

ภาคผนวกที่ 4

ใบรับรองการสอบเทียบเครื่องมือ

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSC-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-200067-1

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 : METTLER TOLEDO Model : AG285

Serial No. : 1122140126 ID No. : MET-EB01/46

Capacity : 210 g Resolution : 0.00001g/81g, 0.0001g/210g

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

Ambient Temperature : (26.4 to 26.8) °C

Relative Humidity : (54.9 to 58.8) %

Air Pressure : 1013.0 mbar

Date of Received : 02 March 2023

Date of Calibration : 02 March 2023

Date of Issue : 13 March 2023

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
E261-E2624	C02222345	10 Nov 2023	National Institute of Metrology (Thailand), (NIMT)

Approved by :

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-200067-1

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 ± (g)
0.01	0.00001	0.000020
0.1	0.00000	0.000019
1	-0.00002	0.000031
5	-0.00004	0.000043
10	-0.00008	0.000054
20	-0.00027	0.000071
50	-0.00059	0.00011
100	-0.0009	0.00023
150	-0.0012	0.00038
200	-0.0019	0.00040

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 $k = 2.43$, providing a level of confidence of approximately 95%

Eccentric error Load test : 50 g

A	B	C	D	E
0.00055	0.00027	-0.00015	-0.00018	0.00000

g



Repeatability Load test : 200 g

Stdev. : 0.000053 g

- o0o -



CAL-F0031-03



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: SP-2100
Serial No. (or ID.): KJOGO5083001 (MET-SP 01/46)
Manufacturer: Spectrum
Condition: In Condition

Certificate No.: C06230484
Issued Date: 16 October 2023
Job No.: WO-00007312
Page: 1 of 2

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

Environment Condition: Temperature 26.5 °C ± 0.5 °C
Humidity 60.6 %RH ± 1.9 %RH

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

Calibration By: [Redacted]
Calibration Date: 16 October 2023
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. 105931 and 105898
The standard for Photometric Certificate No. 105940

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.

บริษัท ดีเคเอส อีเซีย จำกัด

DKSH Technology Limited

2533 สุขุมวิท ถนน แขวงคลองจั่น เขตคลองจั่น กรุงเทพมหานคร 10260

2533 Sukhumvit Road, Bangkok, Phra Khanong, Bangkok 10260

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

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CAL-FM-C06-15: 12 Sep 2022



Certificate No.: C06230484

Page 2 of 2

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	334	0.22	0.59
418.48	418	0.48	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	0.000	0.0000	0.0045
	0.5890	0.586	0.0030	0.0045
	0.7604	0.755	0.0054	0.0045
	1.0241	1.020	0.0041	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5782	0.575	0.0032	0.0045
	0.7430	0.738	0.0050	0.0045
	1.0016	0.996	0.0056	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5283	0.528	0.0003	0.0045
	0.6854	0.681	0.0044	0.0045
	0.9509	0.953	-0.0021	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5457	0.544	0.0017	0.0045
	0.6944	0.689	0.0054	0.0045
	0.9965	0.994	0.0025	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5837	0.580	0.0037	0.0045
	0.7223	0.717	0.0053	0.0045
	1.0935	1.089	0.0045	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5675	0.565	0.0025	0.0045
	0.6900	0.685	0.0050	0.0045
	1.0862	1.084	0.0022	0.0045

บริษัท ดีเคเอส อีเซีย จำกัด

DKSH Technology Limited

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The End of Certificate

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CAL-FM-C06-15: 12 Sep 2022



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00007312

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: SP-2100

หมายเลขเครื่อง: KJOGO5083001

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
16 Oct 2023			16 Oct 2023		
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. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		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 :

Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
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CAL-FM-R31-03: 20 Jul 2022

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Agilent CrossLab Compliance Services

GC-OQ

System ID: CN2138A118_MET
Organization Name: MET Company Limited
Organization Location: 36/659 Moo 6 Tambol Bangrakpattana Nonthaburi 11110 Thailand
Date: March 28, 2023 1:45:04 PM
EQP Name: AgilentRecommended
EQP Revision: GC.02.52
Overall Qualification Status: Pass

Logon: Saenguthai Tarak

Overall CDS Logon Verification - GC Test Status
Pass

Name: 8890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status
Pass

Name: 8890
Front SSL

Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Page 1 / 14

Overall Inlet Pressure Decay Test Status

Pass

Name: 8890
Front SSL

Setpoint Status: Pass

	Setpoint		Actual
Inlet Pressure:	25.0	psi	25.0 psi

Accuracy: 0.0 psi

Agilent Recommended: <= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Name: 8890
Front FID

Setpoint Status: Pass

Flow Type:	Fuel
Setpoint:	30.0 mL/min
Measured Flow:	30.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: <= 10.0 % setpoint (3.0 mL/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Setpoint Status: Pass

Flow Type:	Oxidizer
Setpoint:	400.0 mL/min
Measured Flow:	389.2 mL/min

Accuracy: 10.8 mL/min

Agilent Recommended: <= 10.0 % setpoint (40.0 mL/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Setpoint Status: Pass

Flow Type:	Makeup
Setpoint:	25.0 mL/min
Measured Flow:	25.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: <= 10.0 % setpoint (2.5 mL/min)

Limit is percentage of setpoint or 0.5 ml/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

Name: 8890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.3 °C

Accuracy: 0.3 °C

Agilent Recommended: >= -1.0 % setpoint in K (-5.0 °C)

<= 1.0 % setpoint in K (5.0 °C)

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.3 °C

Accuracy: 0.3 °C

Agilent Recommended: >= -1.0 % setpoint in K (-3.7 °C)

