

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ

Certificate of Calibration

Method 5 Pre-Test Calibration - Liters (L)

UUT Meter Console Information

Model #: XC-572V
Serial #: 0509047
DGM Model #: SK25EX
DGM Serial #: 0008967

Calibration Conditions

Bar. Pressure (mm Hg): 757.4
Ambient Temperature (°C): 25.6
Relative Humidity (%): 65
Altitude (m): 1.50
Bar. Pressure Corr. (mm Hg): 757.3

Calibration Reference

Work No.: SVO28131 Calibration No.: SA2023001

Reference Equipment

WTM Model: W-NK-5B Serial No.: 546321
Gamma: 0.9976 Cal. Due: 24-Mar-24
Thermometer: FLUKE714 Serial No.: 9038005

Judgment : **Pass** According to note :

Factors/Conversions

Std. Temp. (K): 298.15
Std. Press. (mm Hg): 760
K₁ (K/mm Hg): 0.3923

UUT Meter (DGM)

Reference Meter (WTM)

Run Time (seconds)	Orifice, ΔH (mm H ₂ O)	Volume			Meter Temperature (°C)		Meter Pressure (mm H ₂ O)	Volume (L)			Outlet Temperature (°C)	
		Initial (L)	Final (L)	Total (L)	Initial	Final		Initial	Final	Total	Initial	Final
Θ	P _{m(g)}	V _{mi}	V _{mf}	V _m	t _{mi}	t _{mf}	P _w	V _{wi}	V _{wf}	V _w	t _{wi}	t _{wf}
900	13.00	1595.5	1768.5	173.0	27.0	27.0	0.8	450528.64	450696.43	167.8	24.9	24.8
600	25.00	1786.6	1945.4	158.8	27.0	27.0	1.4	450713.99	450869.84	155.9	24.8	24.7
480	50.00	1955.4	2138.1	182.7	27.0	27.0	2.4	450878.62	451058.57	180.0	24.7	24.6
420	80.00	2159.8	2365.3	205.5	27.0	27.0	3.6	451079.10	451280.70	201.6	24.6	24.5
300	120.00	2382.2	2560.5	178.3	27.0	27.0	5.2	451297.17	451472.46	175.3	24.5	24.5

Standardized Data

Calibration Results

Reference Meter (L)		UUT Meter (L)		Correction Factor		ΔH @ (mm H ₂ O)	
Std. Vol.	Std. Flow	Std. Vol.	Std. Flow	Value	Variance	0.0212 SCMM	Variance
V _{w(std)}	Q _{w(std)}	V _{m(std)}	V _{w(std)}	Y	ΔY	ΔH@	ΔΔH@
167.20	11.15	171.45	11.1	0.9752	-0.0112	47.5	1.671
155.58	15.56	157.56	15.6	0.9875	0.0011	47.1	1.251
180.14	22.52	181.71	22.5	0.9914	0.0050	45.3	-0.549
202.48	28.93	204.98	28.9	0.9878	0.0014	44.3	-1.538
176.77	35.35	178.53	35.4	0.9901	0.0037	45.0	-0.835
				0.9864	= Y Avg.	45.9	= ΔH@ Avg. (Metric)

Note1 : For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

Note2 : For ΔH_g, orifice pressure differential that equates to 0.0212m³/min at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

บริษัท สิทธิพรบอสโซซิเอต จำกัด
SITHIPORN ASSOCIATES COMPANY LIMITED

Calibrator : _____

Signature : _____

Date : 09/Feb/24

The instruments listed and described on this certificate have been calibrated against standards traceable to the National Institute of Standards and Technology (N.I.S.T.) and in reference to EPA Method 5, Section 10.3.1.

Calibration Certificate Appendix

METHOD 5 PRE-TEST CONSOLE CALIBRATION

SITHIPORN
Calibration No.: **SA2023001**

UUT Meter / Console Information

Model #: XC 572-V Serial number: 0509047
DGM Model #: SK25EX Serial number: 0008967

Check the Diagnosis

Check the system before calibrating.

	Not Passed	Passed
-Visual instrument normalcy	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-Electrical and Temperature Systems	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-Inclined Manometer with Systems	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-Pressure Gauge	<input type="checkbox"/>	<input checked="" type="checkbox"/>
-Leak Check	<input checked="" type="checkbox"/> Vacuum : Pass	<input checked="" type="checkbox"/> Pressure : Pass
<input checked="" type="checkbox"/> PM and Calibration	<input type="checkbox"/> Repairing before Calibration	

Nomenclature

Pb - Barometric Pressure
DGM - Dry Gas Meter
K₁ - Constant based on standard temp and press
Θ - Run time, in minutes
P_m - ΔH (Meter Pressure, gauge)
V_m - Volume collected by test meter, corrected for STP
Q_{m(std)} - Calculated flow rate of test meter
K' - Critical orifice coefficient
P_w - Measured pressure of reference meter
t_w - Temperature measured in reference meter
t_m - Temperature measured in test meter
Y - Ratio of volume collected from test meter and orifice

Equations

$$K_1 = \frac{T_{std}}{P_{std}}$$

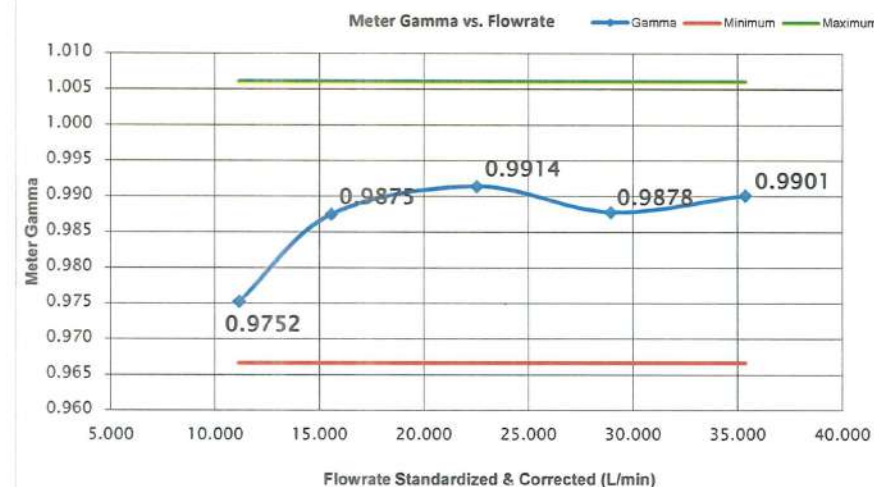
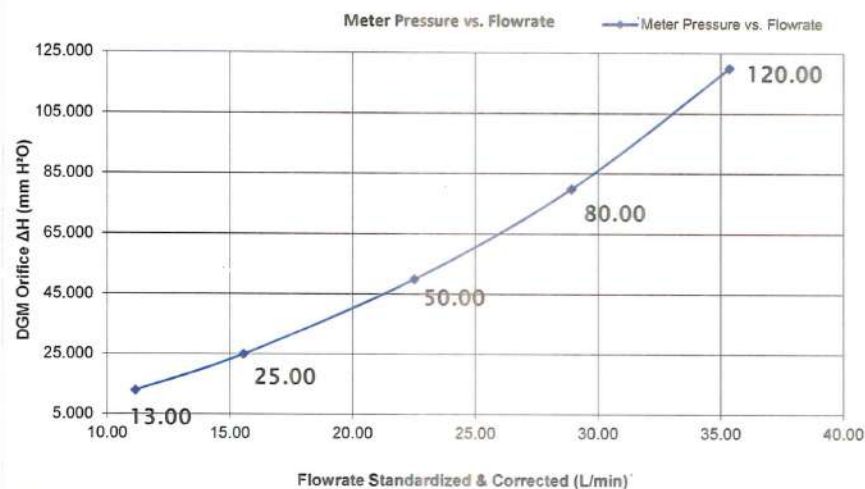
$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{\frac{T_w}{13.6}}$$

$$V_{m(std)} = \frac{K_1 V_m (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m}$$

$$Y = \frac{V_{w(std)}}{V_{m(std)}} \quad Q_{w(std)} = \frac{V_{w(std)}}{\Theta}$$

$$Metric \Delta H_0 = \frac{P_{m(g)} * 0.0011696 * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m} * \left(\frac{T_w * \Theta}{V_w * P_{bar}} \right)^2$$

Calibration Graphs



Console Sensor Audit QA Sheet

Meter Console Information (UUT)

Model #: XC-572V
Serial #: 0509047
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 30.00
Humidity (%): 65%
Amb. Temp. (°C): 25.6
Altitude (m): 100.0
Corrected Pbar (mm. Hg): 29.90

Calibration No. : SA2023001

Work No. : SVO28131

Reference Devices

TC Calibrator Model: FLUKE 714
Serial No.: 9038005
Digital Manometer Model: Dwyer DPGA-00
Serial No.: 721

Audit Data

Reference Point	Reference Temp.	Console Thermocouple Audit						Reference Point Status ¹
		Aux	Stack	Probe	Oven	Filter	Exit	
#	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	26.5	27	27	27	27	27	27	PASS
Acceptance criteria		3.0°C, 5.4°F	1.50%	3.0°C, 5.4°F			1.0°C, 2.0°F	

Reference Thermocouple ID:

90728323

Ref Point	Reference Temp.	DGM Thermocouple Sensor Reading	ΔTabs4	Maximum	Reference Status (±1%)
#	°C	°C	°C	%	Pass/Fail
Ice Water	1.2	1	0.07%	0.08%	PASS
Ambient	25.6	26	0.08%		

Internal temperature thermocouple is not audited to EPA standards, and should not be used as an official reference for ambient temperature.

Console Vacuum Audit			
Reference Point	Reference Vacuum	Console Vacuum	Reference Point Status ³
#	mm. Hg	mm. Hg	Pass/Fail
1	25.37	25.00	PASS

Notes

¹For valid test results, the maximum difference between test and reference readings should be: temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

³For valid test results, the maximum difference between console and reference vacuum readings should be less than 0.5 in. Hg (12.5 mm Hg)

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SITHIPORN ASSOCIATES COMPANY LIMITED

Signature: _____

Date: 09/Feb/24

I certify that the above Thermocouple, Barometric, and Vacuum Sensors were calibrated and audited in accordance with US EPA Methods, CFR 40 Part 60.

