

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์



ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
1.	Ambient Air	TSP	ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/09/2022	November 2023
			High Volume Air Sampler/TET	S/N TSP-NO. 3	04/07/2023	July 2024
			High Volume Air Sampler/TET	S/N TSP-NO. 14	04/07/2023	July 2024
			High Volume Air Sampler/TET	S/N TSP-NO. 15	04/07/2023	July 2024
			High Volume Air Sampler/TET	S/N TSP-NO. 24	05/07/2023	July 2024
		PM-10	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			ORIFICE TRANSFER STANDARD/Tisch	S/N 0068	21/09/2022	November 2023
			High Volume Air Sampler/TET	S/N PM10-NO. 3	04/07/2023	July 2024
			High Volume Air Sampler/TET	S/N PM10-NO. 18	05/07/2023	July 2024
			High Volume Air Sampler/TET	S/N PM10-NO. 31	13/07/2023	July 2024
		NO ₂	High Volume Air Sampler/TET	S/N PM10-NO. 12	04/07/2023	July 2024
			Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
			Certificate of Analyzer/Linde	S/N A00962SK	18/08/2021	August 2023
			NO _x Analyzer/API 200E	S/N 393	10/05/2023	November 2023
			NO _x Analyzer/Teledyne 200E	S/N 1173	10/05/2023	November 2023
		SO ₂	NO _x Analyzer/Teledyne T200	S/N 5158	12/05/2023	November 2023
			NO _x Analyzer/Teledyne T200	S/N 5160	11/05/2023	November 2023
			Certificate of Analyzer/Linde	S/N 118310	19/09/2019	September 2023
			SO ₂ Analyzer/Thermo 41C	S/N 43644269	11/05/2023	November 2023
			SO ₂ Analyzer/API 100A	S/N 1563	12/05/2023	November 2023
		WS & WD	SO ₂ Analyzer/API 100A	S/N 1412	10/05/2023	November 2023
			SO ₂ Analyzer/Teledyne	S/N 1341	11/05/2023	November 2023
			Wind speed and wind direction/weather Wizard III	S/N WC41019A77	21/06/2023	June 2024
			Wind speed and wind direction/weather Wizard III	S/N WC41020A38	12/09/2022	September 2023



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ตารางการสอบเทียบเครื่องมือที่ใช้ในการตรวจวัดและวิเคราะห์ (ต่อ)

Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
2.	Water	pH	pH Meter/Horiba F-71G	S/N V3B1F8H3	31/10/2023	October 2024
		Temperature	pH Meter (Temperature)/Horiba F-71G	S/N V3B1F8H3	31/10/2023	October 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	ID/N TET.LAB.BOD 05	11/04/2023	April 2024
		Oil & Grease	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		H ₂ S	Spectrophotometer/Blue Star A	S/N 1606UV1507	10/04/2023	April 2024
		Hg, As	Atomic Absorption Spectrophotometer Model/AAAnalyst 100	S/N 04050110503	29/09/2023	March 2024
		DO	DO Meter/HORIBA	S/N D75JD0013	14/01/2023	January 2024
		Nitrate, NO ₃ -N	Spectrophotometer/PerkinElmer	S/N 365K9042909	01/11/2022	November 2023
		Na, Mn	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Sulfate	Spectrophotometer/PerkinElmer	S/N 365K9042909	01/11/2022	November 2023
		Ni	Atomic Absorption Spectrophotometer Model/AAAnalyst 600 (Graphite)	S/N 600S5070101	12/07/2023	January 2024
		Pb, Cd	Atomic Absorption Spectrophotometer Model/AAAnalyst 600 (Graphite)	S/N 600S5070101	12/07/2023	January 2024
		SS	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	29/09/2023	March 2024
		Al, Ca	Electronic Balance/METTLER TOLEDO	S/N 1116392227	11/04/2023	April 2024
		Cu, Fe	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Mg	ICP394/PerkinElmer/OPTIMA8000	S/N 078N1310024C	03/04/2023	October 2023
		Fecal Coliform Bacteria	Incubator Model INE 500	S/N E.505.1143	10/04/2023	April 2024
		Coliform Bacteria	Incubator Model INE 500	S/N E.505.0595	10/04/2023	April 2024



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Item	Description	Parameter	List of Equipment	Equipment No.	Calibration	Next Calibration
3.	Sound Level	Leq 24 hr & เสียงรบกวน	Sound Level Meter/ST-11D	S/N 820392	15/12/2022	December 2023
			Sound Level Meter/ST-11D	S/N 820393	15/12/2022	December 2023
			Sound Level Meter/ST : 11D	S/N 820394	15/12/2022	December 2023
			Sound Level Meter/ST : 11D	S/N 820877	01/02/2023	January 2024
			Sound Level Meter/ST : 11D	S/N 820878	01/02/2023	January 2024
			Sound Level Meter/ST : 11D	S/N 820879	01/02/2023	January 2024
4.	Working Air	Total Dust	Personal Air Sampler/Gilian	S/N 20110605020	21/07/2023	August 2023
			Electronic Balance/XP 205	S/N 1129273885	11/04/2023	April 2024
		Respirable Dust	Personal Air Sampler/Gilian	S/N 20120103064	21/07/2023	August 2023
			Electronic Balance/XP 205	S/N 1129273885	11/04/2023	April 2024
5.	Occupational Health and Safety	Noise Dose	Noise Dose Meter/SOUNDTEK ST-130	S/N 220100056	07/03/2023	March 2024
			Noise Dose Meter/SOUNDTEK ST-130	S/N 220100057	07/03/2023	March 2024
		Leq 8 hr	Sound Level Calibrator/TENMARS TM-100	S/N 181203570	16/01/2023	January 2024
			Integrated Sound Level/ACO-TYPE 6226	S/N 110098	24/06/2023	31/07/2023
			Integrated Sound Level/ACO-TYPE 6236	S/N 222037	24/06/2023	31/07/2023
		Heat	Thermal Environment Monitor/JANTYTECH (JT2011-E2A)	S/N 3522210141	09-13/03/2023	March 2024
			Thermal Environment Monitor/JANTYTECH (JT2011-E2A)	S/N 3522210147	09-13/03/2023	March 2024
		Light	Lux Meter/DIGICON LX-50	S/N Q066345	19/06/2023	June 2024



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RECALIBRATION
DUE DATE:
September 21, 2023

Certificate of Calibration

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

Run	Vol. Init (m3)	Vol. Final (m3)	ΔVol. (m3)	ΔTime (min)	ΔP (mm Hg)	ΔH (in H2O)
1	1	2	1	1.3760	3.2	2.00
2	3	4	1	0.9710	6.4	4.00
3	5	6	1	0.8730	8.0	5.00
4	7	8	1	0.8300	8.8	5.50
5	9	10	1	0.8870	12.7	8.00

Data Tabulation			
Vstd (m3)	Qstd (x-axis)	$\sqrt{\frac{Pa}{Pstd} \times \frac{Tstd}{Ta}}$ (y-axis)	Qa (x-axis)
0.9870	0.7173	1.4080	0.9957
0.9828	1.0121	1.9912	0.9914
0.9806	1.1233	2.2262	0.9893
0.9796	1.1802	2.3349	0.9882
0.9744	1.4184	2.8160	0.9830
m = 2.01042		QA	
b = -0.03659		m = 1.25889	
r = 0.99996		b = -0.02312	
		r = 0.99996	

Calculations			
$V_{std} = \Delta Vol / (P_a - \Delta P) / P_{std} / (T_{std} / T_a)$	$V_a = \Delta Vol / (P_a - \Delta P) / P_a$		
$Q_{std} = V_{std} / \Delta Time$	$Q_a = V_a / \Delta Time$		
For subsequent flow rate calculations:			
$Q_{std} = 1/m \left(\sqrt{\frac{P_a}{P_{std}} \times \frac{T_{std}}{T_a}} \right) - b$	$Q_a = 1/m \left(\sqrt{\frac{\Delta H}{\Delta T_a} \times \frac{T_a}{P_a}} \right) - b$		

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



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech Site ID : Bangkok Date : 4-Jul-23
ITEM : TSP Serial No : (No.3) 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) : 750.6 Corrected Average (mm Hg) : -
Average Temp (°C) : 28.2 Average Temp (Deg K) : -

Calibration Orifice

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

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 29.8558 Intercept : 0.1836 Corr. Coeff : 0.9932
1	12.30	1.926	60.0	57.00	
2	10.00	1.755	54.0	52.00	
3	7.60	1.553	50.0	48.00	
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	# of Observations: 5

Calculations

$$Qstd = 1/m \left(\sqrt{Pa/Pstd} \times (Pstd/Tstd) \right) - b$$

$$IC = [Qstd(Pa/Pstd)(Tstd/Ta)]$$

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:

$$1/m \left(\sqrt{Pa/Pstd} \times (Pav/Tav) \right) - b$$

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

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Calibrate By : Pipat

Approve By : Pipat



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High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Tech
ITEM : TSP
Site ID : Bangkok
Serial No : (No. 14)
Date : 4-Jul-23
Calibrate By : Pipat

Site Conditions

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

Calibration Orifice

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

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.50	1.941	60.0	57.00	Slope : 30.0460
2	9.40	1.707	54.0	52.00	Intercept : 0.3184
3	7.20	1.517	50.0	48.00	Corr. Coeff : 0.9881
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	
					# of Observations: 5

Calculations

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

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:

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

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. 15)
Date : 4-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Temperature (deg K) : 298.0
Average Press. (mm Hg) : 750.6
Corrected Average (mm Hg) : -
Average Temp (°C) : 28.4
Average Temp (Deg K) : -

Calibration Orifice

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

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.20	1.919	60.0	57.00	Slope : 30.6943
2	9.40	1.707	54.0	52.00	Intercept : -0.5241
3	7.20	1.517	50.0	48.00	Corr. Coeff : 0.9903
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	
					# of Observations: 5

Calculations

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

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:

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

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. 24)
Date : 5-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 28.0
Corrected Pressure (mm Hg) : 760.0
Average Press. (mm Hg) : 750.8
Average Temp (°C) : 28.6
Temperature (deg K) : 298.0
Corrected Average (mm Hg) : -
Average Temp: (Deg K) : -

Calibration Orifice

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

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.50	1.943	60.0	57.00	Slope : 30.2297 Intercept : 0.1413 Corr. Coeff : 0.9875
2	9.20	1.691	54.0	52.00	
3	7.20	1.517	50.0	48.00	
4	5.00	1.294	40.0	40.00	
5	3.00	1.044	30.0	30.00	
					# of Observations: 5

Calculations

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

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:

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

NOTE: Ensure calibration office 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. 3)
Date : 4-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 28.0
Corrected Pressure (mm Hg) : 760.0
Average Press. (mm Hg) : 750.8
Average Temp (°C) : 28.2
Temperature (deg K) : 298.0
Corrected Average (mm Hg) : -
Average Temp: (Deg K) : -

Calibration Orifice

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

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.50	1.777	60.0	60.00	Slope : 34.3523 Intercept : 0.6343 Corr. Coeff : 0.9868
2	9.50	1.551	54.0	54.00	
3	7.20	1.353	50.0	50.00	
4	5.00	1.130	40.0	40.00	
5	3.20	0.908	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:

