2023-02-01
Due Date:	2024-01-31



- 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 surpass 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-S5310
3. Adjustments to indicated sound levels:
Type of Calibrator: B&K 4231
Sound Pressure Level: 94.0 dB
4. Measuring up limit: 140 dBA
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

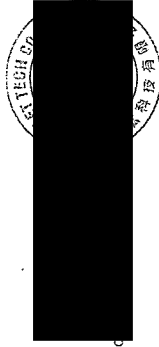
Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
10	-71.2	-14.3	-0.4	1000	0.0	0.0	-0.1
20	-50.1	-6.3	-0.2	2000	1.3	-0.1	-0.1
31.5	-39.2	-2.7	-0.1	4000	1.1	-0.8	-0.1
63	-26.2	-0.5	-0.1	8000	-1.0	-3.1	0.0
125	-16.2	-0.1	0.0	12500	-11.7	-13.7	0.0
250	-8.6	0.2	-0.1	16000	-11.5	-13.6	0.1
500	-3.2	0.0	-0.1	20000	-23.8	-25.8	-0.1



CERTIFICATE OF CALIBRATION

NO. 20230113119

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	820879
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2023-02-01
Due Date:	2024-01-31



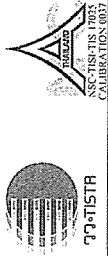
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- II. This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- III. This certificate of calibration shall not be reproduced except in full, without written permission of the Scalet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK
2. Type & serial No. of Microphone: ΔNA14425-16240
3. Adjustments to indicated sound levels:
- Type of Calibrator: B&K 4231
4. Measuring up limit: 140.0 dB
5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests,)

Nominal frequency /Hz	Frequency weighting / dB			Frequency weighting / dB		
	A	C	Z	A	C	Z
10	-71.2	-14.3	-0.3	0.0	0.0	-0.1
20	-50.2	-6.3	-0.1	1.3	-0.1	-0.1
31.5	-39.2	-2.7	-0.1	1.1	-0.6	-0.1
63	-26.2	-0.4	-0.1	-1.0	-3.1	0.0
125	-16.2	-0.1	0.0	-11.7	-13.7	0.0
250	-8.6	0.1	-0.1	-11.5	-13.6	0.1
500	-3.2	0.0	-0.1	-23.6	-25.9	-0.1

Sound Pressure Level 94.0 dB

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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0197

MTC No. EEL. BP. 60/0166

CALIBRATION CERTIFICATE

Submitted by : THAI ENVIRONMENTAL TECHNIC LIMITED.
Address : 1/6 Soi Ramkhamhaeng 145, Khwaeng/Khet 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 : Tannars
Model : TM-100
Serial No. : 181203570

Ambient Environment
Temperature : (23 ± 3) °C
Relative Humidity : (50 ± 15) %
Ambient Pressure : (101.325 ± 1.500) kPa

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0630001.

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

7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

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

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

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

Date of Receipt : 10 Jan. 2023

Date of Calibration : 16 Jan. 2023

1 / 3

The results relate only to the items tested/calibrated or value assigned.

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

Head Office

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

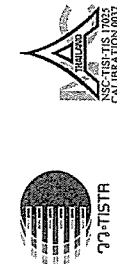
Office/Laboratory

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

Office

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

FIABL/MTC.002 Rev.4



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 IEC60942:2003 Class 2
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 IEC60942:2003 Class 2
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 IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	2.20	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

- The calibrator pressure correction was not included.
- The microphone volume correction was not included.

Date of Calibration : 16 Jan. 2023

2/3

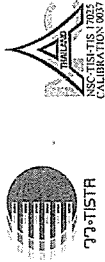
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FM.BL.MTC.002 Rev.4

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

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

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



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 IEC60942:2003 Class 2
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 IEC60942:2003 Class 2
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 IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	2.60	± 0.60	$\pm 4.0\%$

Note : 1. No adjustment.

- The calibrator pressure correction was not included.
- The microphone volume correction was not included.