Certificate of Calibration

Method 5 Console Sensor Calibration - Metric Units

page: 1/1

Console Information

Model #: XC-572V
Serial #: 0509047
Units: Metric

Calibration Conditions

Pbar (mm. Hg): 757.40
Humidity (%): 65
Tamb (°C): 25.6
Elevation (m): 1.5
Corr. Pbar (mm. Hg): 757.40

Calibration Reference

Calibration No.: SA2023001
Work No.: SVO28131
Reference Devices
TC Calibrator Model: FLUKE 714
Serial No.: 9038005

Temperature Sensors Calibration Data

Reference Temp.		Test Thermocouple Calibrations						Reference Point Status ²
		Aux	Stack	Probe	Oven	Filter	Exit	
Point	°C	°C	°C	°C	°C	°C	°C	Pass/Fail
1	-18	-17	-17	-18		-17	-17	PASS
2	38	38	38	38		38	38	PASS
3	93	94	94	94		94	94	PASS
4	149	151	150	150		150	150	PASS
5	260	261	261	261		261		PASS
6	371		374					PASS
7	482		484					PASS
8	593		595					PASS
9	816		821					PASS
10	1038		1051					PASS
		±3.0°C, 5.4°F	1.50%	±3.0°C, 5.4°F	±3.0°C, 5.4°F	±3.0°C, 5.4°F	±1.0°C, 2.0°F	PASS

Overall Audit Status

DGM Temperature Sensor

Ref Point	Reference Temp.	DGM Thermocouple Sensor Reading	Δt_{abs}	Maximum	Reference Status ² (±1%)
#	°C	°C	°C	%	Pass/Fail
Ice Water	1.2	1	0.07%	0.08%	PASS
Ambient	25.6	26	0.08%		

Temperature Controller

Heater Controller	Reference Measure	XC-572V	Deviated to set point	ΔT_{abs}	Temp. Controller Status ³
Set point	(μ)	Thermometer		±3%	
120 °C	°C	°C	°C	°C	Pass/Fail
Probe	115	117	-2	0.52%	PASS
Filter	116	117	-1	0.26%	PASS

Notes

¹ Suggested, minimum reference points are 100, 200, 300, 500, 700, 900, 1100, 1500, 1900 (°F). can test for more.

² For valid test results, the maximum difference between test and reference readings should be temperature from the reference reading and the exit thermocouple which should be less than 2°F (1 °C) from the reference reading (EPA Method 2, Section 6.3 and EPA Method 5, Sections 6.1.1.7-6.1.1.8)

³ Heater control acceptance limit Temperature can be maintained at 120 °C ±14 °C, ±57 °F within ±1.5% (°C) at a flow rate of 20 lpm.

Signature: _____

Date: 09/Feb/24

I certify that the above Thermocouple Sensors were calibrated in accordance with US EPA Methods 2 and 5, CFR 40 Part 60.

Nozzle Calibration

Nozzle Information

Manufacturer Apex
Type Stainless Steel
Identification _____

Calibration Conditions

Bar. Pressure (mm Hg): 757.4
Ambient Temperature (°C): 25.6
Relative Humidity (%): 65

Calibration Reference

Calibration No.: SA2023001
SITHIPHORN
Work No.: SVO28131
Units: Metric

Reference Equipment

Vernier, 0-250mm 0.01 mm increments model Mitutoyo

Serial No

3038570

Cal No.:

L202310355-0001

Cal. due:

07/Nov/24

Calibration Method

Follow the USEPA Method 5 nozzle size calibration procedure. (ref. 40 CFR PART 60).

Calibration Result

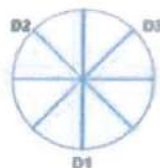
ID No.	Sizes	measured every 60° nozzle			(D ₁ + D ₂ + D ₃) / 3	Different ≤ 0.100 mm.	
	mm.	D ₁	D ₂	D ₃	D _{avg}	I	Judgment
4	3.1	3.01	2.98	3.01	3.000	0.030	PASS
5	3.9	3.89	3.90	3.89	3.893	0.010	PASS
7	5.3	5.38	5.34	5.38	5.367	0.040	PASS
8	6.2	5.95	6.00	5.94	5.963	0.060	PASS
9	7.1	7.18	7.19	7.19	7.187	0.010	PASS
12	9.4	9.35	9.36	9.43	9.380	0.080	PASS
16	12.6	12.35	12.45	12.30	8.217	0.050	PASS

Where :

D₁, D₂, D₃ = There difference nozzle diameters at 60 degrees to each other,
each measured to the nearest 0.025 mm or 0.001 inch

Δ D = Maximum difference between any two diameters, must be ≤ 0.100 mm or 0.004 inch

$$D_{avg} = (D_1 + D_2 + D_3) / 3$$



Signature _____

Date : 09/Feb/24

Sampling Probe and Pitot validation

Sampling Probe Information

Manufacturer: Apex
Probe Type: SS, 3ft
Probe No.:
Pitot tube Type: S Type 3/8 Inc.
Pitot tube No.: A10664

Calibration Conditions

Bar. Pressure (mm Hg): 757.4
Ambient Temperature (°C): 25.6
Relative Humidity (%): 65
Units: Metric

Calibration Reference

Calibration No.: SA2023001
Work No.: SVO28131

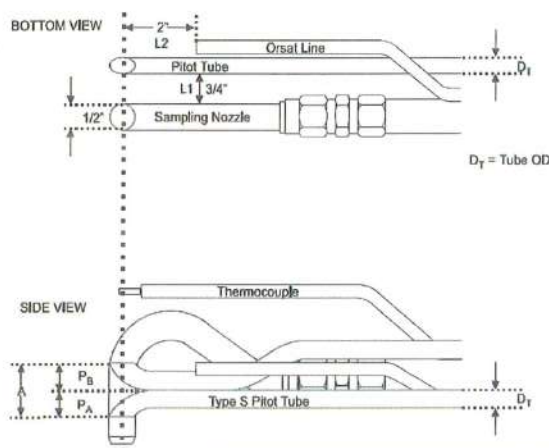
Reference Devices

- Vernier, 0-250mm 0.01 mm increments
Model: Mitutoyo, ID No.: EPD1-VER-57-1-CEN-01

Validation method : Follow the USEPA Method 5 pitot tube (S type) calibration procedure. (ref. 40 CFR PART 60).

Sampling Probe Validation with Tune up

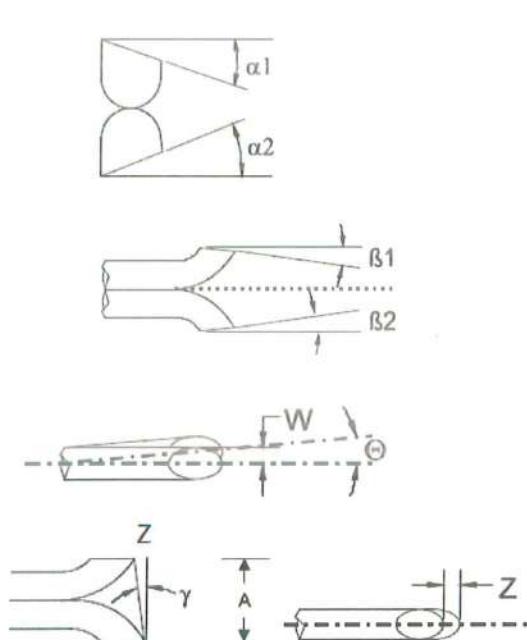
☐ : Measuring and aligning with 1/2" sample nozzle(12.7 mm)



	Measured	Acceptance Standard
$L_1 =$	18.86 mm	(19.05 mm. or 0.75 in.)
$L_2 =$	45.53 mm	(50.8 mm. or 2.0 in.)
$D_T =$	9.55 mm	(9.525 mm., 0.375 in.)
$A =$	21.67 mm	($2.1 D_T \leq A \leq 3D_T$)
$A/2D_T =$	1.135	($1.05 P_A / D_T \leq A \leq 1.5$)

Pitot Tube Validations and Engles measurement Result

☐ : Measure results after maintenance and adjustments.



P_B Size		Acceptance of correctness
$\alpha_1 =$	1.85 °	$\leq 10^\circ$
$\beta_1 =$	0.95 °	$\leq 5^\circ$
P_A Size		
$\alpha_2 =$	1.25 °	$\leq 10^\circ$
$\beta_2 =$	1.10 °	$\leq 5^\circ$

Engles measurement	Calculated Result	Acceptance Criteria
$W =$	0.75 °	0.292 mm
		$W < 0.0794 \text{ mm. (0.03125 in)}$
$Z =$	1.55 °	0.586 mm
		$Z < 3.175 \text{ mm. (0.125 in.)}$

Can be use 0.84 for $C_p(s)$ if the type of face-opening misalignmnet show above with not affect the base line value of $C_p(s)$
Solong as standard range.

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SITHIPORN ASSOCIATES COMPANY LIMITED

Signature: _____

Date: 09/Feb/24

Certificate of Calibration

Certificate No. : 67-200064-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance
Manufacturer : AND Model : FX-2000i
Serial No. : 15639789 ID No. : MET-EB03/61
Capacity : 2200 g Resolution : 0.01 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (25.8 to 26.0) °C
Relative Humidity : (60.8 to 61.2) %
Air Pressure : 1012.0 mbar

Date of Received : 22 February 2024

Date of Calibration : 22 February 2024

Date of Issue : 23 February 2024

Calibrated by :

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
F181-F1821	67-210021-1	29 Jul 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by :

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200064-2

Page : 2 of 2

Result of Calibration : After Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

Nominal Value (g)	Correction (g)	Uncertainty \pm (g)	Error before Adjustment (g)
200	0.00	0.010	0.00
500	0.00	0.011	0.01
600	0.00	0.011	0.01
700	0.00	0.011	0.02
800	0.00	0.011	0.02
1000	0.00	0.011	0.03
1200	0.00	0.012	0.04
1500	0.00	0.012	0.05
2000	-0.01	0.014	0.08
2200	-0.01	0.023	0.09

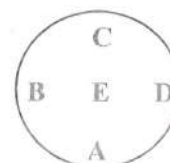
This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 500 g

A	B	C	D	E	
0.00	-0.01	-0.02	-0.01	0.00	g



Repeatability

Load test : 2000 g
Stdev. : 0.004 g

- o0o -





Certificate of Calibration

Equipment:	SPECTROPHOTOMETER	Certificate No.:	C06240454
Model:	SP-2100	Issued Date:	16 October 2024
Serial No. (or ID.):	KJ0G05083001 (MET-SP 01/46)	Job No.:	WO-00045898
Manufacturer:	HACH	Page:	1 of 2
Condition:	In Condition		

Customer: M E T CO.,LTD.
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand.

Environment Condition:

Temperature	26.1	°C	±	0.2	°C
Humidity	67.3	%RH	±	2.1	%RH

Calibration Place: M E T CO.,LTD. (Laboratory Room)
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand.