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

NOTE: Ensure calibration office 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. 18)
Date : 5-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Corrected Temperature (deg K) : 298.0
Average Press. (mm Hg) : 750.5
Average Temp (°C) : 28.5
Average Temp (Deg K) : -

Calibration Orifice

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

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.00	1.741	60.0	60.00	Slope : 35.0529
2	9.20	1.527	54.0	54.00	Intercept : 0.4420
3	7.00	1.334	50.0	50.00	Corr. Coeff : 0.9897
4	5.00	1.130	40.0	40.00	
5	3.00	0.880	30.0	30.00	of Observations: 5

Calculations

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

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

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

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

NOTE: Ensure calibration office 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. 31)
Date : 13-Jul-23
Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00
Temperature (°C) : 25.0
Corrected Pressure (mm Hg) : 760.0
Corrected Temperature (deg K) : 298.0
Average Press. (mm Hg) : 750.8
Average Temp (°C) : 28.7
Average Temp (Deg K) : -

Calibration Orifice

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

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m3/min)	Indicate (CFM)	IC (corrected)	Linear Regression
1	12.20	1.756	60.0	60.00	Slope : 30.3423
2	9.40	1.543	45.0	45.00	Intercept : 4.5728
3	7.20	1.353	50.0	50.00	Corr. Coeff : 0.9299
4	5.00	1.130	40.0	40.00	
5	3.00	0.880	30.0	30.00	of Observations: 5

Calculations

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

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

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)

Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K

Pstd = 760 mm Hg

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

NOTE: Ensure calibration office 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



Thai Environmental Technic Limited
บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

High Volume TSP&PM-10 Calibration Report

Location : Thai Environmental Technic Site ID : Bangkok Date : 4-Jul-23
ITEM : PM10 Serial No : (No. 12) Calibrate By : Pipat

Site Conditions

Barometric Pressure (mm Hg) : 760.00 Corrected Pressure (mm Hg) : 760.00
Temperature (°C) : 25.00 Temperature (deg K) : 298.15
Average Press. (mm Hg) : 750.8 Corrected Average (mm Hg) : 750.8
Average Temp (°C) : 28.2 Average Temp (deg K) : 301.35

Calibration Orifice

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

Calibration Information

Plate or Test #	ORIFICE (in H ₂ O)	Qstd (m ³ /min)	Indicate (CFM)	IC (corrected)	Linear Regression Slope : 34.6658 Intercept : 0.5977 Corr. Coeff : 0.9937
1	12.20	1.756	60.0	60.00	
2	9.20	1.527	54.0	54.00	
3	7.40	1.371	50.0	50.00	
4	5.00	1.130	40.0	40.00	
5	3.00	0.880	30.0	30.00	# of Observations: 5

Calculations

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

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:

$$1/m(I) [\text{Sort}(298/Tav)(Pav/P760)-b]$$

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

m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure

Calibrate By : 

Approve By : 

THE LINDE GROUP

Certificate of Analysis Special Gases Mixture

Customer Details
Name: Thai Environmental Technic Ltd Address: 1/6 Soi Ramkhamhaeng 145, Saphansong, Saphansong, Bangkok 10240 Customer Log No.:
Certificate Details
Number: 3367/19 Date of Issue: 19-Sep-2019 Expiry date: 19-Sep-2023
Material Details
Production Order: 90155812 Material Code: 608-000-5K-44 Cylinder No.: 118310
Gas content: 5.520 M³ Filling pressure: 145.0 bar Valve: CGA 660 SS
Cylinder Owner: LINDE Cylinder Material: Spectra seal Cylinder Size: 40.0 L

Laboratory Report

Component Sulphur Dioxide In Nitrogen
Normal Concentration 40.0 ppm
Analysis Result¹ 41.4 ppm
Uncertainty² ± 1% relative
Method of Analysis³ (6) I-PB-352
Assay Date 10-Sep-19-Sep-19

Reference Standard
Sulphur Dioxide
In Nitrogen
Cylinder number 1138235G
Concentration 25.50±0.25 ppm
Expiry date 7-Mar-2021

Reference Standard used In Assay

Analytical Instruments used In Assay

Instrument/Make/Model
FTIR Spectrometers Nicolet i550

Analytical Principle
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 made basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the 1st Edition of Protocol 016-005 (P-12) 2531 by the Assay and Certification of Gases Standards using procedure 01.
- 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 reference gas standard which is traceable to Syngas National Standard of Mass in other recognised national metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyser, (3) Electrochemical Oxygen Analyser, (4) Electrochemical Methane Analyser, (5) Total Hydrocarbon Analyser, (6) Other - Specified

Page 1 of 1

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ผู้จัดทำ (ผู้สร้าง) : บริษัท เทคนิคสิ่งแวดล้อมไทย จำกัด

ที่ : 15 ถนนรามคำแหง 145 แขวงคลองกุ่ม เขตบึงกุ่ม กรุงเทพมหานคร 10240 โทร : (66) 2336-6333
โทรสาร : (66) 2336-6333
แฟกซ์ : (66) 2336-6333
อีเมล : info@tet.co.th

Sukanya Panyasontorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.

19-Sep-2019

Linde (Thailand) Public Company Limited
15 Floor, Bangkok Tower A, 2/3 Moo 14, Bangna-Trad Rd., 65 Road, Bangnae
Bangkok, Samsilang 10240, Tel : (66) 2336-6300 Fax : (66) 2336-6333
Wongyarn Road 105 Moo 5, Bangnae, A Bangkok, 24180
Thailand, Tel : (66) 2336-6300 Fax : (66) 2336-6333



TEI

Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

Calibrate Date : 11-May-23
Analyzer Type : SO₂
Brand : Thermo
Model : 41 C
Serial Number : 43644269 (No. 6)
Range : 500 ppb

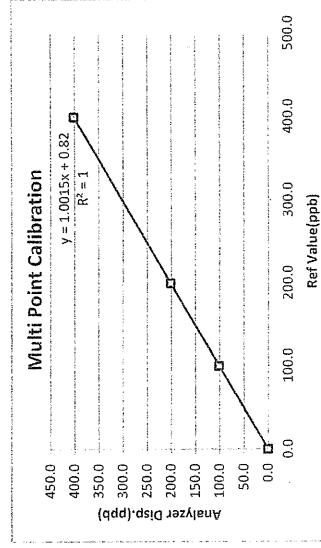
Temperature (°C) : 25 °C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 118310

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	0.9	0.0	0.0
Span	400.0	417.0	400.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp(ppb)	Output Difference		Abs Percent Diff
		Diff (ppb)	Percent Diff	
0.0	0.5	0.5	0.00	0.13
100.0	101.2	1.2	0.01	1.20
200.0	201.4	1.4	0.01	0.70
400.0	401.2	1.2	0.00	0.30
Average Diff (%)				0.58



Calibrate by: Yds

Approved by: Pijechai B

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

เลขที่แบบฟอร์ม : QF-QP16-06

Thai Environmental Technic Limited 1/6 Sai Panthamhaeng 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



TEI

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Analyzer Calibration Report

Calibrate Date : 12-May-23
Analyzer Type : SO₂
Brand : API
Model : 100A
Serial Number : 1563 (No. 15)
Range : 500 ppb

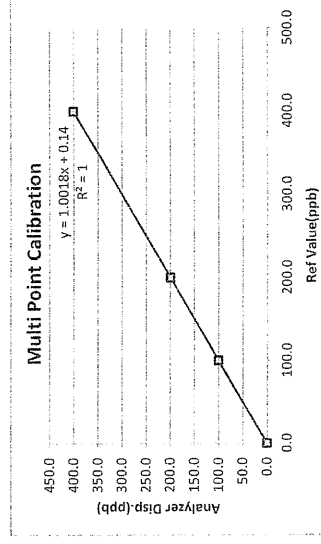
Temperature (°C) : 25 °C
Barometer (mmHg) : 755.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 118310

Calibration of Span

Supply Gas	Ref Value(ppb)	Before of Span(ppb)	After of Span(ppb)	Abs% diff of Span
Zero	0.0	4.1	0.0	0.0
Span	400.0	382.0	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	100.5	0.5	0.01	0.50
200.0	199.7	-0.3	0.00	0.15
400.0	401.2	1.2	0.00	0.30
Average Diff (%)				0.26



Calibrate by: Yds

Approved by: Pijechai B

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

เลขที่แบบฟอร์ม : QF-QP16-06

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Analyzer Calibration Report

Calibrate Date : 10-May-23
Analyzer Type : SO₂
Brand : API
Model : 100A
Serial Number : 1412 (NO. 17)
Range : 500 ppb

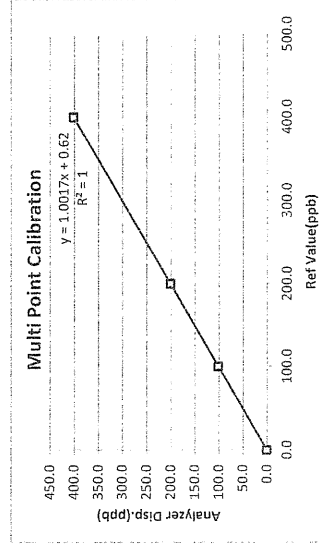
Temperature (°C) : 25 °C
Barometer (mmHg) : 755.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 116310

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	392.0	400.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)	Output Difference		
		Diff (ppb)	Percent Diff	Abs Percent Diff
0.0	0.4	0.4	0.00	0.10
100.0	101.2	1.2	0.01	1.20
200.0	200.8	0.8	0.00	0.40
400.0	401.3	1.3	0.00	0.33
Average Diff (%)		0.51		



Calibrate by: Yds.

Approved by: Piyakon B

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

เลขที่แบบฟอร์ม : QP-QP16-06

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Analyzer Calibration Report

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

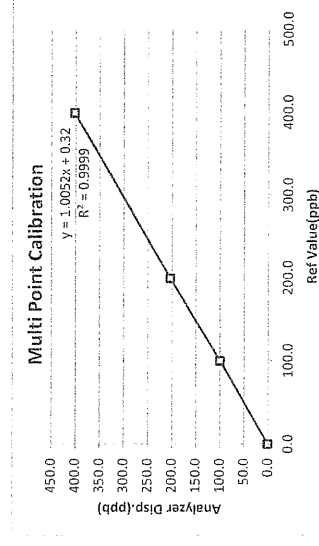
Temperature (°C) : 25 °C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0 %RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : 116310

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: Yds.