Calibrated by :

Approved by :

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011266011000062001

End of Certificate

3 / 3

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

FM.BL.MTC.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 : 24-June-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25 °C
Relative Humidity(50±15 %) : 45.0 % RH
Dued Date of Calibrate : 31-July-2023

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	94.2	94.2	94.2	94.0	0.2	PASS
42	ACO	6226	130128	114.0	114.1	114.1	114.1		
				93.7	93.7	93.7	94.0	0.3	PASS
43	ACO	6226	130129	94.0	94.2	94.2	94.0	0.2	PASS
44	ACO	6226	130130	94.0	93.9	93.9	94.0	0.1	PASS
45	ACO	6226	130131	114.0	113.8	113.8	113.8		
				93.9	93.9	93.9	94.0	0.1	PASS
46	ACO	6226	112029	94.0	93.9	93.9	94.0	0.1	PASS
47	ACO	6226	152073	94.0	94.3	94.3	94.0	0.3	PASS
48	ACO	6226	152074	114.0	114.3	114.3	114.0		
				93.9	93.9	93.9	94.0	0.1	PASS
49	ACO	6226	152075	94.0	93.8	93.8	94.0	0.2	PASS
50	ACO	6226	152076	94.0	94.0	94.0	94.0	0.0	PASS

Calibration

Approve



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 : 24-June-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25 °C
Relative Humidity(50±15 %) : 45.0 % RH
Dued Date of Calibrate : 31-July-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	6226	152077	94.1	94.1	94.1	94.0	0.1	PASS
52	ACO	6226	150142	114.0	114.0	114.0	114.0		
				93.9	93.9	93.9	94.0	0.1	PASS
53	ACO	6226	160095	94.0	93.9	93.9	94.0	0.1	PASS
54	ACO	6226	160096	114.0	113.9	113.9	113.9		
				93.9	93.9	93.9	94.0	0.1	PASS
55	ACO	6226	160097	94.0	93.9	93.9	94.0	0.1	PASS
56	ACO	6226	160098	114.0	113.9	113.9	113.9		
				94.1	94.1	94.1	94.0	0.1	PASS
57	ACO	6226	160099	114.0	114.0	114.0	114.0		
				93.8	93.8	93.8	94.0	0.2	PASS
58	ACO	6226	160143	94.0	93.9	93.9	94.0	0.1	PASS
59	ACO	6226	160203	114.0	113.8	113.8	113.8		
				94.0	94.1	94.1	94.0	0.1	PASS
60	ACO	6226	160204	114.0	113.9	113.9	113.9		
				94.0	94.3	94.3	94.0	0.3	PASS

Calibration

Approve



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 : 24-June-2023
Barometric pressure (mmHg) : 759.0 mmHg
Temperature (23±3)°C : 25 °C
Relative Humidity(50±15 %) : 45.0 % RH
Dued Date of Calibrate : 31-July-2023

Item	Instrument Calibrated		Reference Acoustic dB	Before Adjust			After Adjust ± dB	Deviation ± dB	Result
	Brand	Model	Serial NO.	ครั้งที่ 1	ครั้งที่ 2	ครั้งที่ 3			
73	ACO	6236	222244	93.9	93.9	93.9	94.0	0.1	PASS
74	ACO	6236	222245	94.1	94.1	94.1	94.0	0.1	PASS
75	ACO	6236	222246	94.0	94.0	94.0	94.0	0.0	PASS
76	ACO	6236	222247	94.0	94.0	94.0	94.0	0.0	PASS
77	ACO	6236	222248	94.0	94.0	94.0	94.0	0.0	PASS

Calibration by

Approve by



SP Metrology System (Thailand) Co., Ltd. 1/6 Soi Ramkhamhaeng 145 Khwaeng Khet Saphan Sung Bangkok 10240 Thailand Tel : +66(0)2373-7799 Fax : +66(0)2373-7799 www.spmetrology.com

METROLOGY SYSTEM (THAILAND) CO., LTD.

Certificate of Calibration

Certificate Number : SPR22070316-2 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 : Sound Calibrator
Manufacturer : Tenmars
Model : TM-100
Serial Number : 180501628
ID. Number : No.6
Environmental Conditions
Ambient Temperature : 23 °C ± 3 °C Received Date : 20 Jul 2022
Relative Humidity : 50 % ± 15 % Calibration Date : 23 Jul 2022
Location of Calibration : In-Lab Recommend Due Date : 23 Jul 2023
Calibration Procedure : In-House Method Date of Issue : 24 Jul 2022