<= 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

Name: 8890

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Setpoint Average

Temperature:	100.0	100.2167	°C
Stability:		0.1	°C
Agilent Recommended:	<=	0.5	

Overall GC Oven Temperature Stability Test Status

Pass

Tested Combination1	Front	SSL	/ Front	FID
	Injection Tower			
Name:	7693A			

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Tested Combination1	Front	SSL	/ Front	FID
Name:	8890			

Setpoint Status: Pass

Base Signal: 8.9 pA

ASTM Noise	Drift
pA	pA/Hr
0.05	0.94

Agilent Recommended: <= 0.10 <= 2.50

Status: Pass Pass

Overall Noise and Drift Test Status

Pass

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Tested Combination1	Front	SSL	/ Front	FID
Name:	7693A			

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area RSD: 0.44 % Retention Time RSD: 0.17 %

Agilent Recommended: <= 3.00 <= 1.00

Overall Injection Precision Test Status

Pass

Tested Combination1	Front	SSL	/ Front	FID
	Injection Tower			
Name:	8890			

Setpoint Status: Pass

Signal to Noise: 2198451

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

System Configuration

This section describes the as found system configuration.

System

System ID	CN2138A118_MET
Manufacturer	Agilent Technologies
Name	8890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Inlet	Front
Detector	Front
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4514A
Serial Number	CN22047055
Firmware Revision	A.11.03
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Sampler 2

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN22047055
Firmware Revision	A.11.03
Vial Heater	Not installed

Mainframe 1

Manufacturer	Agilent Technologies
Name	8890
Model Number	G3540A
Serial Number	CN2138A118
Firmware Revision	2.5.1.9
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	8890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	8890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Signature Page

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Full Name of Signer: Saenguthai Tarak
Logged On User Name: saenguthai.tarak@non.agilent.com
Signature Creation Date: March 28, 2023
Reason for Signature: Executed protocol and published this original version of document

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Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:26:58 PM	Audit	SessionCreated	Session	None
March 28, 2023 12:26:58 PM	Audit	Entitlement	Licensing	Session identifier generated: 0800-0002-0000-08HM-Q85 G
March 28, 2023 12:26:58 PM	Start	Configuration	Session	None
March 28, 2023 12:32:02 PM	Audit	Entitlement	Licensing	Successfully unlocked session identified by 0800-0002-0000-08HM-Q85 G with unlock code xb1b-ckbx-4v0e-kzg1-0c4g
March 28, 2023 12:39:59 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks\Gc\Configurations\02.52\Gc.02.52.eqp] EQP File Name: [Gc.02.52.eqp], EQP Name: [AgilentRecommended]Protocol Revision: [Gc.02.52]
March 28, 2023 12:40:04 PM	End	Configuration	Session	None
March 28, 2023 12:40:11 PM	Start	Qualification	Session	OQ
March 28, 2023 12:40:12 PM	Start	Execution	CDS Logon Verification - GC : - Qualitative test	None
March 28, 2023 12:43:12 PM	End	Execution	CDS Logon Verification - GC : - Qualitative test	Run Count : 1
March 28, 2023 12:43:15 PM	Start	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	None

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:43:31 PM	End	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	Run Count : 1
March 28, 2023 12:43:34 PM	Start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 28, 2023 12:43:41 PM	End	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 28, 2023 12:43:43 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 28, 2023 12:43:48 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 28, 2023 12:43:50 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 28, 2023 12:44:12 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 28, 2023 12:44:20 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 28, 2023 12:44:22 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 28, 2023 12:44:42 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry

Page 2 / 6

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Page 10 / 14

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:44:47 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 28, 2023 12:44:52 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 28, 2023 12:45:03 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 28, 2023 12:45:07 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 28, 2023 12:45:09 PM	Start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 28, 2023 12:45:28 PM	Audit	Data	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 28, 2023 12:45:30 PM	End	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 28, 2023 12:45:31 PM	Start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 28, 2023 12:45:48 PM	Audit	Data	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

Page 3 / 6

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Page 11 / 14

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:45:51 PM	End	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 28, 2023 12:45:53 PM	Start	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
March 28, 2023 12:46:53 PM	Audit	Data	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 28, 2023 12:46:57 PM	End	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 28, 2023 12:47:01 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 28, 2023 12:50:08 PM	Start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 28, 2023 12:51:05 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : F:\Data\SC011.D\FID1A.ch
March 28, 2023 12:51:52 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 28, 2023 12:51:57 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None

Page 4 / 6

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Page 12 / 14

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 12:52:26 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : F:\Data\ND012.D\FID1A.ch
March 28, 2023 12:53:21 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 28, 2023 12:53:28 PM	Start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
March 28, 2023 1:12:20 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0107.D\FID1A.ch
March 28, 2023 1:12:20 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0108.D\FID1A.ch
March 28, 2023 1:12:20 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0109.D\FID1A.ch
March 28, 2023 1:12:20 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0110.D\FID1A.ch
March 28, 2023 1:12:24 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0111.D\FID1A.ch

Page 5 / 6

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Page 13 / 14

CN2138A118 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 28, 2023 1:12:25 PM Audit		Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : F:\Data\Pre0112.D\FID1A.ch
March 28, 2023 1:13:38 PM End		Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
March 28, 2023 1:13:49 PM Start		Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 28, 2023 1:16:08 PM Audit		Data	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : F:\Data\SN01.D\FID1A.ch
March 28, 2023 1:17:06 PM End		Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 28, 2023 1:17:14 PM End		Qualification	Session	OQ
March 28, 2023 1:17:14 PM Start		Reporting	Session	None
March 28, 2023 1:43:49 PM Audit		Reporting	Session	Report Generated : Certificate