Approved by: Piyakon B

แก้ไขครั้งที่ : 00

วันที่อนุมัติ 02/09/15

เลขที่แบบฟอร์ม : QP-QP16-06

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Analyzer Calibration Report

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

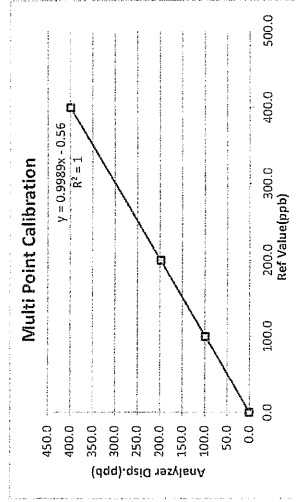
Temperature (°C) : 25 °C
Barometer (mmHg) : 759.9
Humidity (50±15 %) : 50.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1936
Standard gas : A00962 SK

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	0.5	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: gds
Approved by: Piyachon B



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

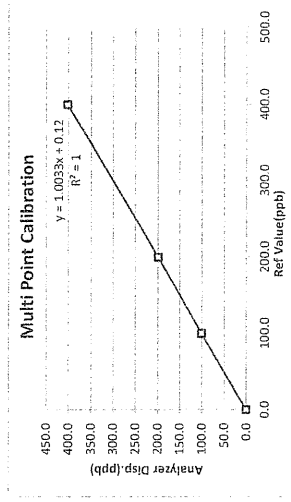
Calibrate Date : 12-May-23
Analyzer Type : NOx
Brand : Teledyne
Model : T200
Serial Number : 5158 (No. 31)
Range : 500 ppb
Temperature (°C) : 25°C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962 SK

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	1.1	0.8	0.3	0.0	0.0	0.0	0.0
Span	400.0	398.7	398.1	0.6	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		
	NOx	NO	NO ₂	Diff(ppb)	% Diff	Abs (%) Diff
0.0	0.4	0.4	0.0	0.40	0.001	0.10
100.0	101.2	101.2	0.0	1.20	0.012	1.20
200.0	199.5	199.1	0.4	-0.90	-0.005	0.45
400.0	402.3	402.1	0.2	2.10	0.005	0.53
Average Diff (%)				0.73		



Calibrate by:

[Signature]

Approved by:

[Signature]

แก้ไขครั้งที่ : 00

วันที่อนุมัติ : 02/09/15

ลงนามพร้อม : QF-QP 6-06

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Kwang/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

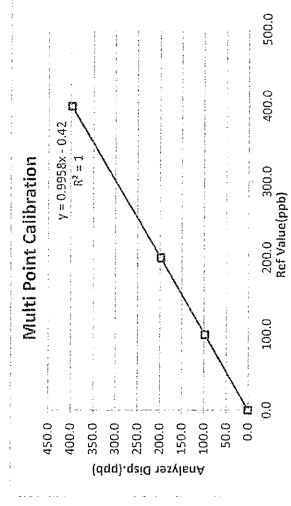
Calibrate Date : 11-May-23
Analyzer Type : NOx
Brand : Teledyne
Model : T200
Serial Number : 5160 (No. 32)
Range : 500 ppb
Temperature (°C) : 25°C
Barometer (mmHg) : 760.0
Humidity (50±15 %) : 50.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962 SK

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	1.7	1.1	0.6	0.0	0.0	0.0	0.0
Span	400.0	385.0	381.0	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	99.2	98.5	0.7	-1.50	-0.015	1.50
200.0	198.4	198.1	0.3	-1.90	-0.010	0.95
400.0	399.1	398.4	0.7	-1.60	-0.004	0.40
Average Diff (%)				0.95		



Calibrate by:

[Signature]

Approved by:

[Signature]

แก้ไขครั้งที่ : 00

วันที่อนุมัติ : 02/09/15

ลงนามพร้อม : QF-QP 6-06

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Kwang/Khet Saphan Sung Bangkok 10240 Thailand
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Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Analyzer Calibration Report

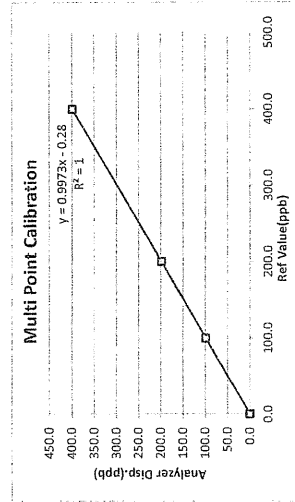
Calibrate Date : 10-May-23
Analyzer Type : NOx
Brand : Teledyne
Model : 200 E
Serial Number : 1173 (No. 35)
Range : 500 PPB
Temperature (°C) : 25°C
Barometer (mmHg) : 759.1
Humidity (50±15 %) : 50.0%RH
Dilutor : API M700 S/N 625
Zero Air : API M701 S/N 1926
Standard gas : A00962 SK

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	387.0	388.0	-1.0	400.0	400.0	0.0	0.0

Multi Point Calibration

Ref Value(ppb)	Analyzer Disp.(ppb)			Output Difference		
	NOx	NO	NO ₂	Diff(ppb)	% Diff	Abs.(%) Diff
0.0	0.6	0.4	0.2	0.40	0.001	0.10
100.0	99.1	99.0	0.1	-1.00	-0.010	1.00
200.0	198.7	198.5	0.3	-1.50	-0.008	0.75
400.0	399.2	399.1	0.1	-0.90	-0.002	0.22
Average Diff (%)						0.52



Calibrate by:

Approved by:

วันที่ตรวจ : 00

วันที่อนุมัติ : 02/09/15

Thai Environmental Technic Limited 1/6 Soi Ramkhamhaeng 145 Khwaeng/Khet Saphan Sung Bangkok 10240 Thailand
Tel : +66(0)2373-7759 (Auto) Fax : +66(0)2373-7979 • admin@tct1995.com • www.tet1995.com

เลขที่ใบตรวจ : QF-QP16-06

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 : 21 June, 2023 Certification No. 217/23

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III

Serial No. : WC41019A77 ID No. : No.7

Customer : Thai Environmental Technic Limited.

1/6 Soi Ramkhamhaeng 145,

Khwaeng/Khet Saphan Sung, Bangkok 10240.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.3 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731/241480 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-850-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by : Watcharapol Subwat
Mechanical Engineer

Signed : Mr. Pisod Pimsut





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 217/23

21 June, 2023

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacuum inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.3	0.72
5.00	-	-	-	4.5	0.50
7.00	-	-	-	6.3	0.70
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.3	0.71
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.3	0.71
17.02	-	-	-	16.5	0.52
20.02	-	-	-	19.3	0.72

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

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer



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 : 12 September, 2022

Certification No. 330/22

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Davis Instruments Inc.

Type : Weather Wizard III

Serial No. : WC41020A38 ID No. : No.20

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

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.6 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

N.I.S.T. Test Reference Number 731241460 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed : Mr. Watcharapol Subwat





THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2304/9-2395-0469

The Result of Calibration

Certification No. 330/22

12 September, 2022

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure Inches H2O	Vacuum Inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
Ultrasonic Anemometer					
1.00	-	-	-	0.4	0.60
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.00	-	-	-	6.8	0.20
9.02	-	-	-	8.5	0.52
11.01	-	-	-	10.8	0.21
13.01	-	-	-	12.5	0.51
15.01	-	-	-	14.8	0.21
17.02	-	-	-	16.5	0.52
20.02	-	-	-	19.8	0.22

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

Calibrated by :

Wacharapol

Mr. Wacharapol Subwint
Mechanical Engineer



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000/29 FAX. 0-2719-9484



Cert.No.: 23CHO641
Page.: 1 of 2

Certificate of Calibration

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

Calibrated by : Khit Ruttanaprapachai

Approved by : 
Sathip
Approved Signatory

(✓) Sathip Meangmai
() Warakorn Lengagitrakul
() Ponpan Paipim

Issue Date : 10 November 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

A 0060437



Cert. No.: 23CHO641
Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument :-
- | Instrument | Serial No. | ID No. | Cert. No. | Due Date |
|--------------------------------|------------|----------|-----------|-------------|
| 1) Document Process Calibrator | 43160066 | 130RC092 | 23E1284 | 10 Apr 2024 |
| 2) Digital Thermometer | - | 130RC018 | 23T1595 | 13 Sep 2024 |
- This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand - Japan)

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	931958	01 Oct 2025
pH 6.865	CPA chem	788996	01 Jan 2024
pH 9.181	CPA chem	931960	01 Oct 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4,7,10)

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

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading	Uncertainty of pH measurement (\pm)	Coverage factor k
pH Electrode S/N.: 9X2E0223	4.008	4.031	160.0	0.0052	2.00
	6.865	6.870	-7.4	0.0087	2.00
	9.181	9.186	-142.0	0.014	2.00

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

-oOo-

Saithip

a 1188742



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



NSC-TS-1871725
CALIBRATION 6086

Cert.No.: 23CHO261
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
Calibration Place: Laboratory (Thai Environment Technic Limited)
Ambient Temperature: (30.2 - 31.3) °C (On-Site)
Relative Humidity: (37.7 - 36.1) % (On-Site)
Calibration Procedure: In -house method :
- CP-OCH3 : based on direct measurement by using certified reference material (CRM)

Calibrated by : Saithip Meangmai

Approved by : 
Approved Signatory

(/) Malee Butkruea
(/) Saithip Meangmai
(/) Warakorn Lemgagrakul

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



Cert.No.: 23CHO261

Page: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

1) Digital Thermometer
Serial No. 307901 ID No. 70RC137 Certificate No. 221236 Due date 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
1.413 mS/cm
Manufacturer CPA Chem
Lot No. 826595
Exp. date 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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Malu.

a 1158495



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ISO 17025:2017
CALIBRATION 0008

Cert.No.: 23MM160

Page: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : AB204

Serial No. : 1116392227

ID No. : TET.LAB.BAL01

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

Location : Balance Room

Received order : 10 April 2023

Calibration Date : 11 April 2023

Ambient Temperature : 15 °C to 40 °C

Relative Humidity : 30 % to 90 %

Calibrated by : Khit Rutlanaprapachai

Malu.

Approved by :

Approved Signatory

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

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

Range capacity : 0 g to 210 g Resolution 0.0001 g

Before Adjustment :

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

After Adjustment :

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

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



Equipment : Electronic Balance
Condition As-Received : 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 Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.14	2.11
0.01	0.0100	0.0000	0.14	2.11
0.1	0.1001	-0.0001	0.14	2.11
0.5	0.5000	0.0000	0.14	2.11
1	1.0001	-0.0001	0.14	2.11
5	5.0000	0.0000	0.14	2.11
10	9.9999	+0.0001	0.14	2.11
25	24.9998	+0.0002	0.15	2.07
50	49.9998	+0.0002	0.16	2.05
100	99.9999	+0.0001	0.18	2.00
200	200.0000	0.0000	0.29	2.00

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

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Valu.

a 1158499

Valu.

a 1158498



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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 : $(25 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Khit Ruttanaprapachai

Approved by : 
Approved Signatory

() Ponthippa Taneyakul
(x) Malee Butkruea
() Suwit Injai

Issue Date : 25 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0148OC-2

Cert. No.: 23TM673
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 34972A MY57013711 22LM93 02 Jul 2023

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

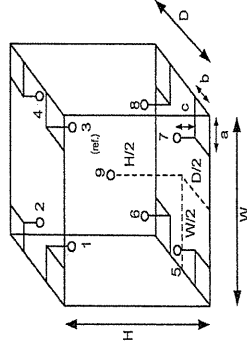
3. This certification is traceable to the International System of Unit

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

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



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm
D = 0.48 m
W = 0.50 m
H = 1.1 m
Capacity = 0.26 m³

Dimension of Chamber :

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



a 1158205

A 0053455



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2304-0146OC-2
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TMM73
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k				
20.0	19.8	19.7	0.54	0.37	1.1	2				
Measured Temperature (°C)										
Calibration Point (°C)	1	2	3	4	5	6	7	8	9 (ref.)	Uncertainty (±°C)
20.0	20.121	20.227	19.983	20.098	19.992	19.963	19.936	19.914	20.048	0.72

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

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

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.
UUC* : Unit Under Calibration

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

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

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Wale .

a 1158204



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NIST-TS1-TS17925
CALIBRATION 006

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: Used Item
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
Laboratory (Thai Environment Technic Limited)
Calibration Place : (30.8 - 31.1) °C (On-Site)
(50.2 - 50.7) % (On-Site)
Relative Humidity : In - house method :
Calibration Procedure : CP-OCH4 based on ASTM E 275-01
Calibrated by : Sathip Meangmai

Approved by : 
Approved Signatory

() Malee Bulkruea
() Sathip Meangmai
() Warakorn Lengagtrakul

Issue Date : 25 April 2023
The Uncertainties are for a confidence probability of approximately 95%

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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

Mdu.

a 1158494



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 %.