Calibration By: Mr.Nattapat Rungrueang

Calibration Date: 16 October 2024

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 113620 and 113619

The standard for Photometric Certificate No. 113650



Person in charge



Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 4 nm and UUC at 4 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
334.22	335	-0.78	0.59
418.48	419	-0.52	0.59
536.90	536	0.90	0.59
637.94	637	0.94	0.59
748.28	748	0.28	0.59
879.70	879	0.70	0.59

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.007	-0.0070	0.0045
	0.5797	0.579	0.0007	0.0045
	0.7119	0.714	-0.0021	0.0045
	1.0124	1.015	-0.0026	0.0045
440 nm	0.0000	0.001	-0.0010	0.0045
	0.5634	0.564	-0.0006	0.0045
	0.7001	0.704	-0.0039	0.0045
	0.9955	1.002	-0.0065	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5239	0.523	0.0009	0.0045
	0.6613	0.660	0.0013	0.0045
	0.9395	0.941	-0.0015	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5212	0.518	0.0032	0.0045
	0.6977	0.692	0.0057	0.0045
	0.9927	0.985	0.0077	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5548	0.552	0.0028	0.0045
	0.7732	0.767	0.0062	0.0045
	1.1021	1.093	0.0091	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5621	0.560	0.0021	0.0045
	0.7629	0.758	0.0049	0.0045
	1.0873	1.081	0.0063	0.0045

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

DKSH Technology Limited

2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00045898

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: SP-2100

หมายเลขเครื่อง: KJ0G05083001

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
16 Oct 2024			16 Oct 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Service Engineer



บริษัท เอ็ม อี ที จำกัด MET Company Limited

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ. นนทบุรี 11110

36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	November 10, 2024
บริเวณโรงเรียนเทศบาลดอนหัวฟ่อ 1				Start Time	10:15 AM
Sampler Number	TSP No.9	Transfer Standard Type	Onifice	Stop Time	10:20 AM
Motor Serial Number	BL-09	Calibrator Model	TE-5025A	Person	
Recorder Serial Number	-	Calibrator Serial Number	1		

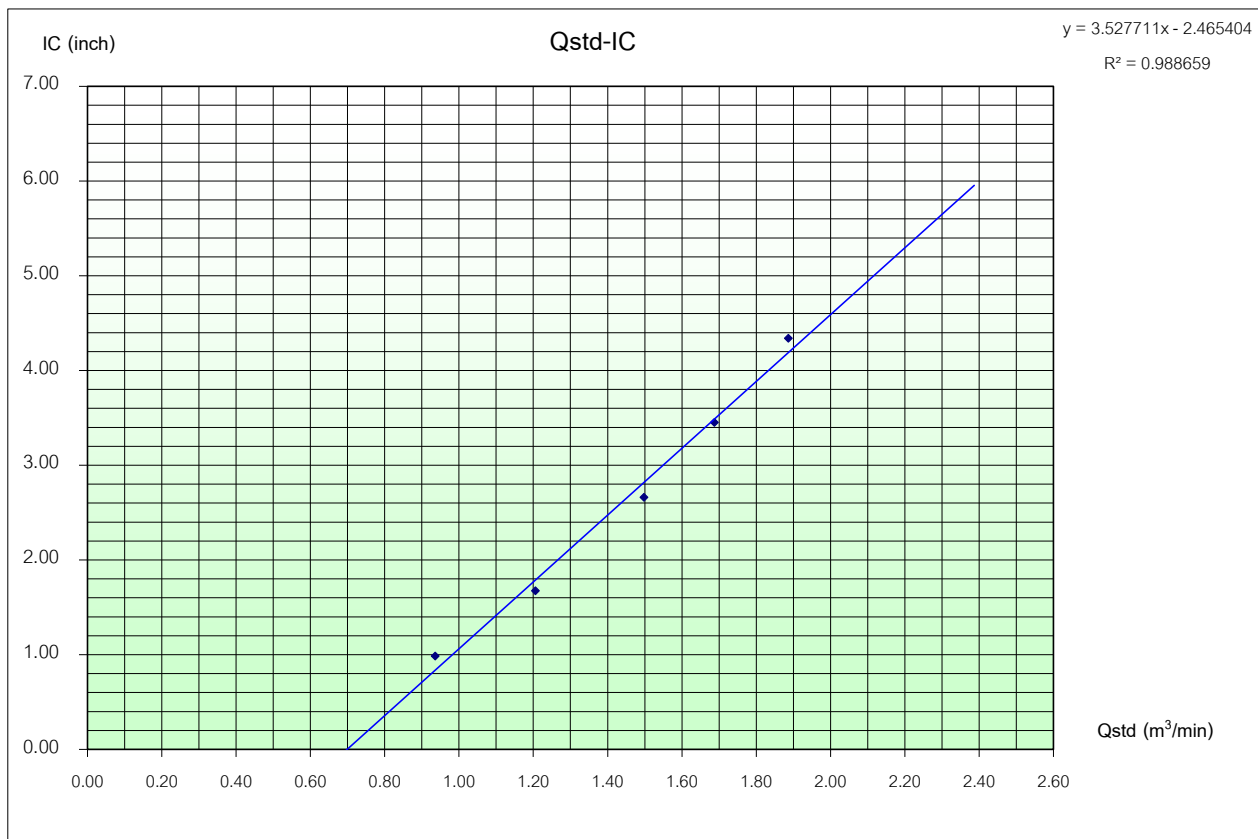
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop
	Positive	Negative	ΔH_2O	$[\Delta H_2O(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m^3/min)	Sample Flow Rate Indication (inch)	$IC = I[(Pa/P_{std})(T_{std}/T_a)]^{1/2}$	($^{\circ}K = ^{\circ}C + 273$)	Pressure (mmHg)	Meter	Meter
5	1.7	1.7	3.4	1.81903	0.93616	1.0	0.99	305.0	757.0		
7	2.8	2.8	5.6	2.33450	1.20555	1.7	1.68	305.0	757.0		
10	4.3	4.3	8.6	2.89300	1.49744	2.7	2.66	305.0	757.0		
13	5.4	5.5	10.9	3.25696	1.68765	3.5	3.45	305.0	757.0		
18	6.8	6.8	13.6	3.63805	1.88681	4.4	4.34	305.0	757.0		

Linear Regression Y ON X : $Y = mX + b$

1	Slope (m)	1.91345	Linear Equation		Average	305.0	757.0		
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m^3/min)	1.133	r^2	0.9857	Pstd(mmHg)	760.0	
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	r	0.99282425	T_{NTP}	298.0	
Result							$C = (Pa/P_{std})(T_{std}/T_a)$	0.973192407	
							$C = (Pa/P_{std})(T_{std}/T_a)^{0.5}$	0.986505148	

COMMENT

Andersen Instruments, Inc.



Calibrated By

Field Environmental

Division Manager



บริษัท เอ็ม อี ที จำกัด MET Company Limited

36/659 หมู่ 6 ต.บางรักพัฒนา อ.บางบัวทอง จ. นนทบุรี 11110

36/659 Moo 6 Tambol Bangrakpattana Amphur Bangbuatong Nontaburi 11110

Tel : 0 2920 1458-9 Fax : 0 2920 1460 E-mail : met_jj@yahoo.com

PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	November 10, 2024
บริเวณโรงเรียนเทศบาลดอนหัวฟ่อ 1				Start Time	1:45 PM
Sampler Number	PM-10 No.5	Transfer Standard Type	Onifice	Stop Time	1:50 PM
Motor Serial Number	HVL-05	Calibrator Model	TE-5025A	Person	Mr.Jirayut Seehabut
Recorder Serial Number	-	Calibrator Serial Number	1		

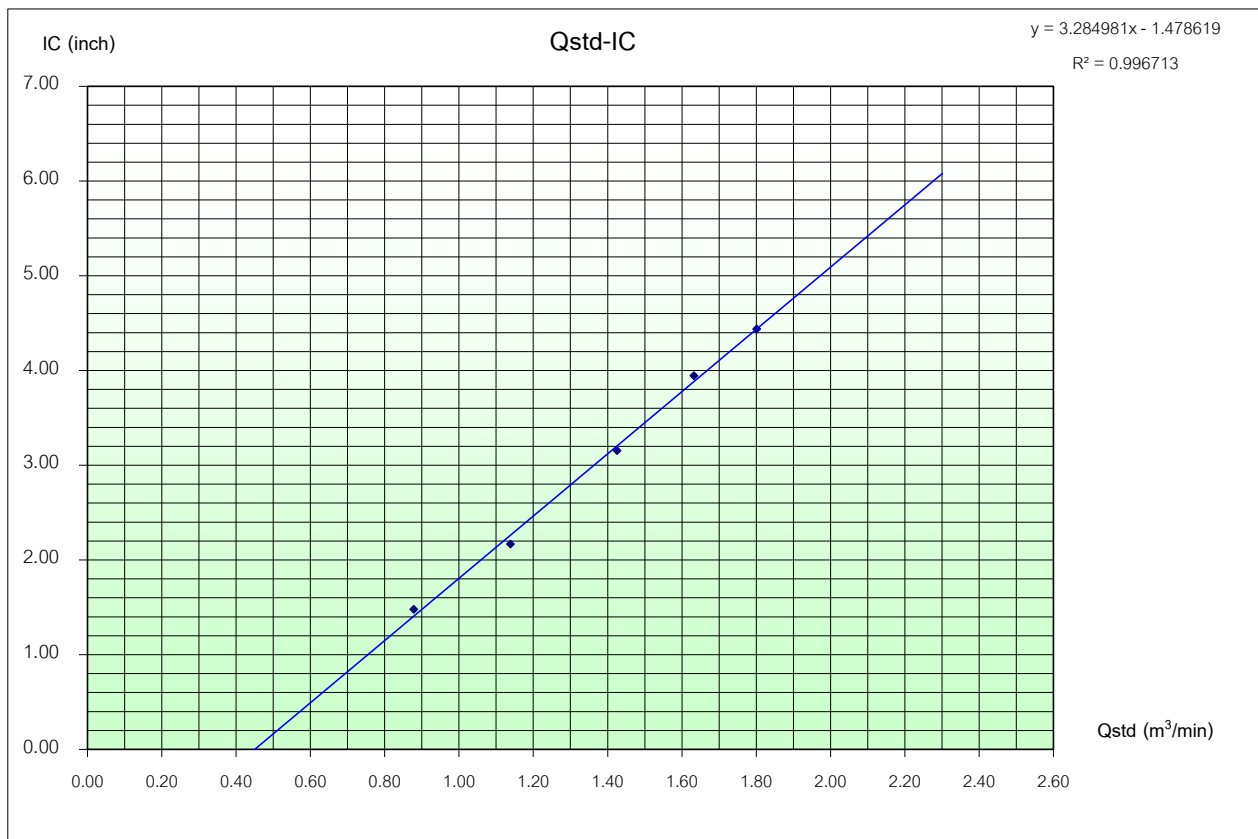
Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Positive	Negative	ΔH_2O	$[\Delta H_2O(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	$Q_{std} = (1/m)[(A-b)]$ (m^3/min)	sample Flow Rate Indication (inch)	$IC = I[(Pa/P_{std})(T_{std}/Ta)]^{1/2}$	(°K = °C+273)	(mmHg)		
5	1.5	1.5	3.0	1.70868	0.87849	1.5	1.48	305.0	757.0		
7	2.5	2.5	5.0	2.20589	1.13834	2.2	2.17	305.0	757.0		
10	3.9	3.9	7.8	2.75516	1.42540	3.2	3.16	305.0	757.0		
13	5.1	5.1	10.2	3.15064	1.63209	4.0	3.95	305.0	757.0		
18	6.2	6.2	12.4	3.47384	1.80099	4.5	4.44	305.0	757.0		

Linear Regression Y ON X : $Y = mX + b$

1	Slope (m)	1.91345	Linear Equation		Average	305.0	757.0		
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m^3/min)	1.133	r^2	0.997347	Pstd(mmHg)	760.0	
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (I)	0	r	0.99867262	T_{NTP}	298.0	
Result							$(Pa/P_{std})(T_{std}/Ta)$	0.973192407	
							$C = (Pa/P_{std})(T_{std}/Ta)^{0.5}$	0.986505148	

COMMENT

Andersen Instruments, Inc.



Calibrated By

(Mr.Jirayut Seehabut)
Field Environmental

(Mr.Jarung Jamnongbut)
Division Manager



บริษัท เอ็นไวร์ เซอร์วิส จำกัด

บริษัท เอ็นไวร์ เซอร์วิส จำกัด
ENVIR SERVICE CO., LTD.