Page 6 / 6

Date: March 28, 2023 1:45:04 PM
System ID: CN2138A118_MET

Page 14 / 14



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

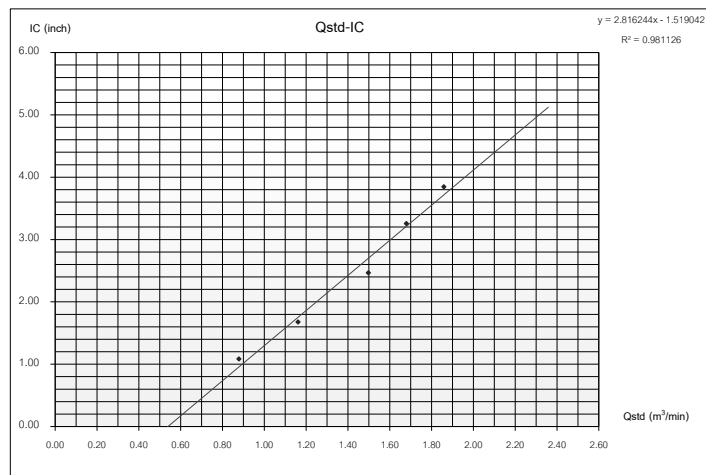
TSP HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location	Date
Project Site	November 9, 2023
Sampler Number	Start Time
Motor Serial Number	Stop Time
Recorder Serial Number	Person

Plate No.	(Delta H)	(A)	(X)	(I)	(Y)	Temperature	Barometric Pressure	Start Meter	Stop Meter
	Pressure Drop Across Orifice (inH ₂ O)	$[\Delta H \cdot C(Pa \cdot Pa_{atm}) / (T_{atm} / Ta)]^{1/2}$	$Qstd = (1 \text{ in}) / [(A-b)]$ (m ³ /min)	Sample Flow Rate Indicator (Inch)	$IC = [(Pa \cdot Pa_{atm}) / (T_{atm} / Ta)]^{1/2}$	(°K = °C + 273)	(mmHg)		
5	1.5	1.5	3.0	1.70868	0.87849	1.1	1.09	305.0	757.0
7	2.6	2.6	5.2	2.24958	1.16117	1.7	1.68	305.0	757.0
10	4.3	4.3	8.6	2.89300	1.49744	2.5	2.47	305.0	757.0
13	5.4	5.4	10.8	3.24199	1.67982	3.3	3.26	305.0	757.0
18	6.6	6.6	13.2	3.58415	1.85864	3.9	3.85	305.0	757.0
Linear Regression: Y = mX + b						Average	305.0	757.0	
1	Slope (m)	1.91345	Linear Equation			r ²	0.9957	Field (mmHg)	760.0
2	Intercept (b)	0.02773	Set Point Flow Rate (X) (m ³ /min)			1.133	r	0.9928243	T _{atm}
3	Correlation Coefficient (r)	0.99995	Final Set Flow Rate = (1)			0	(Pa/P _{atm})*(T _{std} /Ta)	0.973192407	
Result						C = (Pa/P _{atm})*(T _{std} /Ta)*0.5			

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

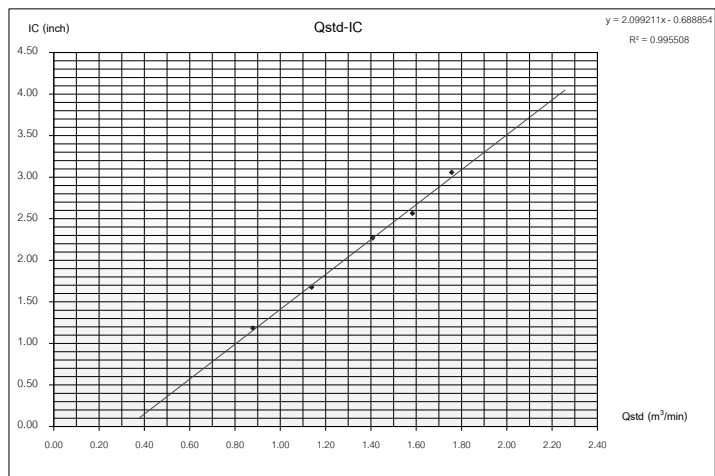
PM10 HIGH VOLUME AIR SAMPLER CALIBRATION REPORT

Sampler Location				Date	November 9, 2023
Project Site				Start Time	9:10 AM
Sampler Number	PM-10 No.14	Transfer Standard Type	Office	Stop Time	9:10 AM
Motor Serial Number	HVL-14	Calibrator Model	TE-5025A		
Recorder Serial Number	-	Calibrator Serial Number	1	Person	Mr.Jirayut Seethabut

Plate No.	(Delta H)			(A)	(X)	(I)	(Y)	Temperature	Barometric	Start	Stop	
	Pressure Drop Across Orifice (inH ₂ O)			$(\Delta H_1 Q) / (Pa(P_{amb} - T_{amb}))^{1/4}$	$Q_{std} = (1/m)[(A-b)]$ (m ³ /min)	sample Flow Rate Indicator (inches)	$Q_C = [(Pa(P_{amb} - T_{amb}))^{1/4}]$ °K = °C + 273	°K = °C + 273	Pressure (mmHg)	Meter	Meter	
5	1.5	1.5	3.0	1.70868	0.87849	1.2	1.18	305.0	757.0			
7	2.5	2.5	5.0	2.20989	1.13834	1.7	1.68	305.0	757.0			
10	3.8	3.8	7.6	2.71961	1.40682	2.3	2.27	305.0	757.0			
13	4.8	4.8	9.6	3.05657	1.58292	2.6	2.56	305.0	757.0			
18	5.9	5.9	11.8	3.38876	1.75653	3.1	3.06	305.0	757.0			
Linear Regression Y=CMX, Y= mX + b								Average	305.0	757.0		
1	Slope (m)			1.91345	Linear Equation			r^2	0.997347	Pa(mHg)	760	
2	Intercept (b)			0.02773	Set Point Flow Rate (X) (m ³ /min)		1.133	r	0.9986726	T _{amb}	298	
3	Correlation Coefficient (r)			0.99995	Final Set Flow Rate = (I)		0	(Pa(P _{amb} - T _{amb})) ^{1/4}	0.973192407			
Result									C=(Pa(P _{amb} - T _{amb})) ^{1/4} * 0.5	0.980505148		

COMMENT

Andersen Instruments, Inc.