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Mdu.

a 1158493



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 100

Customer :	บริษัท เทคโนโลยีสิ่งแวดล้อมไทย	Date Tested:	29-ก.พ.-66
Address :	จำกัด	Recommendation Recertification	
	1/6 ซอยรามคำแหง 145,	Period	6 Months
	แขวงสะพานสูง, เขตสะพานสูง,	Recertification Due:	29-มี.ค.-67
	กรุงเทพมหานคร 10240 TH	Date Last Certified:	30-มี.ค.-66
User Name:	คุณ กิตติศักดิ์ เมืองงาม	Visit Number:	1 of 2
Phone:	02-3737799	TH ONE SOURCE Phone:	081-7316733, 082-1086572
E-mail:	phornvip.p@tet1995.com	E-mail:	thonesource@gmail.com
	ketsarin.c@tet1995.com		



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 100



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAAnalyst 100



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 100

Method Name: Cu Baseline Element: Cu

Method Description: Cu BL Noise

Date: 01/01/2002

Technique: Flame

Wavelength: 324.8 nm

Lamp Current: 15

Sample Info File: Untitled

Calibration Equation: Zero Intercept: Nonlinear

Slit Width: 0.70 nm

Energy: 72

Results Data Set:

Element: Cu Seq. No.: 2 AS Loc.: --- Date: 01/01/2002

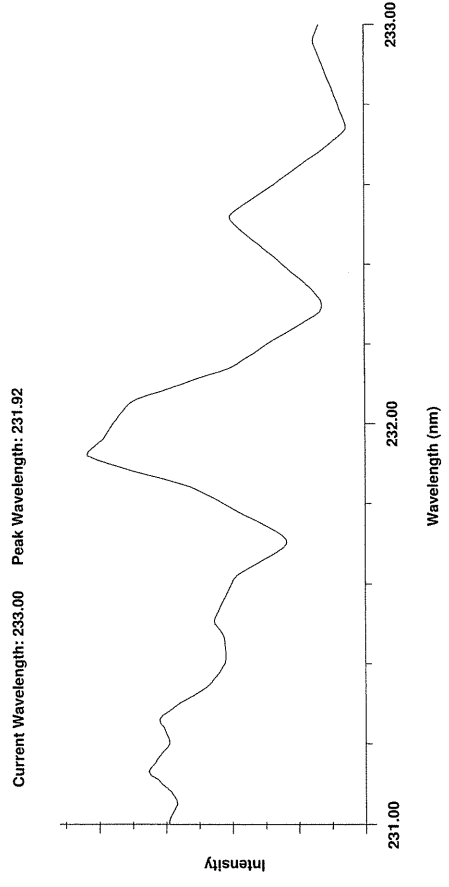
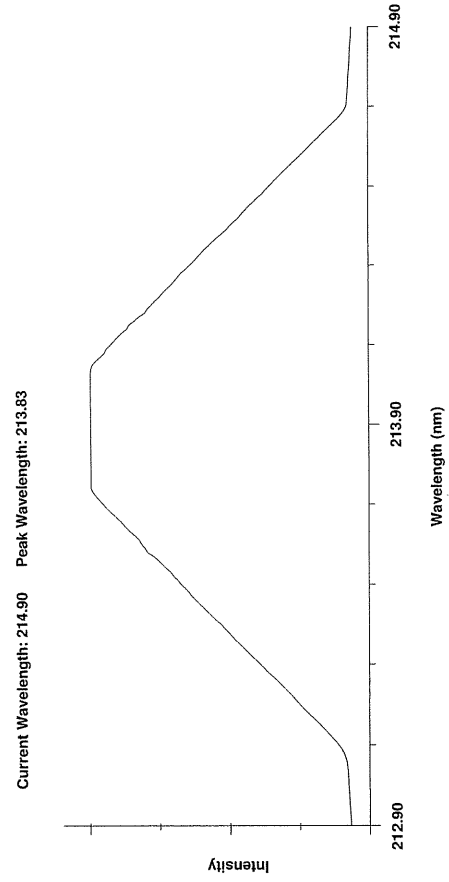
Sample ID: CU BLN Noise

Repl SampleConc StdConc BlkCorr Time

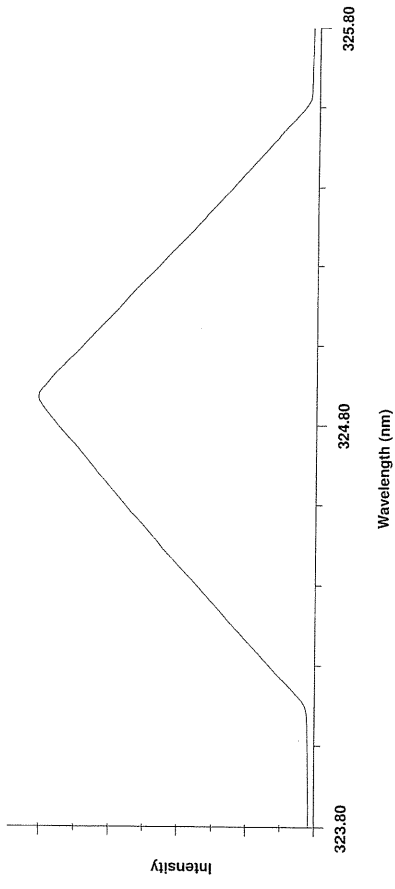
mg/L mg/L Signal

1	0.000	10:35:46	0.000
2	0.000	10:35:49	0.000
3	0.000	10:35:51	0.000
4	0.000	10:35:53	0.000
5	0.000	10:35:55	0.000
6	-0.001	10:35:57	0.000
7	-0.001	10:36:00	0.000
8	-0.002	10:36:02	0.000
9	-0.001	10:36:04	0.000
10	0.000	10:36:07	0.000
11	-0.001	10:36:09	0.000
12	0.001	10:36:11	0.000
13	0.001	10:36:13	0.000
14	0.001	10:36:15	0.000
15	0.001	10:36:17	0.000
16	0.000	10:36:19	0.000
17	-0.001	10:36:21	0.000
18	0.001	10:36:24	0.000
19	0.000	10:36:26	0.000
20	0.001	10:36:28	0.000
21	0.000	10:36:30	0.000
22	0.002	10:36:32	0.000
23	0.000	10:36:34	0.000
24	0.000	10:36:36	0.000
25	0.002	10:36:38	0.000
26	0.002	10:36:41	0.000
27	0.001	10:36:43	0.000
28	0.001	10:36:45	0.000
29	0.000	10:36:47	0.000
30	-0.001	10:36:49	0.000
31	-0.002	10:36:51	0.000
32	-0.001	10:36:53	0.000
33	-0.001	10:36:55	0.000
34	0.000	10:36:58	0.000
35	0.000	10:37:00	0.000
36	0.000	10:37:03	0.000
37	0.003	10:37:05	0.000
38	0.000	10:37:07	0.000
39	0.000	10:37:09	0.000
40	0.001	10:37:11	0.000
41	-0.001	10:37:13	0.000
42	-0.001	10:37:16	0.000
43	-0.002	10:37:18	0.000
44	-0.001	10:37:20	0.000
45	0.002	10:37:22	0.000
46	0.000	10:37:24	0.000
47	0.001	10:37:26	0.000
48	0.000	10:37:28	0.000
49	0.000	10:37:30	0.000
50	0.001	10:37:33	0.000
51	0.002	10:37:35	0.000
52	0.002	10:37:37	0.000
53	0.001	10:37:39	0.000
54	0.000	10:37:41	0.000
55	-0.001	10:37:43	0.000
56	0.001	10:37:45	0.000
57	0.001	10:37:47	0.000
58	0.000	10:37:50	0.000
59	0.001	10:37:52	0.000

60	0.001	10:37:54	0.001
61	0.000	10:37:56	0.000
62	0.001	10:37:58	0.000
63	0.000	10:38:00	0.000
64	-0.001	10:38:03	0.000
65	-0.002	10:38:06	0.000
66	-0.002	10:38:08	0.000
67	-0.001	10:38:10	0.000
68	-0.001	10:38:12	0.000
69	-0.002	10:38:14	0.000
70	0.000	10:38:16	0.000
71	0.000	10:38:18	0.000
72	0.000	10:38:21	0.000
73	0.000	10:38:23	0.000
74	-0.001	10:38:25	0.000
75	-0.001	10:38:27	0.000
76	0.002	10:38:29	0.000
77	0.000	10:38:31	0.000
78	0.000	10:38:33	0.000
79	0.002	10:38:36	0.000
80	0.001	10:38:38	0.000
81	0.000	10:38:40	0.000
82	0.001	10:38:42	0.000
83	-0.001	10:38:44	0.000
84	-0.001	10:38:46	0.000
85	-0.001	10:38:49	0.000
86	-0.002	10:38:51	0.000
87	-0.002	10:38:53	0.000
88	-0.001	10:38:55	0.000
89	-0.001	10:38:57	0.000
90	-0.001	10:39:00	0.000
91	0.000	10:39:02	0.000
92	-0.001	10:39:04	0.000
93	0.000	10:39:07	0.000
94	0.000	10:39:09	0.000
95	-0.001	10:39:11	0.000
96	-0.001	10:39:13	0.000
97	0.000	10:39:16	0.000
98	0.002	10:39:18	0.000
99	0.000	10:39:20	0.000
Mean:	0.000		
SD :	0.001		
%RSD:	4766.11		



Current Wavelength: 325.80 Peak Wavelength: 324.87



Method Name: Cu5ppm Element: Cu

Method Description: Cu 5 ppm

Date: 01/01/2002

Technique: Flame

Wavelength: 324.8 nm

Lamp Current: 15

Sample Info File: Untitled

Calibration Equation: Zero Intercept: Nonlinear

Slit Width: 0.70 nm

Energy: 72

Results Data Set:

Element: Cu Seq. No.: 3 AS Loc.: --- Date: 01/01/2002

Sample ID: Calib Blank

Repl	SampleConc	StdConc	BlankConc	Signal	Time
#	mg/L	mg/L			
1				11:30:33	
2				-0.011	11:30:46
3				-0.011	11:31:00
4				-0.011	11:31:14
5				-0.011	11:31:28
6				-0.011	11:31:43
7				-0.011	11:31:57
8				-0.012	11:32:11
9				-0.012	11:32:24
10				-0.012	11:32:38

Mean:

SD :

%RSD:

Auto-zero performed.