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.Chumpon Dokpikul

Calibration Officer

Approved by

Authorized Signatory



Result of Calibration

Certificate No. : SPR22070316-2

Page : 3 of 3

Function : Sound Level

UUC Setting (±dB)	Standard Reading (dB)	Error (dB)	Uncertainty (±dB)
94	94.06	-0.06	1.5
114	113.97	0.03	1.5

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 $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23020460-1

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 : 170400163
ID. Number : No.20

Environmental Conditions

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

Calibration Officer

Authorized Signatory



Result of Calibration

Certificate No. : SPR23020460-1

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	113.8	113.8	-0.2	-0.2	0.15

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	113.9	113.9	-0.1	-0.1	0.15

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

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 : SPR23030020-7

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 : 170400165
ID. Number : No.21

Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 01 Mar 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 07 Mar 2023
Location of Calibration : In-Lab Recommend Due Date : 07 Mar 2024
Calibration Procedure : SP-CPE-04-01 Date of Issue : 08 Mar 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

Approve

Calibration Officer

Authorized Signatory



Result of Calibration

Certificate No. : SPR23030020-7 Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A	UUC Reading		Error		Uncertainty (±)
	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

Unit : dB

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

Unit : dB

Select Z	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
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 : SPR23010143-8 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 : 170400177
ID. Number : No.22

Environmental Conditions

Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ Received Date : 13 Jan 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 17 Jan 2023
Location of Calibration : In-Lab Recommend Due Date : 17 Jan 2024
Calibration Procedure : SP-CPE-04-01 Date of Issue : 18 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 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

Authorized Signatory



Result of Calibration

Certificate No.: SPR23010143-8

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

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

Select Z Standard Setting	UUC Reading		Error		Unit : dB Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	94.0	94.0	0.0	0.0	0.15
114	113.8	113.8	-0.2	-0.2	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 : SPR23010143-9

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 : 170800191

ID. Number : No.23

Environmental Conditions

Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ Received Date : 13 Jan 2023Relative Humidity : $50\% \pm 15\%$ Calibration Date : 17 Jan 2023

Location of Calibration : In-Lab Recommend Due Date : 17 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 18 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 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



Result of Calibration

Certificate No. : SPR23010143-9

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	113.9	113.9	-0.1	-0.1	0.15

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

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

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 : SPR23010143-10

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 : 170800193
ID. Number : No.24

Environmental Conditions
Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ Received Date : 13 Jan 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 17 Jan 2023
Location of Calibration : In-Lab Recommend Due Date : 17 Jan 2024
Calibration Procedure : SP-CPE-04-01 Date of Issue : 18 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 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

Authorized Signatory



Result of Calibration

Certificate No. : SPR23010143-10

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

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

Select C	Standard Setting	UUC Reading		Error		Uncertainty (±)
		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		Uncertainty (±)
		Fast	Slow	Fast	Slow	
94		94.0	94.0	0.0	0.0	0.15
114		114.0	114.0	0.0	0.0	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 : SPR230300020-4

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 : 170800201

ID. Number : No.25

Environmental Conditions

Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ Received Date : 01 Mar 2023Relative Humidity : $50\% \pm 15\%$ Calibration Date : 07 Mar 2023

Location of Calibration : In-Lab Recommend Due Date : 07 Mar 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 08 Mar 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

App

Authorized Signatory



Result of Calibration

Certificate No. : SPR23030020-4

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

Select A	UUC Reading		Error		Unit : dB
	Fast	Slow	Fast	Slow	
94	93.4	93.4	-0.6	-0.6	0.15
114	113.3	113.3	-0.7	-0.7	0.15

Select C	UUC Reading		Error		Unit : dB
	Fast	Slow	Fast	Slow	
94	93.5	93.5	-0.5	-0.5	0.15
114	113.3	113.3	-0.7	-0.7	0.15

Select Z	UUC Reading		Error		Unit : dB
	Fast	Slow	Fast	Slow	
94	93.3	93.3	-0.7	-0.7	0.15
114	113.2	113.2	-0.8	-0.8	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 No. : 23H028
Page : 1 of 2

Equipment : Heat Stress Monitor

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.