42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201

42 Raminthra 14 yeak 9, Tha Rang, Bangkhen, Bankok 10230 Tel : 02-9435814-5 Fax : 02-9438201

Analyzer Performance Test

Calibrated Date: 10 November 2024

Instruments Information

Analyzer Type: SO2 Analyzer Model: 43C	Manufacturer Thermo Environmental S/N: 43C-33500-719
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Calibration System

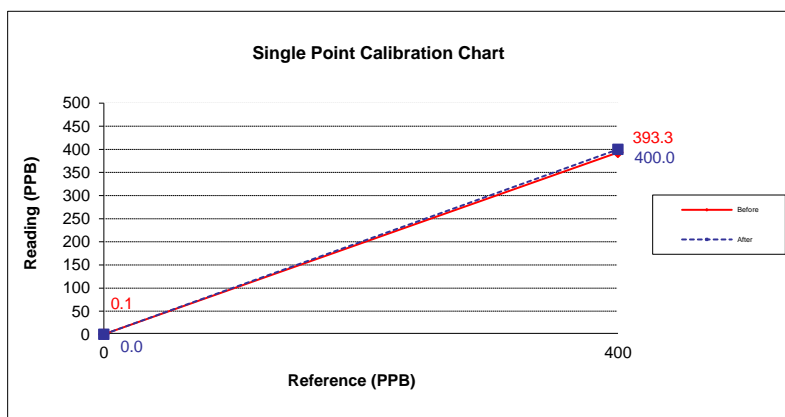
Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API MODEL 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

Humidity: 51 %RH

Calibration Report

Status	Zero			Span		
	Reference (PPB)	Reading (PPB)	Drift (PPB)	Reference (PPB)	Reading (PPB)	Drift%
Before	0.0	0.1	0.1	400.0	393.3	-1.7
After	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :

M

Analyzer Performance Test

Calibrated Date: 10 November 2024

Instruments Information

Analyzer Type: NO/NO2/NOx Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 42C-33500-371
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Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008 S/N: 705 ZERO AIR Generator API Model 701 S/N: 1924	NO Conc 55.47 PPM SO2 Conc 55.11 PPM CO Conc 4,535 PPM Cylinder number EB0129027 Expire Date: 29 Oct. 2027

Environment: Temperature 25.5 °C

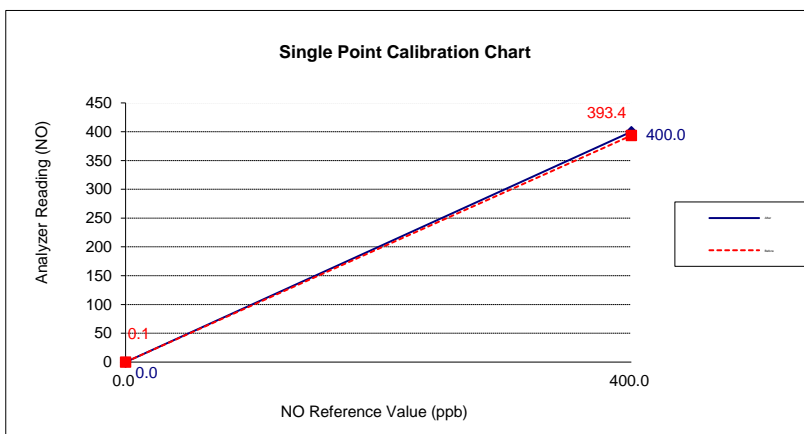
Humidity: 51 %RH

Calibration Check (Before adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.1	0.0	0.1	393.4	400.0	-1.7
NOx	0.1	0.0	0.1	396.7	400.0	-0.8

Calibration Check (After adjust)

GAS	Zero			Span		
	Reading Value (ppb)	Expected Value (ppb)	Drift (ppb)	Reading Value (ppb)	Expected Value (ppb)	Drift%
NO	0.0	0.0	0.0	400.0	400.0	0.0
NOx	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By :





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 11 March, 2024

Certification No. 112/24

Page : 1 of 2

Object : Weather Station

Manufacturer : Davis Instruments

Type : Weather Monitor III

Serial No. : WC60322A19A

Customer : M E T Company Limited.
36/659 Moo 6 Bangrak Phthana,
Bang Bua Thong, Nonthaburi 11110.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1012.5 hPa

NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

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

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)
Serial Number 110730029 (sensor 120629586)

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

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Mr. Pisood Promsut

(Authorised Signatory)

for the Chief

Sub-Standard Instrument





THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 112/24

11 March, 2024

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	0.9	0.10
3.02	-	-	-	2.7	0.32
5.00	-	-	-	4.9	0.10
7.00	-	-	-	6.7	0.30
9.02	-	-	-	9.0	0.02
11.01	-	-	-	10.7	0.31
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by :



Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau





National Institute of Metrology (Thailand)

Certificate of Calibration

Certificate No. : AA-2019-24
Issued by : Acoustics Laboratory
Acoustics and Vibration Group



Page 1 of 5 pages

MEASUREMENT ITEM : Sound Calibrator

MANUFACTURER : RION

MODEL/TYPE : NC-75

SERIAL NUMBER : 34480442

CUSTOMER : MET Co., Ltd.
36/659, Moo 6, T.Bangrakphatthana, A.Bangbuathong,
Nonthaburi 11110

MEASUREMENT DATE : 17 July 2024

The reported measurement result relates only to the measurand and applies only at the time of measurement.

*The calibration results only marked with an asterisk * in this certificate are not included in the scope of accreditation.*

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%. This calibration certificate may not be reproduced other than in full except with the permission of the Director of National Institute of Metrology (Thailand).

Reference
AUVCI32-01/24

Date
24 July 2024

Authorized Signatory

Person in charge

(Anusorn Tonmueanwai)

(Surat Leeudomwong)

This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

National Institute of Metrology (Thailand)

Ministry of Higher Education, Science, Research and Innovation

3/4-5 Moo 3, Klong 5, Klong Luang, Pathumthani 12120, Thailand. Tel: (66) 2577 5100, Fax: (66) 2577 3659
75/7 Rama VI Road, Rachathewi, Bangkok 10400, Thailand. Tel: (66) 2354 3700, Fax: (66) 2354 3692



UNCERTAINTY OF MEASUREMENT

The stated uncertainty is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor $k=2$. It has been determined in accordance with EA publication EA-4/02 M:2022 "Evaluation of the Uncertainty of Measurement in Calibration" and JCGM 100:2008 "Evaluation of measurement data --Guide to the Expression of Uncertainty in Measurement (GUM 1995 with minor corrections)". The value of the measured lies within the assigned range of value with a probability of 95 %.

Parameter	Uncertainty at SPL94 dB	Maximum-permitted uncertainty of measurement for a coverage probability of 95%	Unit
1.Sound Pressure level	0.07	0.15	dB
2. Frequency	0.1	0.2	%
3. THD+N	0.1	0.5	%

TRACEABILITY

This certificate provides traceability of measurement to recognized national standards, and to the realization of the International System of Units (SI).

NIMT



ENVIRONMENTAL CONDITIONS

Ambient condition in the laboratory are as follows :

Temperature : (23.0 ± 1.0) °C
Pressure : (101.325 ± 1.500) kPa
Relative Humidity : (50.0 ± 15.0) %

Reference Condition : 101.325 kPa , 23.0 °C and 50.0 %RH.

Calibration Condition

Preconditionings : 16 hours at ambient conditions.
Measurement Conditions : The average values during measurement are
 (99.947 ± 0.036) kPa, (22.5 ± 0.3) °C and (49.3 ± 2.1) %RH

MEASUREMENT METHOD

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone. The insert voltage technique was employed and the measurement procedure was based on IEC 60942-2017.

Reference Microphone

4180 serial no.1395446

TABULATION OF RESULTS

The following tables give the calibration results and associated measurement uncertainties at 95% of confidence level. The calibration results of sound pressure level which quoted in dB with reference to 20 µPa are corrected to the values under the reference environmental conditions.

The calibration results exclude the calibrator pressure correction but include the microphone volume correction, which was obtained from the manufacturer instruction manual of the sound calibrator, at the level of 0 dB.

MEASUREMENT RESULTS

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value ^[1] (dB)	Acceptance Limit ^[2] (dB)
Microphone 4180 Serial No.1395446			
94	94.18	0.18	± 0.25

Note ^[1] : The deviated value is the absolute value of the difference between the measured value and the corresponding specified sound pressure level.

Note ^[2] : The acceptance limit is obtained from IEC 60942: 2017.

2. Frequency*

Specified Frequency (Hz)	Measured value (Hz)	Deviated value ^[3] (%)	Acceptance Limit ^[4] (%)
At the sound pressure level of 94 dB			
1000	1000.0	0.0	± 0.7

Note ^[3] : The deviated value is the absolute value of the difference in percent between the measured value and the corresponding specified frequency.

Note ^[4] : The acceptance limit is obtained from IEC 60942: 2017.



3. Total distortion + Noise*

Microphone 4180 Serial No.1395446

Measured value ^[5] (%)	Maximum total distortion + Noise ^[6] (%)
At the sound pressure level of 94 dB	
0.2	2.5

Note ^[5] : The measured value is the total distortion, measured over the frequency range from 20 Hz to 20 kHz.

Note ^[6] : The maximum total distortion + noise is obtained from IEC 60942: 2017.

End of Certificate of Calibration

NIMT

Calibration & Test Certificate

We hereby certify that the instrument under mentioned has been certainly calibrated according to our calibration standard and the testing result in the calibration procedure has been good enough within the tolerance regulated in our specification.

Test conditions

Model name Noise Dosimeter
Model number ST-130
Serial number 230600019
Temperature 23.0° C
Humidity 70.0%rh
Date of calibration 2024/09/07
Valid Until. 2025/09/06

Test data

Test Item	Range	Results
M dBA	Range: 30...130 dB	PASS
M dBC	Range: 30...130 dB	PASS
M dBZ	Range: 30...130 dB	PASS

Calibrator

Model	Model Number	Serial Number	Due date
Standard SOUND LEVEL METER	B&K 2239	2449143	OCT/22/2024

The standard generators used for calibration procedure are proofed once a year and can be traceable to the standard authorized by public organization.

Approved by _____



Tim Lin
Scarlet Tech
Head of Engineering Department

Calibration & Test Certificate

We hereby certify that the instrument under mentioned has been certainly calibrated according to our calibration standard and the testing result in the calibration procedure has been good enough within the tolerance regulated in our specification.

Test conditions

Model name Noise Dosimeter
Model number ST-130
Serial number 230600020
Temperature 23.0° C
Humidity 70.0%rh
Date of calibration 2024/09/07
Valid Until. 2025/09/06

Test data

Test Item	Range	Results
M dBA	Range: 30...130 dB	PASS
M dBC	Range: 30...130 dB	PASS
M dBZ	Range: 30...130 dB	PASS

Calibrator

Model	Model Number	Serial Number	Due date
Standard SOUND LEVEL METER	B&K 2239	2449143	OCT/22/2024

The standard generators used for calibration procedure are proofed once a year and can be traceable to the standard authorized by public organization.