Calibrated By

Field Environmental

Division Manager



บริษัท เอ็นไวร์ เซอร์วิส จำกัด
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

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

Analyzer Performance Test

Calibrated Date: 8 November 2023

Instruments Information

Analyzer Type: NO/NO ₂ /NO _x Analyzer Model: 42C	Manufacturer Thermo Environmental S/N: 72706374
---	--

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: 46.05 PPM SO ₂ Conc: 46.01 PPM CO Conc: 4.487 PPM Cylinder number CC507080 Expire Date: 23 Jul. 2025

Environment: Temperature 25.5 °C

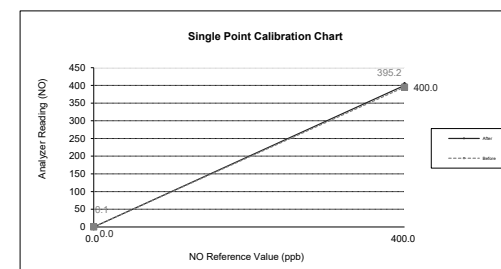
Humidity: 51 %RH

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	395.2	400.0	-1.2
NO _x	0.1	0.0	0.1	400.0	400.0	0.0

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
NO _x	0.0	0.0	0.0	400.0	400.0	0.0



Calibrate By



บริษัท เอ็นไวร์ เซอร์วิส จำกัด
42 รามอินทรา 14 แยก 9 แขวงท่าแร้ง เขตบางเขน กรุงเทพฯ 10230 โทรศัพท์ 02-9435814-5 โทรสาร 02-9438201
บริษัท เอ็นไวร์ เซอร์วิส จำกัด 42 Raminthra 14 year 9, Tha Rang, Bangkok, Bangkok 10230 Tel : 02-9435814-5 Fax : 02-9438201

บริษัท เอ็นไวร์ เซอร์วิส จำกัด

Analyzer Performance Test

Calibrated Date: 8 November 2023

Instruments Information

Analyzer Type: SO2 Analyzer	Manufacturer Thermo Environmental
Model: 43C	S/N: 335003719

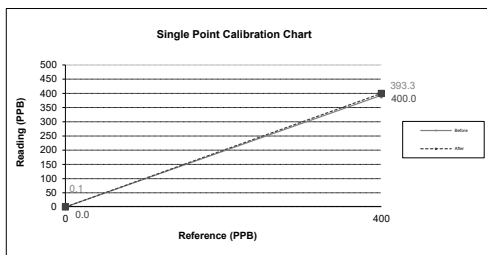
Calibration System

Calibrator Unit	Standard Gas
Dilutor Model Dasibi Model 5008	NO Conc 55.47 PPM
S/N: 705	SO2 Conc 55.11 PPM
ZERO AIR Generator API MODEL 701	CO Conc 4,535 PPM
S/N: 1924	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

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpoed, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



Certificate of Calibration

Certificate No. : 66-400476-4

Page : 1 of 2

Submitted by : M E T Company Limited

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

Equipment : Air Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : YPR-068S

Range : N/A °C

Resolution : 1 °C

Serial No. : YPR0682S-140100003R

ID No. : MET-RE02/57

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

Ambient Temperature : (29.5 to 30.5) °C

Relative Humidity : (54 to 57) %

Line Voltage : (220.5 to 221.8) V

Date of Received : 23 August 2023

Date of Calibration : 23 August 2023

Date of Issue : 23 August 2023

Calibrated by :

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

66-400184-1

03 Oct 2023

National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



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7/106-7 Moo 2, Sukhaphrachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-400476-4

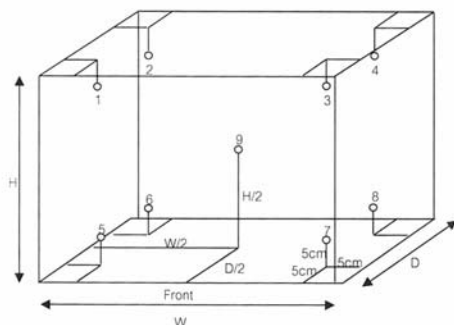
Page : 2 of 2

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	4.4	3.7	4.3	3.9	4.1	4.3	3.9	4.2	3.2	0.89

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
3	2	2	1.5	0.3	1.7

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 -



CAL-F0031-03

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Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaphrachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



Certificate of Calibration

Certificate No. : 66-420002-1

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. : 66365

Environment : Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) %

Date of Received : 05 January 2023

Date of Calibration : 11 January 2023

Date of Issue : 11 January 2023

Calibrated by :

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 21E997 17 Mar 2023 National Institute of Metrology Thailand (NIMT)

2. Standard Buffer Solution

pH Cert. No. Lot No. Exp. Date Traceability

4.008 61235182 857394 11 Dec 2024 CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

6.986 61267169 857395 11 Dec 2023 CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

10.010 61260481 857396 11 Dec 2023 CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03



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Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-420002-1

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	6.99	-0.1	0.1	0.060
	-177.4800	10	10.00	-177.3	-0.2	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
	10.010	10.01	0.00	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 measurement was based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%

- 0(0)0 -



CAL-F0031-03

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpoed, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-400476-2

Page : 1 of 2

Submitted by :

M E T Company Limited

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

Equipment :

Air Chamber (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 : (31.0 to 32.0) °C

Relative Humidity : (55 to 60) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2023

Date of Calibration : 23 August 2023

Date of Issue : 23 August 2023

Calibrated by :