Manufacturer: DELTA OHM

Model : HD 32.2

Serial No.: 22004309

ID No.: HD 12

Condition As-Received: Used Item

Received Date: 25 April 2023

Calibration Date: 02 May 2023

Reference: 2304-0600DSC

Submitted by: Thal Environmental Technic Limited

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

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 :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1523	3240076	231305	15 Mar 2024
2.The certificate is valid only to the item calibrated on date and place of calibration.				
3.This Certification is traceable to the International System of Unit maintained through:-				

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

Calibrated by : Viporn Tantiyawuti
Issue Date : 05 May 2023

Approved Sign

[Signature]
[Signature]
[Signature]



Cert. No.: 23H926
Page: 2 of 2

Result of Calibration:-

Function: Without Adjustment

Temperature Measurement

This instrument was connected with temperature probe.

Measurement Function	Model of Sensor	Serial of Sensor	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)
Tn	HP3201.2	22015697	19.998	20.1	0.102	0.42
			25.013	25.0	-0.013	0.42
			29.978	29.9	-0.078	0.42
			34.964	34.9	-0.064	0.42
Tg	TP3276.2	22014925	39.997	39.8	-0.197	0.42
			19.998	20.2	0.202	0.42
			25.013	25.2	0.187	0.42
			29.978	30.2	0.222	0.42
T	TP3276.2	22015197	34.964	35.1	0.136	0.42
			39.997	40.1	0.103	0.42
			19.998	20.1	0.102	0.42
			25.013	25.1	0.067	0.42
T	TP3276.2	22015197	29.978	29.9	-0.078	0.42
			34.964	34.9	-0.064	0.42
			39.997	39.8	-0.197	0.42

UUC* : Unit Under Calibration

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

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[Signature]

a 1159758



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Certificate of Calibration

Certificate No. : 23H927
Page : 1 of 2

Equipment : Heat Stress Monitor

Manufacturer: DELTA OHM

Model : HD 32.2

Serial No.: 22004310

ID No.: HD 13

Condition As Received: Used Item

Received Date: 25 April 2023

Calibration Date: 02 May 2023

Reference: 2304-0600DSC

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 1523 3240076 230305 15 Mar 2024

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

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

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

Calibrated by : Viporn Tantiyawutti
Issue Date : 05 May 2023

Appr

[] Pornthippa Tameyakul
[] Viporn Tantiyawutti

B 0313363



Cert. No.: 23H927
Page.: 2 of 2

Result of Calibration:

Function:

Without Adjustment

Temperature Measurement

This instrument was connected with temperature probe.

Measurement Function	Model of Sensor	Serial of Sensor	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
Tn	HP3201.2	22015695	19.998	19.9	-0.098	0.42
			25.013	24.9	-0.113	0.42
			29.978	29.8	-0.178	0.42
			34.964	34.9	-0.064	0.42
Tg	TP3276.2	22014924	39.997	39.8	-0.197	0.42
			19.998	20.1	0.102	0.42
			25.013	25.1	0.087	0.42
			29.978	30.1	0.122	0.42
T	TP3276.2	22015199	34.964	35.1	0.136	0.42
			39.997	40.1	0.103	0.42
			19.998	20.1	0.102	0.42
			25.013	25.1	0.087	0.42

UUC* : Unit Under Calibration

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

-o0o-

a 1159757



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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 Bulkruea
() Sathip Meangmai

Issue Date : 19 July 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0042417



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

Condition of this calibration result

1. Reference Standard Instrument :-

- | Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 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

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (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	1.680	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

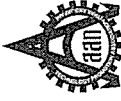
Performing four buffers standard curve by using buffer nominal pH (1.68,4,7,9)

Unit Under Calibration	Standard Buffer Solution	Actual pH Reading		Uncertainty of pH measurement (\pm)	Coverage factor k
		Actual pH Reading	mV		
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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TEL: 0-2717-3000-29 FAX: 0-2719-9484



NSC-168-16817025
CALIBRATION 0008

Cert.No.: 23CHO281
Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Horiba
Model : ES-51E
Serial No. : S205087
ID No. :
Condition As-Received: Used Item
Received Date : 10 April 2023
Calibration Date : 10 April 2023
Reference : 2304-0146OC-15
Submitted by :
Thai Environmental Technic Limited
1/6 Soi Ramkhamhaeng 145,
Khwaeng/Khet Saphan Sung,
Bangkok 10240
Laboratory (Thai Environment Technic Limited)
(30.2 - 31.3) °C (On-Site)
(37.7 - 36.1) % (On-Site)
In -house method :
- CP-0CH3 : based on direct measurement by
using certified reference material (CRM)
Calibrated by : Sathip Meangmai

Approved by :