Approved by _____



Tim Lin
Scarlet Tech
Head of Engineering Department



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24100185-1

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222065

ID. Number : SLM-7

Environmental Conditions

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

Received Date : 10 Oct 2024

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

Calibration Date : 11 Oct 2024

Location of Calibration : In-Lab

Recommend Due Date : 11 Oct 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 12 Oct 2024

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.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24100185-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24100185-1

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

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

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note :

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

Measurement Uncertainty

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

- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24100185-2

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222066

ID. Number : SLM-8

Environmental Conditions

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

Received Date : 10 Oct 2024

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

Calibration Date : 11 Oct 2024

Location of Calibration : In-Lab

Recommend Due Date : 11 Oct 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 12 Oct 2024

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.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24100185-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	ST-120	211203773	EEL.BP. 140/0167	26 Jan 2025

Traceability

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



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24100185-2

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

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

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Select Z

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.8	113.8	-0.2	-0.2	0.15

Note :

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

Measurement Uncertainty

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

- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24010268-9

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222064

ID. Number : SLM-50

Environmental Conditions

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

Received Date : 18 Jan 2024

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

Calibration Date : 22 Jan 2024

Location of Calibration : In-Lab

Recommend Due Date : 22 Jan 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 23 Jan 2024

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.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24010268-9

Page : 2 of 3

Reference Standards

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

Traceability

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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24010268-9

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

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

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

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

Measurement Uncertainty

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

- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24010268-3

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222067

ID. Number : SLM-24

Environmental Conditions

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

Received Date : 18 Jan 2024

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

Calibration Date : 22 Jan 2024

Location of Calibration : In-Lab

Recommend Due Date : 22 Jan 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 23 Jan 2024

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.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24010268-3

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 Feb 2024

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24010268-10

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222072

ID. Number : SLM-52

Environmental Conditions

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

Received Date : 18 Jan 2024

Relative Humidity : $50\text{ } \% \pm 15\text{ } \%$

Calibration Date : 22 Jan 2024

Location of Calibration : In-Lab

Recommend Due Date : 22 Jan 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 23 Jan 2024

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.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24010268-10

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 Feb 2024

Traceability

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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24010268-10

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

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

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

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

Measurement Uncertainty

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

- End of Certificate -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24010268-11

Page : 1 of 3

Customer : MET CO.,LTD.

36/659 Moo. 6 Tambol Bangragpattana, Amphur Bangbuatong,
Nonthaburi 11110

Equipment Name : Sound Level Meter

Manufacturer : ACO

Model : 6236

Serial Number : 222101

ID. Number : SLM-53

Environmental Conditions

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

Received Date : 18 Jan 2024

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

Calibration Date : 22 Jan 2024

Location of Calibration : In-Lab

Recommend Due Date : 22 Jan 2025

Calibration Procedure : SP-CPE-04-01

Date of Issue : 23 Jan 2024

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.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Calibration Officer

Approved by :



Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24010268-11

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 Feb 2024

Traceability

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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24010268-11

Page : 3 of 3

Range : 94 to 114 dB

Function : @1kHz

Select A

Unit : dB

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

Select C

Unit : dB

Standard Setting	UUC Reading		Error		Uncertainty (±)
	Fast	Slow	Fast	Slow	
94	93.9	93.9	-0.1	-0.1	0.15
114	113.9	113.9	-0.1	-0.1	0.15

Note :

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

Measurement Uncertainty

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

- End of Certificate -

Certificate of Calibration

Certificate No. : 67-400505-3

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Refrigerator)

Manufacturer : Sanden Intercool

Model : YPR-068S

Range : N/A °C

Resolution : 1 °C

Serial No. : YPR0659S-141200060R

ID No. : MET-RE03/59

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (29.0 to 30.0) °C

Relative Humidity : (55 to 60) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.

Cert. No.

Due Date

Traceability

400046 & 400023 67-400198-1

01 Oct 2024

National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400505-3

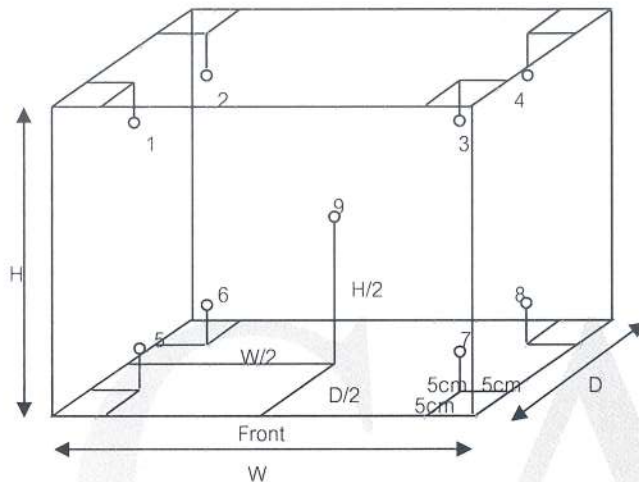
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.58 m

D = 0.60 m

H = 1.45 m

Capacity = 0.50 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
3	2	2	3.9	4.2	4.0	4.5	3.2	3.9	3.6	2.9	3.0	0.9

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	2	2	1.6	0.2	1.9

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

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

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Certificate of Calibration

Certificate No. : 67-200293-1

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Electronic Balance
Manufacturer : Sartorius Model : BSA224S-CW
Serial No. : 35090472 ID No. : MET-EB 02/60
Capacity : 220 g Resolution : 0.0001 g

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (25.9 to 26.2) °C
Relative Humidity : (32.6 to 45.5) %
Air Pressure : 1007.0 mbar

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

Calibrated by : Akaradath Thippichai

Calibration Method : In-house method CAL-M2001 based on UKAS Publication ref : LAB 14
Edition 7 - November 2022

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Weights

ID No.	Cert. No.	Due Date	Traceability
E261-E2624	C02232088	08 Nov 2024	National Institute of Metrology (Thailand), (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-200293-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Departure of indication from nominal value

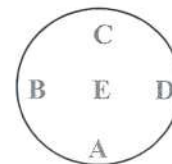
Nominal Value (g)	Correction (g)	Uncertainty \pm (g)
0.05	0.0001	0.00012
0.1	0.0001	0.00012
0.5	0.0001	0.00013
1	0.0000	0.00013
5	0.0000	0.00013
10	0.0000	0.00013
50	0.0001	0.00015
100	0.0000	0.00020
150	0.0000	0.00038
200	0.0001	0.00038

This result of calibration was found accurate as shown on date and place of calibration only.

This reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2.06$, providing a level of confidence of approximately 95%

Eccentric error

Load test : 50 g
 A B C D E
 0.0001 -0.0001 -0.0001 0.0001 0.0000 g



Repeatability

Load test : 200 g
 Stdev. : 0.00005 g

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Certificate of Calibration

Certificate No. : 67-420006-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : pH Meter with electrode

pH meter

Manufacturer : Eutech

Model : pH 150

Range : -2.00 to 16.00 pH

Resolution : 0.01 pH

Serial No. : 2657036

ID No. : MET-PH04/60

Electrode

Model : N/A

Serial No. : ECFC725210

Environment : Ambient Temperature : $(25 \pm 2) ^\circ \text{C}$

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

Date of Received : 18 January 2024

Date of Calibration : 23 January 2024

Date of Issue : 23 January 2024

Calibrated by : Permpon Chanpu

Calibration Method : In-house method CAL-M4201 direct measurement by using standard voltage calibrator and using certified reference material (CRM)

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Multiproduct Calibrator

ID No.	Cert. No.	Due Date	Traceability
440001	23E1240	24 Mar 2025	National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH	Cert. No.	Lot No.	Exp. Date	Traceability
4.008	61293328	944535	27 Nov 2025	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
6.986	61281486	944537	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
9.997	61281073	944536	17 Nov 2024	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved

Laboratory Manager

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-420006-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Electrical measurement

pH meter

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

Adjustment Curve at nominal pH	Applied Voltage (mV)	Nominal Value (pH)	UUC Reading		Correction (mV)	Uncertainty (± mV)
			(pH)	(mV)		
4, 7, 10	177.4800	4	4.00	177.1	0.4	0.060
	0.0000	7	6.98	-0.1	0.1	0.060
	-177.4800	10	10.00	-177.4	-0.1	0.060

Function : pH meter with electrode

Performing a three - buffer standard curve using buffer nominal pH (4,7,10)

Adjustment Curve at nominal pH	Standard Buffer (pH)	UUC Reading (pH)	Correction (pH)	Uncertainty (± pH)
4, 7, 10	4.008	4.01	0.00	0.0097
	6.986	7.00	-0.01	0.011
	9.997	10.01	-0.01	0.014

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

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

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www.calibratech.co.th

Certificate of Calibration

Certificate No. : 67-400029-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Temperature Indicator with Thermistor Probe

Temperature Indicator

Manufacturer : Eutech

Model : pH 150

Range : -10 °C to 110 °C

Resolution : 0.1 °C

Serial No. : 2657036

ID No. : MET-PH04/60

Thermistor Probe

Model : PHWPTEM01W

Sheath Material : Stainless

Diameter : 3 mm.

Length : 85 mm.

Serial No. : N/A

ID No. : MET-PH04/60

Environment : Ambient Temperature : $(23 \pm 2) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Line Voltage : $(220 \pm 22) \text{ VAC}$

Date of Received : 18 January 2024

Date of Calibration : 23 January 2024

Date of Issue : 23 January 2024

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by :

Laboratory Manager

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400029-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
80	20.0024	19.9	0.1	0.11
80	50.0019	50.0	0.0	0.11

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

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

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Certificate of Calibration

Certificate No. : 67-400243-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Temperature Indicator with TC Probe Type K (Temp pH)

Temperature Indicator

Manufacturer : Digicon

Model : PH-235SD

Range : 0 °C to 60 °C

Resolution : 0.1 °C

Serial No. : AL.58184

ID No. : MET-PH12/67

TC Probe Type K

Model : TP-07

Sheath Material : Stainless

Diameter : 3 mm.

Length : 109 mm.

Serial No. : N/A

ID No. : MET-PH12/67

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 25 April 2024

Date of Calibration : 30 April 2024

Date of Issue : 30 April 2024

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4003 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0023-24	16 Feb 2026	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by :

Laboratory Manager

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400243-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Immersion Depth (mm.)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
100	10.0006	10.2	-0.2	0.18
100	25.0008	25.0	0.0	0.22
100	50.0014	49.8	0.2	0.27

Remark

UUC : Unit Under Calibration

This result of calibration was found accurate as shown on date and place of calibration only.