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 66-400227-1

24 Oct 2023

National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-400476-2

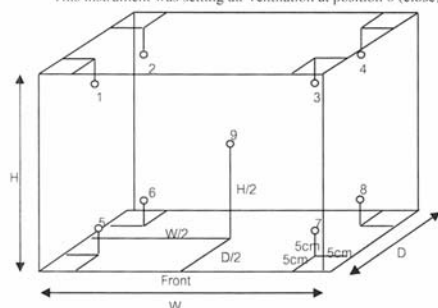
Page : 2 of 2

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	105.0	105.0	105.0	104.9	103.9	103.9	104.2	104.2	104.2	0.94
180	184	184	180.1	181.9	180.8	179.7	180.2	180.8	180.7	180.8	180.2	1.2

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
104	110	110	1.0	0.2	1.3
180	184	184	1.9	0.3	2.7

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 -



CAL-F0031-03

CAL

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7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSG-TISI-TIS 17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 66-400476-1

Page : 1 of 2

Submitted by : M E T Company Limited

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

Equipment : Air Chamber (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 : (31.0 to 32.0) °C

Relative Humidity : (55 to 60) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2023

Date of Calibration : 23 August 2023

Date of Issue : 23 August 2023

Calibrated by :

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 & 400032 66-400228-1

25 Oct 2023

National Institute of Metrology Thailand (NIMT)

Approved by :



Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-400476-1

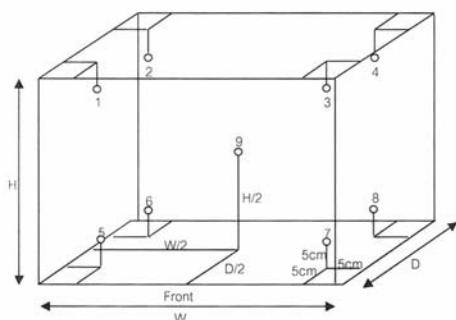
Page : 2 of 2

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	181.7	180.1	180.5	180.7	181.5	181.7	181.3	181.4	180.1	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	1.7	0.2	2.0

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 -



CAL-F0031-03

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Certificate of Calibration

Certificate No. : 66-400476-5

Page : 1 of 2

Submitted by : M E T Company Limited

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

Equipment : Air Chamber (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 : (31.0 to 32.0) °C

Relative Humidity : (55 to 60) %

Line Voltage : (210.0 to 210.8) V

Date of Received : 23 August 2023

Date of Calibration : 23 August 2023

Date of Issue : 23 August 2023

Calibrated by :

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 66-400226-1

27 Oct 2023

National Institute of Metrology Thailand (NIMT)

Approved by

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL-F0031-03

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Tel.(02) 954-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-400476-5

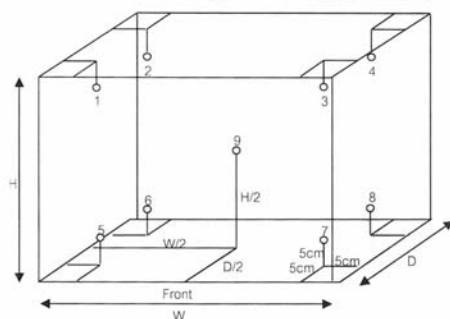
Page : 2 of 2

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	19.94	19.63	19.66	19.60	20.31	20.38	20.27	20.01	20.22	0.34

Test Point (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
20.0	20.0	20.0	0.68	0.05	0.9

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%

- o0o -



CAL-F0031-03

MTEC
Metrology Technical

Metrology Technical Co.,Ltd.

Calibration Certificate

Cert. No. : CT-23-05-23470

Page : 1 of 4

Issued date : 08 May 2023

Equipment : COD Reader , Manufacturer : MLAB , Model : DB1602

S/N = 0169 , Customer ID = -

Client : M E T COMPANY LIMITED.

36/659 M.6 Bang Rak Phatthana, Bang Bua Thong, Nonthaburi 11110

Received Date : 03 May 2023

Ref. Job No. : SO6605-00001

Calibrate by

Cert. prepare by

Calibrated Date : 03 May 2023

Approved by

Calibration Place : Laboratory room

Environment Condition : Temperature 28.6 ± 0.4 (°C) , Humidity 59.5 ± 3.5 (%RH)

Calibration Method : Measure temperature distribution by 9 channel in flat level. , (MTEC WI No. # WICAL-02-005-R01)

Reference Standard Instrument :

No	Instrument	code	Model	Due date
1	Temperature Datalogger	MTEC-CE-0180	MLAB	10/2023
2	Thermo Hygrometer	MTEC-CE-0181	TH-03A	06/2023

Condition of certificate :

(1) This certificate is traceable to International System of units (SI Units). , (2) This certificate was certified only for the instrument we calibrated. , (3) This result of calibration was found accurate as shown on date and place of calibration only. , (4) The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = (see result table) , providing a level of confidence of approximately 95%. , (5) This certificate may not be reproduced other than in full, except with the prior written approval of the head of Calibration Division, Metrology Technical Co.,Ltd.

Approved Signatory

CER04-R01-DF01

44 Soi ChokChai 4 Soi 40 , LadPrao , Bangkok , Tel.: 0-2538-9205 , 0-2935-7096 , Fax.: 0-2931-4015 , Email : contact@mttec.co.th , www.mtec.co.th

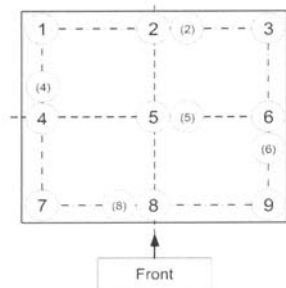
Certificate No. : CT-23-05-23470

Page : 2 of 4

Calibration Result :

Condition of UUC :

- 1) Without Adjustment
- 2) Immersion : 1/2 of the depth of the hole



Pic 1 : Position of each sensor No.