(✓) Malee Bulkrua
() Sathip Meangmai
() Warakorn Lengagtrakul

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 0053466

a 1090860



Cert. No.: 23CHO261

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument Serial No. ID No. Certificate No. Due date
1) Digital Thermometer 307901 70RC137 2211236 10 Oct 2023

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

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

2. Certified Reference Materials :-

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

Conductivity Solution Manufacturer Lot No. Exp. date
1.413 mS/cm CPA Chem 826595 09 July 2023

- Control Conductivity calibration solution temperature by Water bath (25±0.2) °C
3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 µS/cm

Conductivity Electrode Serial No.: 9C0A0150

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
1.413 mS/cm	1.256 mS/cm	1.413 mS/cm	0.011 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

- Adjustment Cell constant = 1.030 cm⁻¹

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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Mal.

a 1158495



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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MSC-TS17826
CALIBRATION 0006

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 : (25 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Khit Ruttanaprapachai

Approved by :

() Pornthipha Tameya

(/) 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 : 2304-0146OC-2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Model Serial No. Cert. No. Due Date
1) Data Acquisition 34972A MY57013711 22LM93 02 Jul 2023

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

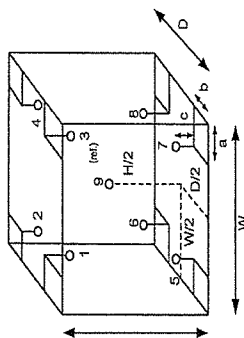
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

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



Probe Installation Details :

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

Dimension of Chamber :
D = 0.48 m
W = 0.50 m
H = 1.1 m
Capacity = 0.26 m³

Valu.

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

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)
	1	2	3	4	5	6	7	8	
20.0	20.121	20.227	19.983	20.098	19.992	19.953	19.936	19.914	0.048
									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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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 :

() 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 0053457



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

Cert. No.: 23TM604
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.

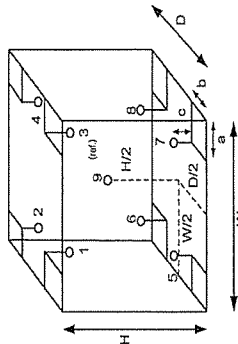
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) 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	18-04RTD-01
2	18-04RTD-02
3	18-04RTD-03
4	18-04RTD-04
5	18-04RTD-05
6	18-04RTD-06
7	18-04RTD-07
8	18-04RTD-08
9 (ref.)	18-04RTD-09

90/11

a 1158197



Equipment: Incubator
Condition As-Received: Used Item
Reference: 2304-0146OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC*: Temperature Source
Fresh air setting: Close

Cert. No.: 23TM604
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	0.065	0.32	0.67	2
41.5	41.5	41.5	0.032	0.49	0.63	2
44.5	44.5	44.5	0.066	0.60	0.86	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.870	34.847	34.722	34.860	34.744	35.047	34.842	35.288	35.026	0.30
41.5	41.625	41.612	41.461	41.733	41.300	41.428	41.418	41.874	41.758	0.30
44.5	44.744	44.708	44.553	44.862	44.205	44.476	44.352	44.931	44.778	0.30

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

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

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

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

UUC*: Unit Under Calibration

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

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

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TEL. 0-2717-3000/29 FAX. 0-2719-9484



MSC-TS-TS17925
CALIBRATION 0008

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 Pattanapongpaiboon

Approved by:

() Ponthippa Tameya
(✓) 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 1158196

A 0053458



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

Cert. No.: 23TM605
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. Due Date
1) Data Acquisition 34970A MY41021843 27 Dec 2023

Cert. No. 22LM172

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.

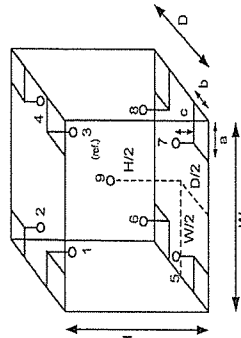
Result of Calibration :-

Function of UUC* : (*) Without Adjustment

Fresh air setting : Temperature Source

Close

Environment during calibration	
Beginning	Finished
Temp. (°C)	25
REL.Humid. (%)	54
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