3.15

Element: Cu Seq. No.: 4 AS Loc.: --- Date: 01/01/2002

Sample ID: Copper 5 ppm

Repl	SampleConc	StdConc	BlankConc	Signal	Time
#	mg/L	mg/L			
1				0.275	11:33:12
2				0.275	11:33:26
3				0.274	11:33:40
4				0.274	11:33:54
5				0.274	11:34:08
6				0.276	11:34:23
7				0.275	11:34:37
8				0.275	11:34:50
9				0.274	11:35:04
10				0.274	11:35:18

Mean:

SD :

%RSD:

0.20



Certificate of Calibration

Certificate Number : SPR23010143-6
Page : 1 of 3
Customer : Thai Environmental Technic Limited.
1/6 Soi Ramkhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan Sung, Bangkok 10240, Thailand.

Equipment Name : DO Meter
Manufacturer : Horiba
Model : OM-71G
Serial Number : D75J0013
ID. Number : No.08

Environmental Conditions
Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ Received Date : 13 Jan 2023
Relative Humidity : $50\text{ \%} \pm 15\text{ \%}$ Calibration Date : 14 Jan 2023
Location of Calibration : In-Lab Recommend Due Date : 14 Jan 2024
Calibration Procedure : In-House Method Date of Issue : 15 Jan 2023

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by 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.Pitak Srisutam
Calibration Officer
Approved by :
(Ms.Bussakorn Chalkaew)
Authorized Signatory



Calibration Report

Certificate Number : SPR23010143-6
Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due Date
Zero Oxygen Solution	HI7040L	Lot. S0066/21	01524	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.: SPR23010143-6

Page : 3 of 3

Function : Dissolved Oxygen Permanance Test

Range	Actual Standard	UUC, Reading	Error	Uncertainty (±)
0-40	0.3	0.23	-0.07	0.13
	8.3	8.15	-0.15	0.13

Unit : mg/L

Note:

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

Measurement Uncertainty

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 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:	Used Item
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 :	 Approved Signatory
	(✓) Malee Butkruea () Saitip Meangmai () Warakorn Lerngagrakul
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.



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 (\pm 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

Wale

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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 0.5796 0.7105 1.0186	0.0000 0.5788 0.7095 1.0179	0.0028 0.0028 0.0028 0.0028	2.00 2.00 2.00 2.00
546.1	Zero 0.5281 0.6962 0.9984	0.0000 0.5258 0.6945 0.9956	0.0028 0.0028 0.0028 0.0028	2.00 2.00 2.00 2.00
635.0	Zero 0.5699 0.7606 1.0927	0.0000 0.5684 0.7590 1.0904	0.0028 0.0028 0.0028 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	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 %.

-o0o-

Wale

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MAINTENANCE REPORT AND TEST CERTIFICATE
OPTIMA 8000

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

CONFIGURATION TESTED	ACCESSORIES/COMPONENT NOT INCLUDED
MODEL OPTIMA 8000 S10	SERIAL NUMBER 078N1310024C
TESTED EQUIPMENT IPV Methods	CALIBRATION NUMBER
TEST STANDARD USED Mixed standard 1/10 Mixed standard 1/100	PART NUMBER N069-1579 N930-0221
CUSTOMER SUPPLIED 2 % HNO3 10 % HNO3	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 purgefilters.	OK
C. Recheck optical alignment.	OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	OK
B. Flush out the chiller every six months.	OK
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	OK
B. Wavelength Calibration.	OK



MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

SERIAL NUMBER : 078N1310024C		DATE TESTED : April 3, 2023	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	0.00702	
	Ni 231.604 nm	0.00790	
	Ni 341.476 nm	0.01192	
Spectral Resolution : VIS	Ba 455.403 nm	0.01500	
Precision	Zn 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	
	Ti 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	
BEC : Axial (IB X 1000)/(S-IB)	Ba 455.403 nm	3(SD) ppb	
	Ba 493.408 nm	3(SD) ppb	
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 30 ppb	
	Mn 257.610 nm	≤ 30 ppb	



MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

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

Remarks : _____
Commissioning follow as commissioning performance sheets.

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

☒ meets ☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department-PerkinElmer Ltd.

Authorized Representative : Wiphan Promlumda (Wiphan Promlumda)
Service Engineer

Align View XY Axial for analyte Mn 257.610

X-position Y-position

-2.0 15.0 2920926.2

-1.6 15.0 5581541.7

-1.2 15.0 6990827.7

-0.8 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 8850206.3

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 8902714.8

0.8 15.0 8341631.7

0.4 13.0 4448485.6

0.4 13.5 5980471.5

0.4 14.0 7205087.4

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

-7.0 15.0 23032.5

-6.5 15.0 27006.7

-6.0 15.0 35560.5

-5.5 15.0 57821.4

-5.0 15.0 90935.9

-4.5 15.0 136105.4

-4.0 15.0 206645.2

-3.5 15.0 299882.1

-3.0 15.0 428877.1

-2.5 15.0 589771.2

-2.0 15.0 706184.3

-1.5 15.0 841150.2

-1.0 15.0 1019788.8

-0.5 15.0 1329407.6

0.0 15.0 1381151.1

0.5 15.0 1426400.1

1.0 15.0 1309824.4

1.5 15.0 1099234.2

2.0 15.0 784376.5

2.5 15.0 574061.3

3.0 15.0 437455.8

3.5 15.0 324105.7

4.0 15.0 264022.3

4.5 15.0 193005.6

5.0 15.0 117089.3

5.5 15.0 70743.1

6.0 15.0 40927.8

6.5 15.0 27379.1

7.0 15.0 20863.3

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

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

Dilution: 3X Sample Prep Vol:
Wash Time:

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

Mean Data: IDL-RL (2% HNO3)				
Analyte	Mean Corrected Intensity	Conc. Units	Std.Dev.	Sample Conc. Units
As 193.696	-32.0	-0.0 mg/L	0.00	-35.2 µg/L
Zn 213.857	37.4	0.0 mg/L	0.00	0.7 µg/L
Mn 257.610	475.9	0.0 mg/L	0.00	0.9 µg/L
La 379.478	-36.3	-0.0 mg/L	0.00	-0.3 µg/L
Ba 455.403	26579.4	0.0 mg/L	0.00	9.5 µg/L
Ba 493.408	-20698.9	-0.0 mg/L	0.00	-9.8 µg/L
				Std.Dev. RSD
				2.60 7.40%
				0.26 35.07%
				1.49 168.85%
				1.12 350.55%
				2.86 30.09%
				9.64 98.34%

Method Loaded
Method Name: DURL-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
Logged In Analyst (Original) : TET
Initial Sample Wt:
Initial Sample Vol:
Sample Prep Vol:
Dilution:
Wash Time:

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	Calib Conc. Units
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
Logged In Analyst (Original) : TET
Initial Sample Wt:
Dilution:
Wash Time:

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	Calib Conc. Units
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
As 193.696	1	Lin, Calc Int	0.0	2731	0.00000
Zn 213.857	1	Lin, Calc Int	0.0	149800	0.00000
Mn 257.610	1	Lin, Calc Int	0.0	1616000	0.00000
La 379.478	1	Lin, Calc Int	0.0	340800	0.00000
Ba 455.403	1	Lin, Calc Int	0.0	8399000	0.00000
Ba 493.408	1	Lin, Calc Int	0.0	6332000	0.00000
				Corr. Coef.	Reslope
				1.000000	1.000000
				1.000000	1.000000
				1.000000	1.000000
				1.000000	1.000000
				1.000000	1.000000

Sequence No.: 3
Sample ID: IDL-RL (2% HNO3)
Logged In Analyst (Original) : TET
Initial Sample Wt:
Initial Sample Vol:

Autosampler Location:
Date Collected: 3/4/2566 11:19:52
Data Type: Reprocessed on 3/4/2566 11:32:52

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

Mean Data: IDI-XL (2# H2O2)			
Analyte	Mean Corrected Intensity	Calib. Conc. Units	Std.Dev.
AS 130.801	35.1	2 µg/L	1.24
TL 130.696	-14.0	-1 µg/L	1.42
Se 136.026	-6.5	-1 µg/L	0.96
Pb 220.353	-135.0	-2 µg/L	3.83

Logged In Analyst: TET
Technique: ICP Continuous

```
Results Data Set (original): PM3APR23
Results Library (original): C:\Users\Public\PerkinElmer\IPV\Results.mdb
Results Data Set (reprocessed):
Results Library (reprocessed):
```

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

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

Mean Data: Calib Blank 1			
Analyte	Mean Corrected Intensity	Std.Dev.	RSD
Tl 190.801	-113.3		
As 193.696	285.4		
Se 196.026	99.6		
Pb 220.353	1176.2		
	Conc.	Units	Calib
	[0.00]	µg/L	
	[0.00]	µg/L	
	[0.00]	µg/L	
	[0.00]	µg/L	

```

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

```

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

Mean Data: DL-Standard		Mean Corrected Intensity	Std.Dev.	RSD	Conc. Units	Calib.
Analyte					[1000]	$\mu\text{g/L}$
TL 190.801		19454.6			[1000]	$\mu\text{g/L}$
As 193.696		17563.5			[1000]	$\mu\text{g/L}$
Se 196.026		4574.6			[500]	$\mu\text{g/L}$
Pb 220.353		31327.5			[500]	$\mu\text{g/L}$

Calibration Summary						
Analyte	Stds.	Equation	Intercept	Slope	Curvature	Corr. Coef.
Pin 190.801	1	Lin, Calc Int	0.0	19.45	0.00000	1.000000
Pin 193.696	1	Lin, Calc Int	-0.0	17.56	0.00000	1.000000
Pin 196.026	1	Lin, Calc Int	0.0	9.149	0.00000	1.000000
Pin 220.353	1	Lin, Calc Int	0.0	62.65	0.00000	1.000000

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

Method: Resolution
Result: PM3APR23

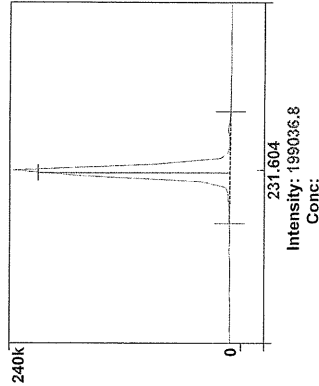
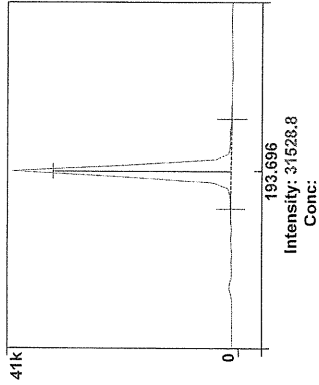
Spectra

Sample ID: Res (N069-1579/10)

As 193.696-Res

Rep: 3 | Ni 231.604-Res

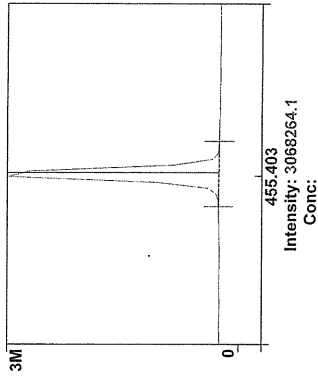
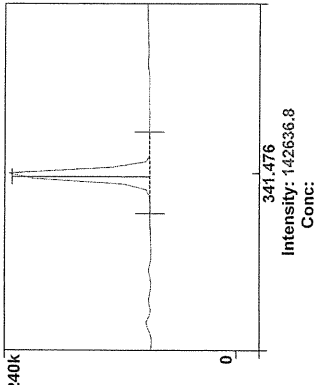
Rep: 3