- (1) The quoted uncertainty include with "Stability".
 (2) Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors , for at least half an hour after reaching stead state.
 (3) Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
 (4) Overall variation = The difference of the maximum and the minimum measured temperature throughout observation time.

Section 1 : Report of Temperature distribution

Unit : (°C)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Measured Temperature @ Sensor No.									Uncertainty (±)	k (**)
			#1	#2	#3	#4	#5	#6	#7	#8	#9		
150	150	150	150.51	149.89	150.16	149.93	150.56	150.67	149.80	150.25	149.76	0.627	2

(*) = The average of 30 values in each point , (**) = Coverage factor (k) value

Section 2 : Report of Chamber Performance

Unit : (°C)

Calibration Point	UUC Setting	UUC Reading (*)	Temperature Uniformity	Temperature Stability (± °C)	Temperature Overall Variation
150	150	150	1	0.05	1

(*) = The average of 30 values in each point

Approved Signatory : _____

Certificate No. : CT-23-05-23470

Page : 3 of 4

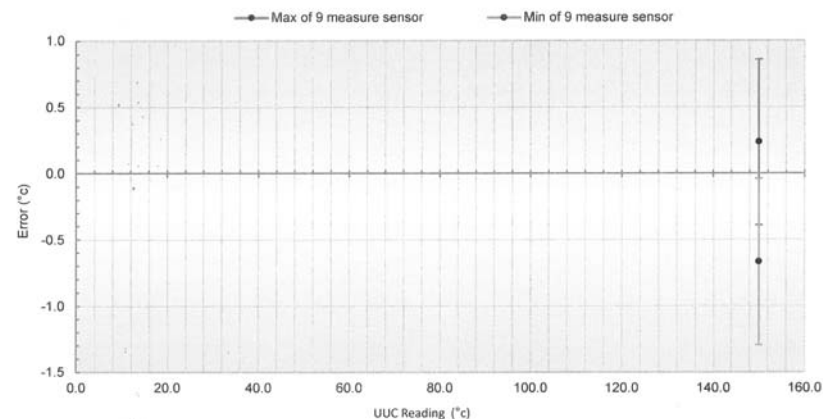
Section 3 : Possible of temperature. Show minimum and maximum of the average values and include with uncertainty of measurement. The average values is average of each position standard sensor throughout observation time.

Unit : (°C)

Calibration Point	UUC Setting (*)	UUC Reading (*)	Possible of Minimum temperature	Possible of Maximum temperature
150	150	150	149.14	151.30

(*) = The average of 30 values in each point

Section 4 : Trend of accuracy

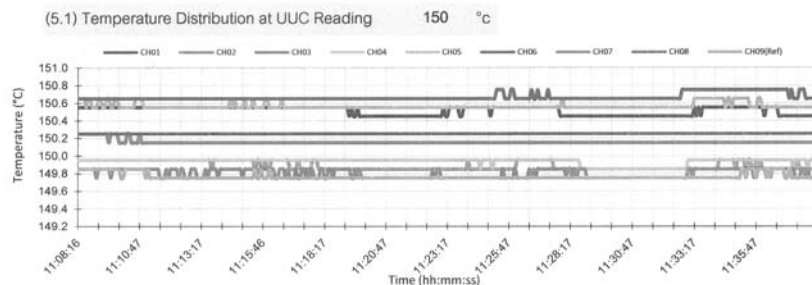


Approved Signatory : _____

Certificate No. : CT-23-05-23470

Page : 4 of 4

Section 5 : Graph report for Temperature distribution ; not include uncertainty of measurement



Certificate of Calibration

Certificate No. : 66-300123-4

Page : 1 of 2

Submitted by : M E T Company Limited

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

Equipment : Burette

Manufacturer : TS

Class : A

Capacity : 10 ml

Graduation : 0.02 ml

ID No. : MET-BU10:02/64

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

Relative Humidity : (50 ± 15) %

Air Pressure : 1015.1 mbar.

Date of Received : 02 March 2023

Date of Calibration : 09 March 2023

Date of Issue : 09 March 2023

Calibrated by :

Calibration Method : In-house method CAL-M3001 based on ASTM E 542-01

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

Electronic Balance

ID No.	Cert. No.	Due Date	Traceability
241005	65-200370-4	02 Jun 2023	National Institute of Metrology (Thailand) (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-300123-4

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 : 36.97 sec.

Nominal Volume (ml)	Measuring Volume (ml)
2	2.0008
5	5.0035
10	10.0072

Uncertainty of measurement with in \pm 0.0039 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 -

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. Absaugereinheit 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 Certificate

Final Test Inspection

Unit : BÜCHI Kjeldigester K-446

Serial number : 1000281006

Examination Procedure

- Visual control of the glass parts and the unit** ✓ OK
 - No scratches on the coated surface
 - Mounted in accordance to the specific drawing
- 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)
- Functional tests** ✓ OK
 - 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)
- 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 englisch		✓ OK

Packed by





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** ✓ OK
 - 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 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
- Display is working
- All buttons of the keypad are working
Pump testing
- All pumps are working
- All pumps (exception: water pump of the steam generator) are precalibrated
Valve testing
- All valves are working
Steam generator testing
- The steam generator is filled with water
- The steam generator valve is working
- The amount of distillate corresponds to specifications
Further testing
- 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: MET Company Limited.