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

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Certificate of Calibration

Certificate No. : 67-400505-2

Page : 1 of 2

Submitted by : M E T Company Limited
36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Oven)
Manufacturer : Binder Model : ED53
Range : N/A °C Resolution : 1 °C
Serial No. : 13-07419 ID No. : MET-OV02/57

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited
Ambient Temperature : (30.0 to 31.0) °C
Relative Humidity : (50 to 55) %
Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with Thermocouple probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400030	67-400246-1	25 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400505-2

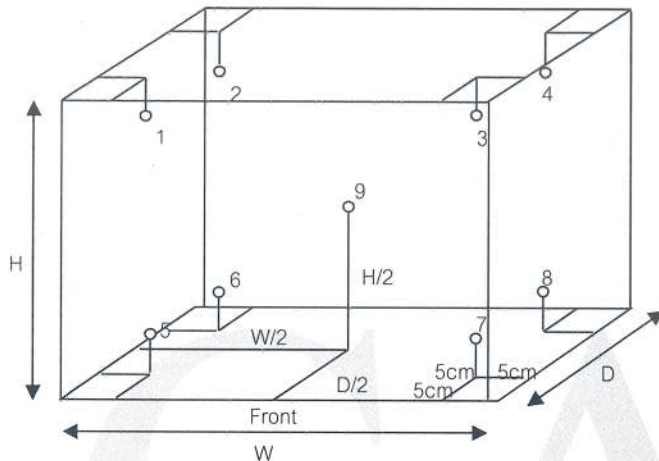
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.40 m

D = 0.33 m

H = 0.40 m

Capacity = 0.05 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
104	110	110	103.4	105.0	104.8	105.0	104.1	103.8	104.2	104.4	104.2	0.96
180	184	184	179.3	182.0	180.1	180.6	180.1	180.4	180.0	180.7	179.9	1.3

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.1	0.3	2.0
180	184	184	2.5	0.4	3.3

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

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

- o0o -



Certificate of Calibration

Certificate No. : 67-400505-1

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Oven)

Manufacturer : Memmert

Model : UM 100

Range : N/A °C

Resolution : 0.1 °C

Serial No. : b197.0985

ID No. : MET-OV01/46

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (30.0 to 31.0) °C

Relative Humidity : (50 to 55) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

Calibrated by : Permpon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

Standard Digital Thermometer with Thermocouple probe

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
400029 & 400032	67-400247-1	26 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400505-1

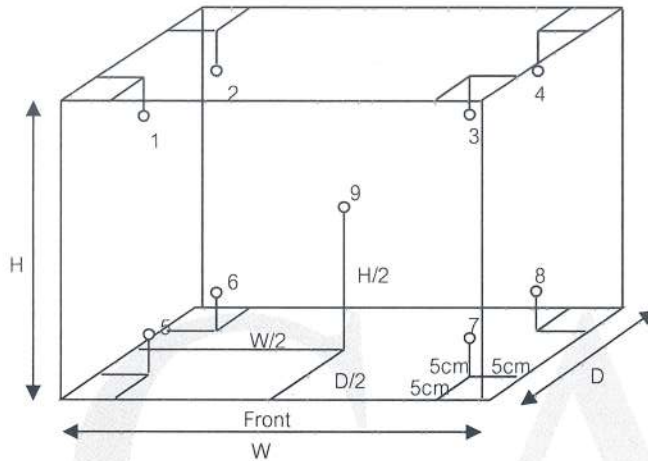
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.32 m

D = 0.18 m

H = 0.24 m

Capacity = 0.01 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
180.0	180.0	180.0	181.6	181.2	181.9	180.7	180.7	181.9	179.2	179.1	180.8	0.95

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
180.0	180.0	180.0	1.9	0.2	3.1

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

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

- o0o -



Certificate of Calibration

Certificate No. : 67-400505-5

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T.Bangrakpattana, A.Bangbuatong, Nonthaburi 11110

Equipment : Temperature controlled enclosure (Incubator)

Manufacturer : M-LAB

Model : BIC-140

Range : N/A °C

Resolution : 0.1 °C

Serial No. : 240412

ID No. : MET-BI01/55

Environment : On site calibration was carried out at the Laboratory, M E T Company Limited

Ambient Temperature : (26.0 to 26.5) °C

Relative Humidity : (40 to 45) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 20 August 2024

Date of Calibration : 20 August 2024

Date of Issue : 21 August 2024

Calibrated by : Permpoon Chanpu

Calibration Method : CAL-M4004, TLAS G-20

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units
Standard Digital Thermometer with RTD Probe

ID No.	Cert. No.	Due Date	Traceability
400029 & 400043	67-400245-1	27 Oct 2024	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 67-400505-5

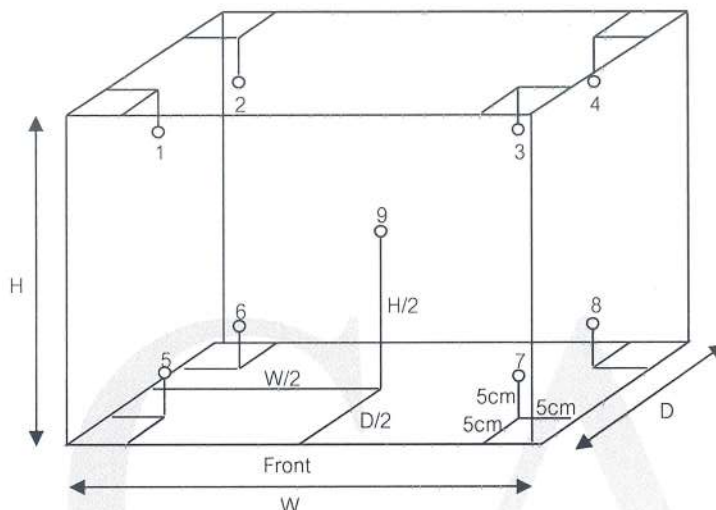
Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

This instrument was setting air ventilation at position 0 (close)



Inside of Chamber

W = 0.37 m

D = 0.33 m

H = 1.14 m

Capacity = 0.14 m³

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Temperature (°C) @ Sensor No.									Uncertainty (± °C)
			1	2	3	4	5	6	7	8	9	
20.0	20.0	20.0	19.77	19.63	19.60	19.50	20.50	20.34	20.20	19.86	20.04	0.33

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.58	0.06	1.07

Remark The uncertainty is not combine uniformity of the air chamber

This result of calibration was found accurate as shown on date and place of calibration only.

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

- o0o -



Certificate of Calibration

Equipment:	COD Reactor	Certificate No.:	C17240180
Model:	DB1602	Issued Date:	29 October 2024
Serial No. (or ID.):	0169	Job No.:	WO-00047579
Manufacturer:	M-LAB	Page:	1 of 4
Condition:	In Condition		
Covers: Open (Max)	Locations heating Block: Single		

Customer: M E T CO.,LTD.
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand.

Environment Condition:

Temperature:	28 °C	±	0.9 °C
Humidity:	58 %RH	±	5.1 %RH
Voltage:	229 VAC	±	3.9 VAC

Calibration Place: M E T CO.,LTD. (Laboratory Room)
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand.

Calibration By: Mr. Nakarin Ruenros
Calibration Date: 28 October 2024
The Method used: In house method, CAL-WI-59, base on Direct Measurement with Standard Thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10240016



Person in charge

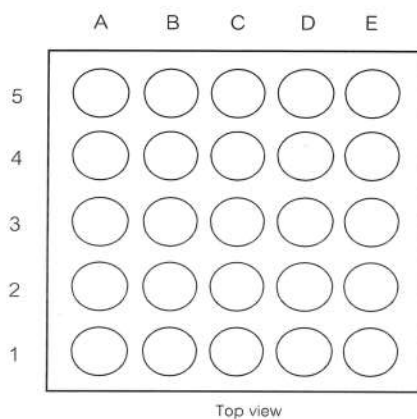


Authorized signatory

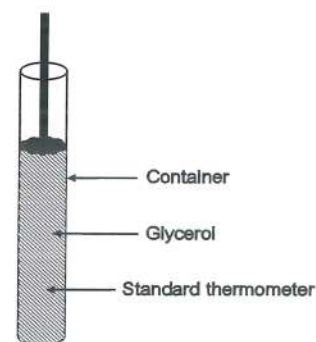
This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.



Location of standard



Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Calibration Results:
Before Adjustment

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
<u>Single</u>	150.0	150.0

Location heating Block:	A1	A2	A3	A4	A5
Measured Temperature (°C)	146.78	146.54	146.81	147.54	146.45

Location heating Block:	B1	B2	B3	B4	B5
Measured Temperature (°C)	145.67	147.87	146.52	148.41	147.12

Location heating Block:	C1	C2	C3	C4	C5
Measured Temperature (°C)	145.90	147.99	149.21	147.88	146.56

Location heating Block:	D1	D2	D3	D4	D5
Measured Temperature (°C)	147.16	147.34	148.23	148.09	146.65

Location heating Block:	E1	E2	E3	E4	E5
Measured Temperature (°C)	146.31	148.42	148.67	148.26	147.45

Calibration Results:

After Adjustment

Measured temperature at the spread locations:

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
Single	150.0	150.0

Location heating Block:	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (\pm °C)
A1	149.74	-0.26	0.30
A2	149.00	-1.00	0.31
A3	149.61	-0.39	0.30
A4	149.65	-0.35	0.31
A5	150.15	0.15	0.31
B1	149.34	-0.66	0.30
B2	151.09	1.09	0.31
B3	149.19	-0.81	0.33
B4	150.76	0.76	0.33
B5	149.58	-0.42	0.31
C1	148.85	-1.15	0.31
C2	150.41	0.41	0.31
C3	151.36	1.36	0.32
C4	150.02	0.02	0.34
C5	148.94	-1.06	0.34
D1	148.79	-1.21	0.31
D2	149.79	-0.21	0.32
D3	150.77	0.77	0.30
D4	150.52	0.52	0.30
D5	149.34	-0.66	0.32
E1	150.36	0.36	0.31
E2	150.27	0.27	0.30
E3	150.30	0.30	0.31
E4	150.79	0.79	0.32
E5	150.28	0.28	0.30

Characterization of the unit under calibration:

Locations heating Block	Desired	Unit Under Calibration (°C)		Measured Temperature (°C)
	(°C)	Setting	Reading	Stability (\pm °C)
Single	150.0	150.0	150.0	0.14

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00047579

ชนิดเครื่องมือ: COD Reactor

รุ่น: DB1602

หมายเลขเครื่อง: 0169

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
28 Oct 2024			28 Oct 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. สภาพ Hole	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. สภาพฝาปิด	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr. Nakarin Ruenros

Service Engineer

Packing List

Unit : K-446 Kjeldigester standard



151111112791000281006111

Serial Number

1000281006

Page 1(1)

Item	Pieces	Description		
11059833	1.0000	Packing parts Kjeldigester K-446/K-449 Beipackteile K-446/K-449		✓ OK
037377	5.0000	Sample tubes 300 ml (set of 4) Probengläser 300 ml (Set à 4 Stück)		✓ OK
11059754	1.0000	Rack 20 cpl. Rack 20 kpl.		✓ OK
11058955	1.0000	Aspiration device Kjeldigester K-446/K-449 cpl. Absaugeinheit K-446/K-449		✓ OK
040444	1.0000	Weighing boat 20pcs. Wägeschiffchen 20 Stk.		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11058825	1.0000	Fume collection tube with ball joint Dampfsammelrohr mit Kugelschliff		✓ OK
11592548	1.0000	Kjeldahl Practice Guide en Kjeldahl Practice Guide en		✓ OK
11593546	1.0000	Operation Manual K-446/K-449 english Bedienungsanleitung K-446/K-449 englisch		✓ OK
11593635	1.0000	Supplementary sheet Kjeldigester K-446/K-449 Beiblatt K-446/K-449		✓ OK

Packed by



BUCHI
LABORATORY



BUCHI Certificate

Final Test Inspection

Unit : BÜCHI KjeldDigester K-446

Serial number : 1000281006

Examination Procedure

1. **Visual control of the glass parts and the unit**

✓ OK

- No scratches on the coated surface
- Mounted in accordance to the specific drawing

2. **Security tests**

✓ OK

- High voltage test in accordance with EN 61010-1 (IEC 1010)
- Ground connection test in accordance with EN 61010-1 (IEC 1010)