1
Ni 341.476-Res

Rep: 3 | Ba 455.403-Res

Rep: 3



3

4

Method: Precision

Page 1

Date: 3/4/2566 11:12:20

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

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

Sequence No.: 4
Sample ID: RSD STD (N069-1579/10)
Analyst:
Initial Sample Wt:
Dilution:
Wash Time:

Autosampler Location:
Date Collected: 3/4/2566 11:02:43
Data Type: Original
Initial Sample Vol:
Sample Prep Vol:

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

Mean Data: RSD STD (N069-1579/10)
Analyte
Zn 206.200
Mg 280.271
Mg 285.213
Ba 455.403

Mean Corrected
Intensity
3275340.1
196113.7
7794526.3

Calib.
Conc. Units
Sample
Conc. Units

Std.Dev.
17093.12
23266.88
11109.46
80474.48

RSD
3.46%
0.71%
5.66%
1.03%

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

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

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

Mean Data: RSD STD (N069-1579/10)
Analyte
Zn 206.200
Mg 280.271
Mg 285.213
Ba 455.403

Mean Corrected
Intensity
515663.2
3404809.8
197460.0
8071203.3

Calib.
Conc. Units
Sample
Conc. Units

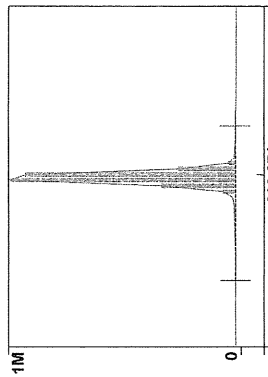
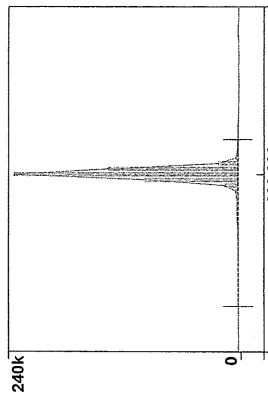
Std.Dev.
2890.08
43469.63
775.34
31631.19

RSD
0.56%
0.28%
0.39%
0.39%

Zn 206.200

Rep: 5 | Mg 280.271

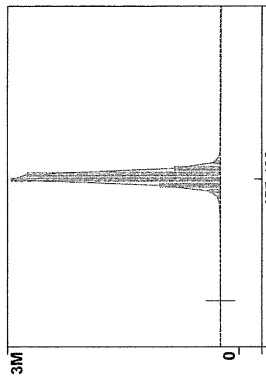
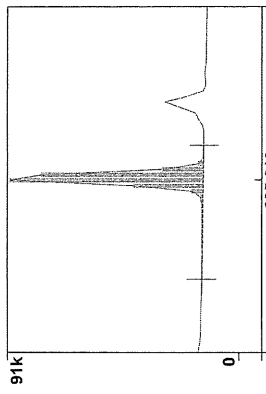
Rep: 5



Mg 285.213

Rep: 5 | Ba 455.403

Rep: 1



PerkinElmer TruQ Atomic Spectroscopy Standard

Certificate of Analysis

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

Certification Date: NOV -- 2021
Expiration Date: MAY 3 0 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM	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	3129a*	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.

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 errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and lashed, triple-insulated bottles. All glassware used is class A.



Certifying Officer:

Y. Smith

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PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N9300221
Description: Instrument Calibration Standard 4
Matrix: 5% HNO₃
Lot Number: 58-169CRY1

Certification Date: MAY -- 2022
Expiration Date: NOV 30 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	3168*	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 errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer:

Y. Lavish

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

Instructor:

Geoff Cook
Geoff Cook

Date: July 20, 2012

Certified by:
(Manager, Global Training Operations)

Paul Quinn



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 600

Customer : THAI ENVIRONMENTAL	Date Tested: 12-ก.ค.-66	
TECHNIC LIMITED.	Recommendation Recertification	
Address : 1/6 Soi Ramkhamheang 145, Khaeng/Khet Saphan Sung, Bangkok 10240	Period 6 Months	
	Recertification Due: 12-ก.ค.-67	
	Date Last Certified: 20-ก.ค.-66	
	Visit Number: 2 OF 2	
User Name: คุณ กนกวรรณ จันทร์ระชาญไทย	TH One Source Phone: 081-7316733	
Phone: 02-3937799		
E-mail: ketsarin.c@tet1995.com	thonesource@gmail.com	
admin@tet1995.com		

CONFIGURATION TESTED	SERIAL NUMBER	SOFTWARE
MODEL		
AAnalyst 600	600S5070101	AA WinLab32 Version 6.5
AS 800	801S5070102	
FIAS-100	2288	
TEST STANDARD USED	PART NUMBER	
GFAAS Mixed standard	N9300244	



MAINTENANCE REPORT

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

AAnalyst 600

SERIAL NUMBER	600S5070101	DATE TESTED	12-ก.ค.-66
1. INSTRUMENT CHECKS			
A. The Mirror and Lenses Condition			<input type="checkbox"/> OK
B. Grating Condition			<input type="checkbox"/> OK
C. Replace or Clean Dust Filter			<input type="checkbox"/> OK
D. Cleaning the Contact Cylinders			<input type="checkbox"/> OK
E. Cleaning the Furnace Windows			<input type="checkbox"/> OK
2. AUTOSAMPLE CHECK			
A. Sampling and Arm			<input type="checkbox"/> OK
B. Sampling & Rinse Pump			<input type="checkbox"/> OK
C. Sample Position & Clean			<input type="checkbox"/> OK
D. Clean or Replace the Hall Sensor			<input type="checkbox"/> OK
3. COOLING SYSTEM CHECKS			
A. Clean and Change Distill water			<input type="checkbox"/> OK
B. Thermosensor			<input type="checkbox"/> OK
4. FIAS CHECKS			
A. Pump and 5 Port Valve			<input type="checkbox"/> OK
B. Chemifold and Tubing			<input type="checkbox"/> OK
C. Power Supply			<input type="checkbox"/> OK
D. Flow meter and Gas system			<input type="checkbox"/> OK



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 600

SERIAL NUMBER	600S5070101	DATE TESTED	12-01-66	
PARAMETER		SPECIFICATION		ACTUAL VAULE
B. THGA Tests				
1. Furnace Gas Flows				
Internal Flow	250 ± 25 mL/min		235	mL/min
External Flow	100 ± 10 mL/min		110	mL/min
2. Chromium Baseline Noise (measure 5 furnace dry firings without any sample)				
	Baseline ≤ 0.005 Int.Abs		0.0015	Int.Abs
	SD ≤ 0.005 Int.Abs		0.0034	Int.Abs
3. Chromium Characteristic Mass(m_0) and Precision (measure 5 furnace firing using 20 ul sample injections of 10 ug/L Cr standard)				
	m_0 Results 6.5 pg ± 1.5 pg		6.0	pg
	Precision ≤ 2.0%		0.36	%
4. Copper Characteristic Mass(m_0) and Zeeman Ratio (measure 5 furnace firing using 20 ul sample injections of 25 ug/L Cu standard)				
	m_0 Results 17.0 pg ± 3.5 pg		14.2	pg
	Zeeman Ratio 0.58 ± 0.04		0.541	



MAINTENANCE REPORT
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL
AAAnalyst 600

SERIAL NUMBER	600S5070101	DATE TESTED	12-01-66	
Remarks :	Changed The Controller Bd. Atomizer (4 May 2015)			
Zeeman Ratio	=	Atomic Signal(peak area)		
		Atomic Signal(peak area)-Background Signal(peak area)		
This is to certify that the above tests have been performed and the configuration tested				
<input checked="" type="checkbox"/> meets <input type="checkbox"/> does not meet				
the PerkinElmer Specifications listed on this certificate.				
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.				
Service Department TH ONE SOURCE CO., LTD.				
<i>Krungchai J.</i>				
(Krungchai Treevichien)				
Customer Support Engineer				



Certificate of Training

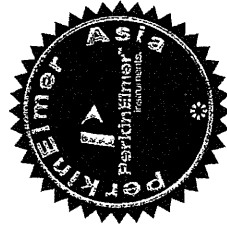
This is to certify that

Krungchai Treevichien

has successfully completed

Aanalyst 600/700/800 Service Training

09 to 13 February 2004



CS
CS Lim
Service Specialist

13 Feb 2004

WO-WO-02471695/



MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

Customer : บริษัท เทคโนโลยีสิ่งแวดล้อมไทย	Date Tested: September 29, 2023
Address : 1/6 ซอยรามคำแหง 145	Recommendation Recertification Period 6 Months
แขวงสะพานสูง เขตสะพานสูง กรุงเทพมหานคร 10240	Recertification Due: March 29, 2024
User Name: Khun Natapong	Date Last Certified: April 3, 2023
Phone: 02-3737799	Visit Number: 2 of 2
Fax:	PerkinElmer Phone: 02-719-6420 ext 203
	PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED	ACCESSORIES/COMPONENT NOT INCLUDED
MODEL OPTIMA 8000 S10	SERIAL NUMBER 078S1310024C
TESTED EQUIPMENT IPV Methods	CALIBRATION NUMBER
TEST STANDARD USED Mixed standard 1/10 Mixed standard 1/100	EXPIRATION DATE November 30, 2023 November 30, 2023
CUSTOMER SUPPLIED 2 % HNO3 10 % HNO3	CUSTOMER INITIALS

MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

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

1. MECHANICAL CHECKS

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

2. OPTICAL CHECKS

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

3. COOLING SYSTEM CHECKS

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

4. PERFORMANCE CHECKS

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

MAINTENANCE REPORT AND TEST CERTIFICATE OPTIMA 8000

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

PARAMETER SPECIFICATION FINAL VALUE

Spectral Resolution : UV	As 193.696 nm	≤ 0.009	0.00702
	Ni 231.604 nm	≤ 0.011	0.00790
	Ni 341.476 nm	≤ 0.015	0.01192

Spectral Resolution : VIS	Ba 455.403 nm	≤ 0.020	0.01500
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Precision	Zn 206.200 nm	% RSD < 1.0	0.60
	Mg 280.271 nm	% RSD < 1.0	0.36
	Mg 285.213 nm	% RSD < 1.0	0.67
	Ba 455.403 nm	% RSD < 1.0	0.72

Detection Limits : Axial	As 193.696 nm	3(SD) ppb	1.11
	Se 196.026 nm	3(SD) ppb	7.96
	Tl 190.801 nm	3(SD) ppb	0.05
	Pb 220.353 nm	3(SD) ppb	3.67

Detection Limits : Radial	As 193.696 nm	3(SD) ppb	0.28
	Zn 213.857 nm	3(SD) ppb	0.83
	Mn 257.610 nm	3(SD) ppb	0.07
	La 379.478 nm	3(SD) ppb	1.89
	Ba 455.403 nm	3(SD) ppb	0.08
	Ba 493.408 nm	3(SD) ppb	0.12

BEC : Axial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 30 ppb	15.70
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BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 30 ppb	23.89
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MAINTENANCE REPORT AND TEST CERTIFICATE

OPTIMA 8000

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

Remarks :

Commissioning follow as commissioning performance sheets.