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

Cert. No.: 23TM605
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	0.021	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)
		Position									
		1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.998	34.938	34.900	34.866	35.143	35.446	35.083	35.362	34.765	34.765	0.30
37.0	36.978	36.975	36.972	36.971	37.390	37.559	37.324	37.437	37.010	37.010	0.30
44.5	44.631	44.502	44.429	44.412	44.752	45.106	44.600	45.021	44.183	44.183	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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a 1158194



Certificate of Calibration

Certificate Number : SPR23010143-5
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 : DO Meter
Manufacturer : Horiba
Model : OM-71G
Serial Number : D75J0012
ID. Number : No.07

Environmental Conditions
Ambient Temperature : 23 °C ± 2 °C
Relative Humidity : 50 % ± 15 %
Location of Calibration : In-Lab
Calibration Procedure : In-House Method
Received Date : 13 Jan 2023
Calibration Date : 14 Jan 2023
Recommend Due Date : 14 Jan 2024
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 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.Kijja Visitsilo
Calibration Officer
Approved : [Redacted]
Authorized Signatory



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. S00666/21	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 -



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 100

Customer : บริษัท เทคโนโลยีสิ่งแวดล้อมไทย
จำกัด
Address : 1/6 ขอบรรณคำแหง 145,
แขวงสะพานสูง, เขตสะพานสูง,
กรุงเทพฯ 10240 TH
User Name: คุณ กิตติศักดิ์ เนื่องงาม
Phone: 02-3737799
E-mail: phornitip.p@tet1995.com
ketsarin.c@tet1995.com
Date Tested: 30-มิ.ค.-66
Recommendation Recertification
Period 6 Months
Recertification Due: 29-ก.ย.-66
Date Last Certified: 3-ค.ค.-65
Visit Number: 1 of 2
TH ONE SOURCE Phone: 081-7316733
thonesource@gmail.com

CONFIGURATION TESTED

MODEL SERIAL NUMBER SOFTWARE
AAAnalyst 100 040S0110503 AA WinLab 3.2

TEST STANDARD USED

Copper PART NUMBER
Filter 0.2 % N9300183
MG0-057

Page 1 of 4



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 100

SERIAL NUMBER	040S0110503	DATE TESTED	30-11-66
1. OPTIC CHECKS			
A. Optical alignment condition (if necessary)			
B. Condition of Mirrors,Lenses etc.(if necessary)			
C. D2,HCL beam adjust (if necessary)			
2. GAS SYSTEM CHECKS			
A. Leak test all internal and external gas box joints			
B. All gas box safety features			
C. Burner system including nebulizer and all o-ring and gasket			
D. Drain system (safety)			
3. ELECTRONICS CHECKS			
A. Power Supplies			
+ 5.00 Vdc ± 0.2 Vdc			
+ 11.50 Vdc ± 0.2 Vdc			
+ 15.00 Vdc ± 1.0 Vdc			
- 15.00 Vdc ± 1.0 Vdc			
+ 35.00 Vdc ± 3.0 Vdc			
4. WAVELENGTH ACCURACY TEST			
A. Zn Lamp wavelength 213.9 nm ± 0.3 nm.			
B. Fe Lamp wavelength 248.3 nm ± 0.3 nm.			
C. Cu Lamp wavelength 324.8 nm ± 0.3 nm.			



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 100

SERIAL NUMBER	040S0110503	DATE TESTED	30-11-66
5. PERFORMANCE TESTS			
* A. Neutral density filter checks with Copper (324.8 nm)			
Neutral Density Filter 0.2 ± 10%			
0.180			
Abs.			
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			
Abs.			
0.285			
Abs.			
0.18			
%			
≤ 0.3			
%RSD			



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 100

SERIAL NUMBER 040S0110503 **DATE TESTED** 30-11-66

Remarks :

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

☒ meets
☐ 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.



Certificate of Training

This is to certify that

Mr. Krungchai Treevichien

Has successfully completed

Atomic Absorption 100/300 Service Training
17 September, 2007 TO 21 September, 2007



21 September 2007
 Date



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX 0-2719-9484



Cert.No.: 22CHO625
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-OCH4 based on ASTM E 275-01

Calibrated by : Uthen Kankawi

Approved by :

(/) Malee Butkruea
() Sathip Meangmai
() Warakorn Lengagitrakul

Issue Date : 10 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 Corporate Services 3 : Equipment Calibration and Testing Services.

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Cert. No. : 22CHO625
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 k
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

* Stray/light 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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