3. **Functional tests**

Operating panel

✓ OK

- All buttons are working
- Cooling system is working after the instrument has been switched on

Connector plugs

✓ OK

- Scrubber connector is working

Heating element

✓ OK

- Heating-up temperature 420 °C is reached after 40 minutes
- Temperature calibration at 420 °C (3 measuring points)

4. **Completeness of order checked**

✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications



Packing List

Unit : K-415 TripleScrub 230V










151111112781000281005111

Serial Number

1000281005

Page 1(1)

Item	Pieces	Description		
11057332	1.0000	Tray for adsorption storage Ablage für Adsorption		✓ OK
048355	1.0000	Silicone hose D6/9 L=3m Silikonschlauch D6/9 L=3.0m		✓ OK
033701	1.0000	Glass wool 30g Glaswolle 30g		✓ OK
028737	2.0000	Hose clamp Anschlussklemme		✓ OK
11064971	1.0000	Activated Charcoal 2-6mm, 150g Aktivkohle 2-6mm, 150g		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11593505	1.0000	Operation Manual K-415 english Bedienungsanleitung K-415 english		✓ OK

Packed by



BUCHI



BUCHI Certificate Final Test Inspection

Unit : BÜCHI Scrubber K-415

Serial number 1000281005

Examination Procedure

1. **Visual control of the glass parts and the unit**

✓ OK

- No scratches or splinters on the glass parts
- Mounted in accordance to the specific drawing

2. **Security tests**

✓ OK

- High voltage test in accordance with EN 61010-1 (IEC 1010)
- Ground connection test in accordance with EN 61010-1 (IEC 1010)

3. **Functional tests**

Vacuum test

✓ OK

- Bypass valve open: Pressure is 0 - 65 mbar below the atmospheric pressure
- Bypass valve closed: Pressure is 400 mbar (+/- 10 %) below the atmospheric pressure

4. **Completeness of order checked**

✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications

Packing List

Unit : K-360 Plastik Basic



151111113001000281014111

Serial Number

1000281014

Page 1(1)

Item	Pieces	Description		
043410	3.0000	Canister 10L thin-walled Kanister 10L dünnwandig		✓ OK
043603	1.0000	Packing parts K-360 Beipackteile K-360		✓ OK
047871	1.0000	Suppl. sheet distillation unit Beiblatt Distillation Unit		✓ OK
010020	1.0000	Power cable type USA, 3 pole 120V Anschlusskabel USA W 120V		✓ OK
11592548	1.0000	Kjeldahl Practice Guide en Kjeldahl Practice Guide en		✓ OK
093176	1.0000	Operation Manual K-360 english Bedienungsanleitung K-360 englisch		✓ OK

Packed by



BUCHI
SWITZERLAND



BUCHI Certificate Final Test Inspection

Unit : BÜCHI BÜCHI Kjelflex K-360

Serial number 1000281014

Examination Procedure

1. Visual control of the glass parts and the unit

✓ OK

- No scratches on the coated surface or splinters on the glass parts
- Mounted in accordance to the specific drawing

2. Security tests

✓ OK

- High voltage test in accordance with EN 61010-1:2002 (IEC 61010-1, VDE 0411)
- Ground connection test in accordance with EN 61010-1:2002 (IEC 61010-1, VDE 0411)
- Safety door sensor checked

3. Functional tests

✓ OK

Electronics

- Electronic modul is tested with the checking device PG157
- Connector plugs are working

Operating panel

✓ OK

- Display is working
- All buttons of the keypad are working

Pump testing

✓ OK

- All pumps are working
- All pumps (exception: water pump of the steam generator) are precalibrated

Valve testing

✓ OK

- All valves are working

Steam generator testing

✓ OK

- The steam generator is filled with water
- The steam generator valve is working
- The amount of distillate corresponds to specifications

Further testing

✓ OK

- Beeper is working

4. Unit configuration and completeness of order checked

✓ OK

BÜCHI Labortechnik AG hereby declares that this unit is in accordance with the specifications





Optima8000 Preventive Maintenance Report

Company Name:

Instrument Location:

Instrument Serial No.:

Date:

ICP-OES/Optima8000 Preventive Maintenance (PM)

Company Name:			
Address (Instrument Location):			
Serial Number:		PM Number:	
Customer Name (if applicable):		Telephone Number:	
Service Engineer Name:		Service Order Number:	
Date PM Performed: (DD-MMM-YYYY)		Next PM Due Date: (DD-MMM-YYYY)	
Standard Labor Hours to Complete PM :		4 hours	

Part Number	Release	Publication Date	
09370140 Rev.5	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer/Optima8000 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
09995098	Air Filter-Spectrometer	
N077520	Air Filter-RF Generator	
09992731	Axial Window	
B0810377	Radial Window	
N0770438	O-ring kit, injector support adapter	
N0780437	O-ring kit, torch	

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date: (MM/YY)
N0691579	Multi-Element Standard (N069-1579 diluted 10X)	1		
N9300221	Instrument Calibration-4 (N9300221 diluted 100X)	1		

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☐ Ask customer about unit's performance since last visit.
- ☐ Check incoming AC line voltage under load for proper levels and grounding.
- ☐ Is the instrument operational?

2. Mechanical:

- ☐ Inspect and clean all fans and filters.
- ☐ Inspect and replace torch components and necessary.

Torch Components Replaced: ☐ Yes ☐ No

If yes, list components replaced:

- ☐ Inspect all tubing for signs of cracking or leaking and replace as necessary.

Tubing Replaced: ☐ Yes ☐ No

If yes, list tubing replaced:

- ☐ Inspect the peristaltic pump for proper operation.
- ☐ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ☐ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures

Regulator	Measured Pressure	Set Pressure
Nitrogen	N/A	NA (calibrated in Factory)
Main Argon		76psig
Torch Argon		67psig
Shear Gas		65psig
Water		35psi

- ☐ Check the shear gas nozzle for blockages and proper, uniform flow.
- ☐ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
- ☐ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. Check all motors, couplings, set screws, gears or drive assembly located on the spectrometer (prism/grating wavelength drives, slits, shutter, DV mirror, X/Y mirror) if problems are found.
- ☐ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ☐ Drain air compressor surge tank.
- ☐ Clean exterior of instrument.

3. Electrical:

- ☐ Visually inspect all PC boards for cleanliness and signs of corrosion.
 - ☐ Check all RF generator and spectrometer power supply voltages.
 - ☐ Run instrument diagnostic checks from the appropriate Device Control Module.

RF Generator:

- ☐ Check the RF generator status screens.
- ☐ Check the function of all interlocks.

Spectrometer:

- ☐ Check the spectrometer status screens.
- ☐ Check for proper function of all motors from the Motor Control window.

4. Optical:

- ☐ Check the neon lamp for proper operation.
- ☐ Ensure that neon initialization passes at power up.
- ☐ Ensure that there is a single, well defined peak of sufficient intensity (approximately 15,000 to 60,000 cts.) for the 703.241nm neon line viewed in the DCM Collect Spectra window. Re-generate the neon correction table if problems are encountered. If problems are still exhibited after the table is re-generated, replace the neon lamp assembly.

Neon Lamp Replaced: ☐Yes ☐No

- ☐ Perform the Initialize Optics routine from the Spectrometer Control window.
- ☐ Insure that the routine passes with no error codes. If it fails, run a manual prism scan from the spectrometer DCM.
- ☐ Insure the Dark Current measurement (Detector Calibration) passes at initialization.
- ☐ Check the shutter home sensor position.
- ☐ Check prism/electronics temperature sensor readback values from the DCM. It is normal for these readings to be shown in red. A typical prism temperature is approximately 29.5 degree C. A typical electronics temperature is approximately 35 degree C.
- ☐ Check the detector temperature from the DCM for -7.0 to -8.5 degree C. If outside of this range the detector cooling fan may not be operational. Further inspection may be necessary.
- ☐ Inspect for proper function of the transfer optics. 1) shutter 2) DV mirror 3) X/Y mirror.
- ☐ Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☐Yes ☐No
Radial Window Replaced: ☐Yes ☐No

5. Post PM Performance Tests:

- ☐ Perform View Align.

5.1 Spectral Resolution:

- ☐ Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.009		
Ni 231.604 - Resolution	≤0.011		
Ni 341.476 - Resolution	≤0.015		
Ba 455.403 - Resolution	≤0.020		

5.2 Precision:

- ☐ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
Zn 213.856	%RSD ≤ 1 %		
Mg 280.856	%RSD ≤ 1 %		
Mg 285.207	%RSD ≤ 1 %		
Ba 455.403	%RSD ≤ 1 %		

5.4 Mn BEC:

- ☐ Run Axial and Radial BEC according to the A&T spec, or the commissioning test procedure.

Mn Background Equivalent Concentration:

Method "MnBEC" For Samples "IB (2%HNO3)" and "IS (N069-1579/10)", record intensities.

Calculated BEC: $BEC = (IB * Conc\ of\ Std) / (IS - IB)$. Where Conc of Std = 1,000 PPB

Element	Mode	Conc.	IB	IS	
Mn 257.610	Radial	1,000 ppb			
Mn 257.610	Axial	1,000 ppb			
Mn 257.610	IB*Conc.	IS - IB	BEC	Spec	Pass/Fail
Radial				<30 PPB	
Axial				<30 PPB	

6. Review:

- ☐ Review with the customer PM work performed.
- ☐ Discuss recommended customer supplied materials to have on hand.
- ☐ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM



Review

The preventive maintenance checks and if applicable performance tests for ICP-OES/Optima8000 have been completed.

This ICP-OES/Optima8000 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Date:

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

(DD-MMM-YYYY)



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: SP-2100
Serial No. (or ID.): KJ0G05083001 (MET-SP 01/46)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06240454
Issued Date: 16 October 2024
Job No.: WO-00045898
Page: 1 of 2

Customer: M E T CO.,LTD.
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand.

Environment Condition:

Temperature	26.1	°C	±	0.2	°C
Humidity	67.3	%RH	±	2.1	%RH

Calibration Place: M E T CO.,LTD. (Laboratory Room)
36/659 Moo 6, Tambol Bangrakpattana,
Amphur Bangbuathong, Nonthaburi 11110 Thailand.

Calibration By: Mr.Nattapat Rungrueang

Calibration Date: 16 October 2024

The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 113620 and 113619

The standard for Photometric Certificate No. 113650



(Mr. Nattapat Rungrueang)

Person in charge



(Miss Kaewkan Suradech)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด

DKSH Technology Limited

2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260

2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 4 nm and UUC at 4 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
334.22	335	-0.78	0.59
418.48	419	-0.52	0.59
536.90	536	0.90	0.59
637.94	637	0.94	0.59
748.28	748	0.28	0.59
879.70	879	0.70	0.59

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.007	-0.0070	0.0045
	0.5797	0.579	0.0007	0.0045
	0.7119	0.714	-0.0021	0.0045
	1.0124	1.015	-0.0026	0.0045
440 nm	0.0000	0.001	-0.0010	0.0045
	0.5634	0.564	-0.0006	0.0045
	0.7001	0.704	-0.0039	0.0045
	0.9955	1.002	-0.0065	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5239	0.523	0.0009	0.0045
	0.6613	0.660	0.0013	0.0045
	0.9395	0.941	-0.0015	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5212	0.518	0.0032	0.0045
	0.6977	0.692	0.0057	0.0045
	0.9927	0.985	0.0077	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5548	0.552	0.0028	0.0045
	0.7732	0.767	0.0062	0.0045
	1.1021	1.093	0.0091	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5621	0.560	0.0021	0.0045
	0.7629	0.758	0.0049	0.0045
	1.0873	1.081	0.0063	0.0045

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00045898

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: SP-2100

หมายเลขเครื่อง: KJ0G05083001

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
16 Oct 2024			16 Oct 2024		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Mr.Nattapat Rungreuang

Service Engineer

Certificate of Calibration

Certificate No. : 67-300113-8

Page : 1 of 2

Submitted by : M E T Company Limited

36/659 Moo 6, T. Bangrakpattana, A. Bangbuatong, Nonthaburi 11110

Equipment : Burette

Manufacturer : Witeg

Class : B

Capacity : 50 ml

Graduation : 0.1 ml

ID No. : MET-BU50:01/64

Environment : Ambient Temperature : (20 ± 3) °C

Relative Humidity : (50 ± 10) %

Air Pressure : 1006.5 mbar.