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

<input checked="" type="checkbox"/>	<input type="checkbox"/>
meets	does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative : Wiphan Promlumda
(Wiphan Promlumda)
Service Engineer

PerkinElmer TruQ
Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N9300221

Description: Instrument Calibration Standard 4

Matrix: 5% HNO₃

Lot Number: 58-169CRY1

Certification Date: MAY -- 2022

Expiration Date: NOV 30 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 errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer: Y. Parikh

PerkinElmer

PerkinElmer, Inc.

U.S.A. Tel: 1-203-925-4600

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

PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N9300221
Description: Instrument Calibration Standard 4
Matrix: 5% HNO₃
Lot Number: 58-169CRY1

Certification Date: MAY -- 2022
Expiration Date: NOV 30 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	100 µg/mL	99.8 µg/mL	3103a*
Tl	100 µg/mL	98.4 µg/mL	3158*
Cd	50.0 µg/mL	50.0 µg/mL	3108*

* - indicates NIST SRM

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

Reference Multi: Lot# 57-156CR, 1-177YJ, 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 errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer: Y. Pavlich

PerkinElmer
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PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N0691579
Description: Multi-Element Standard
Matrix: 2% HNO₃
Lot Number: 58-146CRX1

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

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	49.3 µg/mL	3103a*
K	50.0 µg/mL	50.0 µg/mL	3141a*
La	10.0 µg/mL	9.91 µg/mL	3127a*
Li	10.0 µg/mL	9.95 µg/mL	3129a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*

* - indicates NIST SRM

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

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

Refer to side 2 for details of certification.

Balances are calibrated with weight sets traceable to NIST.
We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to ±0.5% of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value is the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer: Y. Pavlich

PerkinElmer
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PerkinElmer TruQ

Atomic Spectroscopy Standard

Certificate of Analysis

PerkinElmer Number: N0691579
Description: Multi-Element Standard
Matrix: 2% HNO₃
Lot Number: 58-146CRX1

Certification Date: MAY -- 2022
Expiration Date: NOV 30 2023

* Instrumental Analysis using ICP Spectrometer:

Analyte	Labeled	Measured	SRM	Analyte	Labeled	Measured	SRM
As	50.0 µg/mL	49.3 µg/mL	3103a*	Ni	10.0 µg/mL	9.89 µg/mL	3138*
K	50.0 µg/mL	50.0 µg/mL	3141a*	Sr	10.0 µg/mL	10.0 µg/mL	3153a*
La	10.0 µg/mL	9.91 µg/mL	3127a*	Zn	10.0 µg/mL	9.99 µg/mL	3168a*
Li	10.0 µg/mL	9.96 µg/mL	3129a*	Ba	1.00 µg/mL	0.996 µg/mL	3104a*
Mn	10.0 µg/mL	10.1 µg/mL	3132*	Mg	1.00 µg/mL	0.992 µg/mL	3131a*

* - indicates NIST SRM

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

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

Refer to side 2 for details of certification.

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 errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use high purity acids, ASTM Type I water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used is class A.

Certifying Officer: *Y. Parikh*

PerkinElmer
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PerkinElmer

Global Service Training Department
Service Engineer Certification

Wiphan Promlunda

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

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

Instructor:

Geoff Cook

Geoff Cook

Date: July 20, 2012

Certified by:

Andrey G. G. G.

(Manager, Global Training Operations)



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



NSC-T&T-17025
CALIBRATION 0006

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 : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Man Pattanapongpalboon

Approved by :
Approved Signatory

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

Issue Date : 25 April 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written

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

A 0053458



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-01460C-5

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

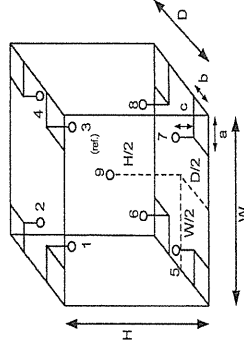
Instrument Model Serial No. Cert. No. Due Date
1) Data Acquisition 34970A MY41021843 22LM172 27 Dec 2023
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ($^\circ\text{C}$)	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 m^3

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

a 1158195



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

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

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

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.998	34.938	34.900	34.866	35.143	35.446	35.083	35.362	34.785	0.30
37.0	36.978	36.975	36.972	36.971	37.390	37.559	37.324	37.437	37.010	0.30
44.5	44.631	44.502	44.429	44.412	44.752	45.106	44.600	45.021	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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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10230
TEL: 0-2717-3000-29 FAX: 0-2719-9484



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

Certificate of Calibration

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

Approved by : 
Approved Signatory

(/) Ponthippa Tameyakul
(/) Malee Burkrua
() 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 1158194

A 0053457



Cert. No.: 23TM604
Page: 2 of 3

1

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:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>
1) Data Acquisition	34970A	MY41021843

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

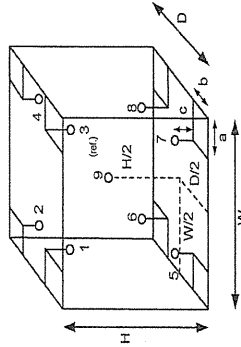
3. This certification is traceable to the International System of Unit.

Result of Calibration :-

Function of UUC* :

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	m ³

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

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a 1158197



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

Reference : 2304-01460C-4

Result of Calibration :-

Function of UUC* :

Fresh air setting :

Calibration	11004
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Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (%)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.085	0.32	0.67	2
41.5	41.5	41.5	0.032	0.49	0.63	2
44.5	44.5	44.5	0.036	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	41.900	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

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included liability 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 1158196



Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย 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	:	109698

Calibration Date 21 / 07 / 66

Calibration By ASIM

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

 \sqrt{n}

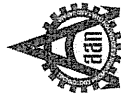
: SD = Standard deviation

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

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.



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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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 Sol 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 :
Khrit Rutlanaprapachai

Approved by : Mali.

Approved Signatory

() Pornthippa Tameyakul

(✓) Malee Butkruea

() Suwit Imjai

Issue Date : 25 April 2023

25 April 2023

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

- Reference standard Instruments:-

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

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

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

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (\pm mg)	Coverage Factor (k)
80	79.99946	+0.00054	0.15	2.00
200	199.9984	+0.0016	0.30	2.00

After Adjustment :

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

Applied Weight (g)	Standard Deviation of Reading (g)	
	80	200
80	0.000023	0.000008
200	0.000023	0.000008

Wala.

a 1156497



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	Position 2	Position 3	Position 4	Position 5	maximum difference between off-center and central loading (g)
(g)	(g)	(g)	(g)	(g)	
-0.0001	-0.0001	-0.0002	-0.0001	0.0000	
					0.0001

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (\pm mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.038	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 %.

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Wala.

a 1158496



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

Calibrated by: Jim Lin

- 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: AWA14425-52235
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.): 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)	16.1 dB(Z)
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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 _{max} -L _A	L _{max} -L _A	L _A -L _A	L _{max} -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	Positive half		Negative half	
	nominal value	nominal value	nominal value	nominal value	
LCpeak-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
LAeq,T	103.2	103.2	0.0

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	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	2979405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
Signal generator	DS 340	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 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



SCARLET TECH



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

Calibrated by:

Jim Lin

- 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 then, 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

4. Measuring up limit: 140 dBA

3. Adjustments to indicated sound levels:

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

6. Self-generated noise

Microphone replaced by electrical input signal device

7.7 dB(A)	8.4 dB(C)	13.9 dB(Z)
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7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.2
Rate of the S weighting decrease (dB/s)	4.2
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 _{1max} -L _A	L _{1max} -L _A	L _A -L _A	L _A T-L _A
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-18.0	-26.9	-26.9	-7.0
10	-27.2	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	nominal value	Negative half	nominal value
LCpeak-LC(dB)	3.4	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	76.9	76.8	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	2929405	2024-12-15	NWL
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
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 SMP004-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



SCARLETT TECH

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

Calibrated by:

Jim Lin

- 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 surpasses 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 Scarlett Tech Co Ltd Taiwan.

1. Preliminary inspection:

OK

2. Type & serial No. of Microphone:

AWA14425-52756

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
31.5	-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	-6.5	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

6. Self-generated noise

Microphone replaced by electrical input signal device

10.8 dB(A)	10.3 dB(C)	15.8 dB(Z)
------------	------------	------------

7. F&S Weighting

Rate of the F weighting decrease (dB/s)	35.1
Rate of the S weighting decrease (dB/s)	4.1
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 _{50ms} -L _A	L _{50ms} -L _A	L _{50ms} -L _A	L _{50ms} -L _A
500	0.0	-4.0	-2.9	-7.0
200	-1.0	-7.4	-6.9	-7.0
50	-16.0	-26.9	-26.9	-7.0
10	-27.1	/	-36.0	-7.0

10. Peak C sound level (500Hz) :

Cycle	One cycle	nominal value	Positive half	Negative half	nominal value
L _{Cpeak-L} (dB)	3.4	3.5	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	76.9	76.8	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	2929405	2024-12-15	NMIL
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
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 SMTPO04-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. 20230113117

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	870877
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2023-02-01
Due Date:	2024-01-31

Calibrated by:



Jim Lin

- 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 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: AWA14435-57377

4. Measuring up limit: 140 dBA

3. Adjustments to indicated sound levels:

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	-14.2	-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	-28.2	-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

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L _{Aeq,T}	103.2	103.2	0.0
L _S	110.8	110.8	0.0
L ₁₀	108.8	108.8	0.0
L ₅₀	92.9	92.8	0.1
L ₉₀	76.9	76.8	0.1
L ₉₅	75.0	74.9	0.1

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

Environment conditions:

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

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NML
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CGISMEC
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 SMTF004-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. 20230113118

Name of Product:	Sound Level Meter
Model:	ST-11D
Serial Number:	8X0978
Specification:	Class 1
Conclusion:	Pass
Date of calibration:	2023-02-01
Due Date:	2024-01-31

Calibrated by:

Jm Lin



- This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surplus then, and applies only to the unit identified above.
- 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: AWA14425-5531Q

4. Measuring up limits: 140 dBA

3. Adjustments to indicated sound levels:

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	-71.2	-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

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L _{eq,T}	103.2	103.2	0.0
L ₅	110.8	110.8	0.0
L ₁₀	108.8	108.8	0.0
L ₅₀	92.9	92.8	0.1
L ₉₀	76.9	76.8	0.1
L ₉₅	75.0	74.9	0.1

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

Environment conditions:

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

Reference equipment used in the calibration:

Description:	Model	Serial No.	Expiry Date	Traceable To
Microphone	B&K 4191	2929405	2024-12-15	NMIL
Multi function sound calibrator	B&K 4226	2288444	2024-10-15	CIGISMEC
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 SLP-004-CA-152.
- The reference were performed using an electrical signal substituted for the microphone which was removed and replaced by an equivalent capacitor within a tolerance of ±20%.
- The acoustic calibration was performed using 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. 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

Calibrated by:

Jim Lin



- 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 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.