Instrument Location: 36 659 Soi Mu Ban Monwadi Park 6,
Bang Rak Phatthana, Bang Bua Thong District, Nonthaburi 11110

Instrument Serial No.: 078S1407053C

Date: 07-Jun-2023

ICP-OES/Optima8000 Preventive Maintenance (PM)			
Company Name:	MET Company Limited.		
Address (Instrument Location):	Bang Rak Phatthana, Bang Bua Thong District, Nonthaburi 11110		
Serial Number:	078S1407053C	PM Number:	2 of 2
Customer Name (if applicable):		Telephone Number:	
Service Engineer Name:		Service Order Number:	
Date PM Performed: (DD-MMM-YYYY)	07-Jun-2023	Next PM Due Date: (DD-MMM-YYYY)	07-Dec-2023
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
Optima8000	078S1407053C	Winlab V 5.5.0.0714
S10 Autosampler		

Parts Lists

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

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	58-146CRX1	Oct-2023
N9300221	Instrument Calibration-4 (N9300221 diluted 100X)	1	58-169CRY1	Nov-2023

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	76	76psig
Torch Argon	67	67psig
Shear Gas	65	65psig
Water	35	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	0.00721	Passed
Ni 231.604 - Resolution	≤0.011	0.00878	Passed
Ni 341.476 - Resolution	≤0.015	0.01273	Passed
Ba 455.403 - Resolution	≤0.020	0.01590	Passed

5.2 Precision:

☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
Zn 213.856	%RSD \leq 1 %	0.71	Passed
Mg 280.856	%RSD \leq 1 %	0.55	Passed
Mg 285.207	%RSD \leq 1 %	0.74	Passed
Ba 455.403	%RSD \leq 1 %	0.40	Passed

5.3 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	11658.2	1135839	
Mn 257.610	Axial	1,000 ppb	45267.9	9443358.7	
Mn 257.610	IB*Conc.	IS - IB	BEC	Spec	Pass/Fail
Radial	11658200	1124180.8	10.37	<30 PPB	Passed
Axial	45267900	9398090.8	4.82	<30 PPB	Passed

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)

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpoed, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



Certificate of Calibration

Certificate No. : 66-400012-1

Page : 1 of 2

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

Equipment : Digital Thermometer with Thermistor Probe
Temperature Indicator
Manufacturer : Thermo Scientific Model : pH 150
Range : N/A 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. : 237 ID No. : MET-PH04/60

Environment : Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Line Voltage : (220 ± 22) VAC

Date of Received : 05 January 2023

Date of Calibration : 11 January 2023

Date of Issue : 11 January 2023

Calibrated by : [Redacted]

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-0016-20	04 Mar 2022	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	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.



CAL-F0031-03

CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpoed, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

Certificate of Calibration

Certificate No. : 66-400012-1

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)
85	10.0035	9.8	0.2	0.11
85	50.0025	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%

- 000 -



CAL-F0031-03



PinAAcle 900T Preventive Maintenance Report

Company Name: SPS Consulting Service Co., Ltd.
Instrument Location: 7 Soi Phaholyothin 24, Phaholyothin Rd.
Jompol, Chatuchak, Bangkok, 10900
Instrument Serial No.: PTCS14111103
Date: 29-Jun-2023

PinAAcle 900T Preventive Maintenance (PM)

Company Name:	SPS Consulting Service Co., Ltd.		
Address (Instrument Location):	7 Soi Phaholyothin 24, Phaholyothin Rd. Jompol, Bangkok, 10900		
Serial Number:	PTCS14111103	PM Number:	2/2
Customer Name (if applicable):		Telephone Number:	
Customer Support Engineer Name:		Service Order Number:	
Date PM Performed: (DD-MMM-YYYY)	29-Jun-2023	Next PM Due Date: (DD-MMM-YYYY)	29-Dec-2023
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370143 Rev.9	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900T 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
AS900	AS91S14B1002	Winlab32

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	N/A
B3002013	THGA Contact Cylinders	N/A
B3141064	Glycerol for THGA Cooling	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	56-21CRY1	30-Jun-2023

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

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. PC Instrument Software:

- ✓ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ✓ Inspect and clean all fans and filters. Replace filters if necessary
- ✓ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ✓ Clean exterior of the instrument.

3.1 Flame Technique

- ✓ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ✓ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ✓ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ✓ Check the drain system for signs of wear. Replace worn or damaged parts.
- ✓ Visually check for proper flame conditions when igniting the Air-C₂H₂ and N₂O-C₂H₂ flames (if applicable).

3.2 THGA Technique

- ✓ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ✓ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ✓ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ✓ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ✓ Check furnace open/close function.
- ✓ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ✓ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ✓ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ✓ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN

- ✓ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ✓ Check auto sampler operation.
- ✓ Perform an auto sampler check valve test as described in the Service Manual.
- ✓ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ✓ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.

4. Electrical:

- ✓ Inspect PC boards. Clean if necessary.
- ✓ Carefully check all internal and external cable connections.
- ✓ Check instrument firmware revisions upgrade to current levels (if necessary)
- ✓ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ✓ Inspect and clean the sample compartment windows, if needed.
- ✓ Inspect and clean the furnace windows, if needed.
- ✓ Inspect and clean the GFTV camera lens, if needed.
- ✓ Inspect optics. Clean or replace if necessary,

6. Gasses:

- ✓ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ✓ Verify that the air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests [Flame]:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9877	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1985	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0016	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

8.4 D₂ Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0044	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0001	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0013	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3421	Passed

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min ± 25 mL/min	255	Passed
External Flow Rate	100 mL/min ± 10 mL/min	105	Passed

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0005	Passed
Standard Deviation	≤ 0.005	0.0004	Passed

9.3 Chromium Characteristic Mass and Precision

Description: Calculate the characteristic mass using the characteristic mass tool and precision from the integrated absorbance values.

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	≤ 7.0 pg/0.0044 A-s	5.8	Passed
Precision	≤ 2.0 %	1.18	Passed

9.4 Copper Characteristic Mass and Zeeman Ratio

Description: Calculate the characteristic mass using the characteristic mass tool and check the Zeeman Ratio.

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	13.6	Passed
Zeeman Ratio	0.52 ± 0.04	0.52	Passed

10. 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.