Date of Received : 22 February 2024

Date of Calibration : 28 February 2024

Date of Issue : 28 February 2024

Calibrated by : Wipa Tovadee

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-22

Reference Standard Instruments : This certification is traceable to the International System of Units

Electronic Balance

ID No.

Cert. No.

Due Date

Traceability

241003

66-200388-2

02 Jun 2024

National Institute of Metrology (Thailand) (NIMT)

Approved by :



Supervisor

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 Calibratech Co.,Ltd.



www.calibratech.co.th

Certificate of Calibration

Certificate No. : 67-300113-8

Page : 2 of 2

Result of Calibration : This result of true Volume is referred to standard temperature at 20 °C

UUC Condition As-Received : Good

Delivery Time : 33.08 sec.

Nominal Volume (ml)	Measuring Volume (ml)
10	9.9977
30	29.9778
50	49.9898

Uncertainty of measurement with in \pm 0.011 ml

This result of calibration was found accurate as shown on date and place of calibration only.


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

- o0o -



Lambda UV Preventive Maintenance (PM)

Company Name:	S.P.S. CONSULTING SERVICE CO., LTD.		
Address:	7, Soi Phaholyothin24, Ladyao, Jatujak, Bangkok		
User Name:	K. Benjawan	WO Number:	WO-02883711
Telephone Number:	086-141-2523	Certificate Number:	UV2106-2024
Customer Support Engineer:		PM Number:	5 of 6
Date PM Performed: (DD-MMM-YYYY)	17-Jul-2024	Next PM Due Date: (DD-MMM-YYYY)	17-Jan-2025

Part Number	Release	Publication Date	
09370504	B	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer Lambda UV/Vis Spectrophotometer by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component Specific Model	Serial #	Software Version		Configuration Notes
Lambda 25	501S14123010	6.2.0.0741	STD	1.27
NA	NA	NA	NA	NA

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot/SN #	Expiration Date (MM/YY)
B250 0999	Stray Light standard			
	Nal cell	1	1943	Mar-26
	NaNO2 cell	1	2963	
	KCl cell	1	31030	
	H2O	1	71497	
B050 7805	Secondary Standards for calibration of wavelength and photometric accuracy or use NBS/NIST 390 standards			
	Gray Glass G1	1	2926	Mar-26
	Gray Glass G2	1	3501	
	Gray Glass G3	1	2552	
	Holmium Glass	1	1085	

Additional Tools Required for PM					
Part Number (if applicable)	Description	Quantity	Serial #		Remark
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Additional Reagents and Standards Required for PM					
Part Number (if applicable)	Description	Quantity	Batch/Lot #		Expiration Date (MM/YY)
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. Optical checks:

- ☒ Lamp Alignment/Energy
- ☒ Sample Compartment Windows/Monochromator
- ☒ Mirror and Grating Alignment
- ☒ Cell Holder Alignment

3. Mechanical:

- ☒ Physical inspection – Please write any comments in the additional comments section.
- ☒ Grating Drive Mechanism.
- ☒ Lamp Change Mechanism.
- ☐ Slit Drive Manual Servo.

4. Test:

Refer to Appendix A for the specifications of the instrument being tested.

- ☒ D2 Wavelength accuracy

	Actual Value	Specification
Accuracy at 656.1 nm	656.13	± 0.1

☒ Holmium Oxide wavelength accuracy

Filter ID #		1085		
Test	Calibration Value	Actual Value	Deviation	Specification
279.3 nm	279.3	279.43	-0.13	± 0.5
360.8 nm	360.9	361.01	-0.11	± 0.5
459.9 nm	459.9	460.03	-0.13	± 0.5
536.4 nm	536.3	536.34	-0.04	± 0.5

☒ Scattered Light.

Test	Filter ID #	Result	Specification
NaI @ 220 nm	1943	0.0189	< 0.02 %T
NaNO ₂ @ 340 nm	2963	0.0711	< 0.02 %T
NaNO ₂ @ 370 nm	2963	0.0629	< 0.02 %T
KCl @ 200 nm	31030	2.4281	≥ 2 A

☒ Baseline Flatness.

Corrected Baseline	Specification
0.000264	± 0.001 A

☒ Noise Test @ 500 nm.

Actual Value	Specification
0.0000430	± 0.00008 A

☒ Photometric Accuracy.

Filter 1 ID #		2926		
Test	Calibrated Value	Actual Value	Deviation	Specification
440.0 nm	0.3496	0.3491	0.0005	± 0.006 A
546.1 nm	0.3046	0.3044	0.0002	± 0.006 A
635.0 nm	0.3238	0.3241	-0.0003	± 0.006 A
Filter 2 ID #		3501		
Test	Calibrated Value	Actual Value	Deviation	Specification
440.0 nm	1.0037	1.0039	-0.0002	± 0.006 A
546.1 nm	0.9806	0.9797	0.0009	± 0.006 A
635.0 nm	1.0324	1.0317	0.0007	± 0.006 A
Filter 3 ID #		2552		
Test	Calibrated Value	Actual Value	Deviation	Specification
440.0 nm	0.4943	0.4961	-0.0018	± 0.006 A
546.1 nm	0.4595	0.4589	0.0006	± 0.006 A
635.0 nm	0.5080	0.5067	0.0013	± 0.006 A

5. Accessory (where applicable):

- ☐ Integrating Sphere
- ☐ Reflecting Attachment
- ☐ Cell Changer
- ☐ Sipper
- ☐ Auto Sampler


6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand
- ☒ Attach PM sticker.
- ☐ Update Logbook.

Additional Comments

Additional Comments Regarding the PM
- Straylight ไม่ผ่านเนื่องจาก Filter Wheel เสื่อมสภาพ

Review

<p><i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i></p>	
<p>This Lambda UV Passes <input type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</p>	
<p>Review of Preventive Maintenance:</p>	
<p>Authorized PerkinElmer Representative:</p> 	<p>Date:</p> <p>17-Jul-24 (DD-MM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p>17-Jul-24 (DD-MM-YYYY)</p>

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	Date Tested:	July 4, 2024
Address :	7 Soi Phaholyothin 24 Paholyothin Road Jompol Chatuchak, Bangkok 10900	Recommendation Recertification	
User Name:	K.Phenpha Vipasthawatt	Period	6 Months
Phone:	083-9269252	Recertification Due:	January 4, 2025
Email:		Date Last Certified:	January 4, 2024
		Visit Number:	2 OF 2
		PerkinElmer Phone:	02-719-6420 ext 204
		PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
1. INSTRUMENT CHECKS			
A. The Mirror and Lenses Condition			<input type="text" value="OK"/>
B. Grating Condition			<input type="text" value="OK"/>
C. Replace or Clean Dust Filter			<input type="text" value="OK"/>
D. Cleaning the Contact Cylinders			<input type="text" value="OK"/>
E. Cleaning the Furnace Windows			<input type="text" value="OK"/>
F. Cleaning the Burner Head			<input type="text" value="OK"/>
G. Cleaning the Nebulizer			<input type="text" value="OK"/>
H. Cleaning the Drain System			<input type="text" value="OK"/>
2. AUTOSAMPLE CHECK			
A. Sampling and Arm			<input type="text" value="OK"/>
B. Sampling & Rinse Pump			<input type="text" value="OK"/>
C. Sample Position & Clean			<input type="text" value="OK"/>
3. COOLING SYSTEM CHECKS			
A. Clean and Change Distill water			<input type="text" value="OK"/>
B. Themensor			<input type="text" value="OK"/>
4. FIAS CHECKS			
A. Pump and 5 Port Valve			<input type="text" value="N/A"/>
B. Chemifold and Tubing			<input type="text" value="N/A"/>
C. Power Supply			<input type="text" value="N/A"/>
D. Flow meter and Gas system			<input type="text" value="N/A"/>

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
PARAMETER		SPECIFICATION	ACTUAL VAULE
A. Flame Mode Tests			
1. Detector-Linearity with Barium (553.55 nm)			
Neutral Density Filter 0.2 :	0.2042	Abs. \pm 5%	0.1815 Abs.
Neutral Density Filter 1.0 :	0.9798	Abs. \pm 5%	1.0220 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm)			
(at an integration time of 0.5 seconds			
and 99 replicates)			
	SD \leq 0.010 Abs.		0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm)			
(at an integration time of 0.5 seconds			
and 99 replicates)			
	SD \leq 0.001 Abs.		0.0001 Abs.
4. D ₂ Background Compensation (Copper 324.75 nm)			
with Neutral Density Filter 1.0	Absorbance \leq 0.010 Abs		0.0079 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm)			
(at an integration time of 2.0 seconds			
and 99 replicates)			
	SD \leq 0.005 Abs.		0.0007 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm)			
(at an integration time of 2.0 seconds			
and 99 replicates)			
	SD \leq 0.005 Abs.		0.0024 Abs.

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	<u>PTCS14111103</u>	DATE TESTED	<u>July 4, 2024</u>
PARAMETER	SPECIFICATION	ACTUAL VAULE	
7. Flame Interlock Shutdown	Shutdown correct?	<div>OK</div>	
8. Flame Sensitivity with Copper (324.75 nm)			
(5 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner and Stainless stell nebulizer)			
	Sensitivity ≥ 0.250 Abs.	<u>0.3118</u>	Abs.
(2 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner and High sensitivity nebulizer)			
	Sensitivity ≥ 0.250 Abs.	<u>N/A</u>	Abs.

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
PARAMETER	SPECIFICATION	ACTUAL VAULE	
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm)			
(mesure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0021	
	SD ≤ 0.005 Int.Abs	0.0004	Int.Abs.
3. Chromium Characteristic Mass(m ₀) and Precition (357.87 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 10 ug/L Cr standard)			
	m0 Results ≤ 7.0 pg/0.0044A-s	7	pg/0.0044A-s
	Precision ≤ 2.0%	1.32	%
4. Copper Characteristic Mass(m ₀) and Zeeman Ratio (324.75 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 25 ug/L Cu standard)			
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
	Zeeman Ratio 0.52 + 0.04	0.559	

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** July 4, 2024

Remarks :

- Neutral Density Filter refer to data sheet

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

= 0.1491/0.1491+0.1176

0.559

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.

Customer Service Engineer:



Service Engineer