- Preliminary inspection: OK
- Type & serial No. of Microphone: AWA14425-16240
- 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	-71.2	-14.3	-0.3	1000	0.0	0.0	-0.1
20	-50.2	-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	-0.4	-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	0.1	-0.1	16000	-11.5	-13.6	0.1
500	-3.2	0.0	-0.1	20000	-23.8	-25.9	-0.1



Certificate of Calibration

Certificate Number : SPR23030020-1 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 : 220100056
ID Number : No.36

Environmental Conditions

Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ 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 : 06 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 NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

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

Calibrated by : Mr. Karoon Pengsalung
Calibration Officer

Approved by :
(Mr. Prayoon Topat)
Authorized Signatory

Items	Measured value/dB	Theoretical calculated value/dB	Error/dB
L _{Aeq,T}	103.2	103.2	0.0
L _S	110.8	110.8	0.0
L _{L0}	108.8	108.8	0.0
L ₅₀	92.9	92.8	0.1
L ₉₀	76.9	76.8	0.1
L ₉₅	75.0	74.9	0.1

Uncertainty of measurement results: 0.1 dB (k=2)

Environment conditions:

Air temperature: $20\text{ }^{\circ}\text{C}$
Relative humidity: 50%
Static pressure: 101.8 kPa

Reference equipment used in the calibration:

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

Test specifications:

- All Scairet's Sound level Meter has been calibrated in accordance with the requirements as specified in ISO 17025 and the lab calibration procedure SMTPO04-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 420K.
- The acoustic calibration was performed using an B&K 4226 sound calibrator and corrections was applied for the difference between the free-field and pressure responses of the Sound Level Meter.

References:

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



Calibration Report

Certificate Number : SPR23030020-1

Page : 2 of 3

Reference Standards

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

Traceability

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



Result of Calibration

Certificate No. : SPR23030020-1

Page : 3 of 3

Range : 94 to 114 dB Function : @1kHz

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

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

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



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Certificate of Calibration

Certificate Number : SPR23030020-3
Customer : Thai Environmental Technic Limited.
1/6 Soi Rankhamhaeng 145, Khwaeng Saphan Sung, Khet Saphan
Sung, Bangkok 10240, Thailand.

Page : 1 of 3

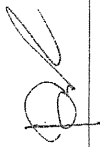
Equipment Name : Noise Dose Meter
Manufacturer : SOUNDTEK
Model : ST-130
Serial Number : 220100057
ID. Number : No.37

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C
Relative Humidity : 50 % ± 15 %
Location of Calibration : In-Lab
Calibration Procedure : SP-CPE-04-01
Received Date : 01 Mar 2023
Calibration Date : 07 Mar 2023
Recommend Due Date : 07 Mar 2024
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
Approved by : 
(Mr. Prayoon Topart)
Authorized Signatory

SP-FM-04-15 rev.0



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Calibration Report

Certificate Number : SPR23030020-3

Page : 2 of 3

Reference Standards

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

Traceability

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



Result of Calibration

Certificate No. : SPR23030020-3

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	113.9	113.9	-0.1	-0.1	0.15

Note:

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

Measurement Uncertainty

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

– End of Certificate –



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

NISC-TS17025
CALIBRATION 8008

Certificate of Calibration

Certificate No. : 23H554

Page : 1 of 2

Equipment : Thermal Environment Monitor
Manufacturer : JANITYTECH
Model : JT2011-EZA
Serial No. : 3522210141
ID No. : HD 3
Condition As-Received: Used Item
Received Date : 03 March 2023
Calibration Date : 09 March 2023
Reference : to 13 March 2023
Ambient Temperature : 2303-0118DSC
Relative Humidity : (25 ± 3) °C
(50 ± 20) %

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

Submitted by: 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-H03 according to comparison with
standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Handheld Thermometer With Sensor	1521	ASA339	221251	12 Oct 2023
2) The certificate is valid only to the item calibrated on date and place of calibration.				
3) This Certificate is traceable to the International System of Unit maintained at:-				

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Chakrit Waewanjua
Issue Date : 17 March 2023

Approved Signatory :

[] Chakrit Waewanjua
[] Ponthipha Taneyakul
[x] Viporn Tantiyawutti



Cert. No.: 23H554
Page.: 2 of 2

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for Ta

Standard Temperature	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.021	19.7	-0.321	0.42
29.990	29.7	-0.290	0.42
40.012	39.8	-0.212	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for Tnw

Standard Temperature	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.021	19.8	-0.221	0.42
29.990	29.7	-0.290	0.42
40.012	39.7	-0.312	0.42

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement for Tg

Standard Temperature	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.021	19.9	-0.121	0.42
29.990	29.7	-0.290	0.42
40.012	39.7	-0.312	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%.

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



Certificate of Calibration

Certificate No. : 23H560
Page : 1 of 2

Equipment : Thermal Environment Monitor
Manufacturer: JANTYTECH
Model : JT2011-EZA
Serial No.: 3522210147
ID No.: HD 9
Condition As-Received: Used Item
Received Date: 03 March 2023
Calibration Date: 09 March 2023 to 13 March 2023
Reference: 2303-0118DSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %
Submitted by: Thai Environmental Technic Limited
116 Soi Ramkhamhaeng 145, Khwaeng/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	1521	ASA339	2211251	12 Oct 2023
2) The certificate is valid only to the item calibrated on date and place of calibration.				
3) This Certification is traceable to the International System of Unit maintained at:-				
-National Institute of Metrology Thailand (NIMT)				

Calibrated by : Chakrit Waewanjua
Issue Date : 17 March 2023

Approved Signatory :

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

B 0310141



Result of Calibration:-

Function:

Without Adjustment
Temperature Measurement for T_a

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.011	19.9	-0.111	0.42
30.009	29.9	-0.109	0.42
40.030	39.8	-0.230	0.42

Result of Calibration:-

Function:

Without Adjustment
Temperature Measurement for T_{hw}

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.011	20.0	-0.011	0.42
30.009	29.9	-0.109	0.42
40.030	39.6	-0.430	0.42

Result of Calibration:-

Function:

Without Adjustment
Temperature Measurement for T_g

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.011	20.0	-0.011	0.42
30.009	29.9	-0.109	0.42
40.030	39.7	-0.330	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%.

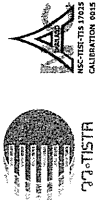
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Cert. No.: 23H560

Page.: 2 of 2

1153228

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Request No. : 22-66 / 0597

MTC No. : PSL-P 0152 / 66

CERTIFICATE OF CALIBRATION

Nomenclature : Digital Lux Meter

Serial No. : Q066345

Maker : DIGICON

Model : LX-50

Customer : THAI ENVIRONMENTAL TECHNIC LIMITED

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

Date of receipt : 7 June 2023

Date of calibration : 19 June 2023

Place of calibration : Photometry and Temperature Standards Laboratory, MTC. (Bangpoo)

Basis of calibration : calibration at 0 ~ 5000 lux.

Condition of calibration :- Ambient temperature : (25 ± 2) °C

- Relative humidity : (60 ± 20) %

Reference Standard : Working Standard Luminous Intensity Lamp, Serial No.: FEL003 and 3501,

can be traceable to international system of units (SI), through calibration certificate

MTC No. PSL-P 131/66 and PSL-P 132/66, date of calibration 12 May 2023.

Traceability : This certificate is traceable to SI units through the National Institute of Metrology (Thailand)

calibration certificate No. TP-1010-23, TP-1011-23 and TP-1012-23

Support Equipment :

1. Photometric bench, 3.0 meter long

2. DC power supply, Serial No.: BC - 341006035007/2

3. Digital Multimeter, Model : R 6551, S/N : 92041186 and 92041192

Calibration Procedure : The measurement was done in accordance with WICP.10.

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

page 1 of 2

R.P.

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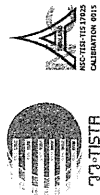
Office/Laboratory

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PM.BLMTC.002 Rev.4



73-TISTR

73-TISTR

Request No. : 22-66 / 0597

Serial No. : Q066345

Results :

UUC Range (lux)	Standard (lux)	*UUC Reading (lux)	Uncertainty of Measurement \pm (lux)
2000	100	103	2.3
	500	506	11
	1000	1006	22
	1500	1506	33
	2000	1999	44
20000 ($\times 10$)	2000	201	50
	3000	302	70
	4000	403	90
	5000	502	110
	2000	19	80
50000 ($\times 100$)	3000	29	90
	4000	38	110
	5000	47	130

Note : *UUC = Unit Under Calibration.

...end of certificate...

Calibrated by :

Rattana Wadde
(Ms. Rattana Wadde Pholprom)

Approved by :

Mr. Kamchat-Singhapivat
Director
Photometry and Temperature Standards Laboratory

Ref. : 201226000702194001

Issued date : 21 June 2023

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FM.BLMTC.002 Rev.4

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 Saphaung, 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 : $(23 \pm 3) ^\circ\text{C}$

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

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

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

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

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

Date of Receipt : 10 Jan. 2023

Date of Calibration : 16 Jan. 2023

1/3

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

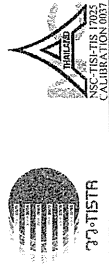
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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch 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	±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	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Date of Calibration : 16 Jan. 2023

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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit 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	±2.0%

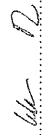
3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	2.60	± 0.60	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :  (Mr. Weerachai Deechaiyae)

Approved by :

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Jan. 2023

Date of Issue : 18 Jan. 2023

Ref : 201126601100062001

End of Certificate

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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			
31	ACO	6226	110098	94.0	94.0	94.0	94.0	0.0	PASS
32	ACO	6226	110105	94.1	94.1	94.1	94.0	0.1	PASS
33	ACO	6226	110096	94.1	94.1	94.1	94.0	0.1	PASS
34	ACO	6226	110099	94.2	94.2	94.2	94.0	0.2	PASS
35	ACO	6226	110097	93.7	93.7	93.7	94.0	0.3	PASS
36	ACO	6226	110102	94.1	94.1	94.1	94.0	0.1	PASS
37	ACO	6226	110101	94.2	94.2	94.2	94.0	0.2	PASS
38	ACO	6226	110106	93.9	93.9	93.9	94.0	0.1	PASS
39	ACO	6226	110104	93.9	93.9	93.9	94.0	0.1	PASS
40	ACO	6226	110100	93.9	93.9	93.9	94.0	0.1	PASS

Calibration By :

Approve by : 





Thai Environmental Technic Limited
บริษัท เทคโนโลยีสิ่งแวดล้อมไทย จำกัด

Sound Level Meter Calibration Report

Equipment Type : Sound Level Meter
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			
61	ACO	6226	160205	94.0	94.0	94.0	94.0	0.0	PASS
62	ACO	6226	160211	94.0	94.0	94.0	94.0	0.0	PASS
63	ACO	6226	160212	94.0	94.1	94.1	94.0	0.1	PASS
64	ACO	6226	160213	94.0	94.1	94.1	94.0	0.1	PASS
66	ACO	6226	160215	94.0	93.7	93.7	94.0	0.3	PASS
67	ACO	6226	160216	94.0	94.1	94.1	94.0	0.1	PASS
68	ACO	6236	222036	94.0	93.9	93.9	94.0	0.1	PASS
69	ACO	6236	222037	94.0	94.1	94.1	94.0	0.1	PASS
70	ACO	6236	222038	94.0	94.1	94.1	94.0	0.1	PASS
71	ACO	6236	222039	94.0	94.0	94.0	94.0	0.0	PASS
72	ACO	6236	222040	94.0	94.0	94.0	94.0	0.0	PASS

Calibration By :

Approve by : 