Additional Comments

Additional Comments Regarding the PM

Zeeman Ratio

=

Atomic Signal (Peak area)

Atomic Signal (Peak area) + Background Signal (Peak area)

=

0.1614

0.1614+0.1448

=

0.52

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.

This PinAAcle 900T Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Authorized Customer Representative:

Date:

06-Jun-2023

(DD-MMM-YYYY)

Date:

06-Jun-2023

(DD-MMM-YYYY)



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Certificate of Calibration

Certificate Number : SPR23020546-2

Page : 1 of 3

Customer : MET CO.,LTD.

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

Equipment Name : Noise Dose Meter

Manufacturer : Tenmars

Model : ST-130

Serial Number : 220100185

ID. Number : ND-02

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 28 Feb 2023

Calibration Date : 14 Mar 2023

Recommend Due Date : 14 Mar 2024

Date of Issue : 15 Mar 2023

Method of Calibration

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

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

Calibrated by

Authorized Signatory

SP-FM-04-15 rev.0



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Calibration Report

Certificate Number : SPR23020546-2

Page : 2 of 3

Reference Standards

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

Traceability

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

SP-FM-04-15 rev.0



Result of Calibration

Certificate No. : SPR23020546-2

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	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	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select Z

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

Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23020546-7

Page : 1 of 3

Customer : MET CO.,LTD.

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

Equipment Name : Noise Dose Meter

Manufacturer : Tenmars

Model : ST-130

Serial Number : 220100186

ID. Number : ND-11

Environmental Conditions

Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ Received Date : 28 Feb 2023

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 14 Mar 2023

Location of Calibration : In-Lab Recommend Due Date : 14 Mar 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 15 Mar 2023

Method of Calibration

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

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

Calibrated by :

Authorized Signatory



Calibration Report

Certificate Number : SPR23020546-7

Page : 2 of 3

Reference Standards

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

Traceability

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



Result of Calibration

Certificate No. : SPR23020546-7

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	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Select Z

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

Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR23010249-5

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-31

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 19 Jan 2023

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 23 Jan 2023

Location of Calibration : In-Lab Recommend Due Date : 23 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 24 Jan 2023

Method of Calibration

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

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

Calibrated by :



Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23010249-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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

SP-FM-04-15 rev.0



Certificate No. : SPR23010249-5

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	94.3	94.2	0.3	0.2	0.15
114	114.1	114.1	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 Number : SPR23010249-6

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-32

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 19 Jan 2023

Relative Humidity : 50 % \pm 15 % Calibration Date : 23 Jan 2023

Location of Calibration : In-Lab Recommend Due Date : 23 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 24 Jan 2023

Method of Calibration

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

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

Calibrated by :

Authorized Signatory



Calibration Report

Certificate Number : SPR23010249-6

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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



Result of Calibration

Certificate No. : SPR23010249-6

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	94.0	94.0	0.0	0.0	0.15
114	114.1	114.1	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 Number : SPR23010249-11 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 : 222102

ID. Number : SLM-07

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 19 Jan 2023

Relative Humidity : 50 % \pm 15 % Calibration Date : 23 Jan 2023

Location of Calibration : In-Lab Recommend Due Date : 23 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 24 Jan 2023

Method of Calibration

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

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

Calibrated by :

Authorized Signatory



Certificate Number : SPR23010249-11 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Result of Calibration

Certificate No. : SPR23010249-11

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	93.9	93.9	-0.1	-0.1	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	94.2	94.2	0.2	0.2	0.15
114	114.3	114.3	0.3	0.3	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 -

SP-FM-04-15 REV.0



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Certificate of Calibration

Certificate Number : SPR23010249-13

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 : 222103

ID. Number : SLM-47

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$	Received Date : 19 Jan 2023
Relative Humidity : $50\% \pm 15\%$	Calibration Date : 23 Jan 2023
Location of Calibration : In-Lab	Recommend Due Date : 23 Jan 2024
Calibration Procedure : SP-CPE-04-01	Date of Issue : 24 Jan 2023

Method of Calibration

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

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

Calibrated by :



Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23010249-13

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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



Result of Calibration

Certificate No. : SPR23010249-13

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	94.1	94.1	0.1	0.1	0.15
114	114.1	114.1	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 -



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Certificate of Calibration

Certificate Number : SPR23010249-14

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 : 222104

ID. Number : SLM-09

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPE-04-01

Received Date : 19 Jan 2023

Calibration Date : 23 Jan 2023

Recommend Due Date : 23 Jan 2024

Date of Issue : 24 Jan 2023

Method of Calibration

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

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

Calibrated by :



Authorized Signatory

SP-FM-04-15 rev.0



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Calibration Report

Certificate Number : SPR23010249-14

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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

TISTR - Thailand Institute of Scientific and Technological Research

SP-FM-04-15 rev.0



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Result of Calibration

Certificate No. : SPR23010249-14

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	94.0	94.0	0.0	0.0	0.15
114	114.0	114.0	0.0	0.0	0.15

Note:

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

Measurement Uncertainty

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

- End of Certificate -

SP-FM-04-15 REV.0



METROLOGY SYSTEM (THAILAND) CO.,LTD.



Certificate of Calibration

Certificate Number : SPR23010249-15

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 : 222105

ID. Number : SLM-10

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Received Date : 19 Jan 2023

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 23 Jan 2023

Location of Calibration : In-Lab Recommend Due Date : 23 Jan 2024

Calibration Procedure : SP-CPE-04-01 Date of Issue : 24 Jan 2023

Method of Calibration

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

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

Calibrated by :

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23010249-15

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Sound Level Calibrator	SC-942	B014059	EEL.BP. 34/1264	22 Dec 2023

Traceability

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



Result of Calibration

Certificate No. : SPR23010249-15

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	94.1	94.1	0.1	0.1	0.15
114	114.2	114.2	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 –