

ภาคผนวกที่ 4

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สรุปเอกสารสอบเทียบอุปกรณ์เครื่องมือ

เอกสารการสอบเทียบเครื่องเมื่อตรวจวัดคุณภาพน้ำ

		<b>CERTIFICATE OF CONFORMITY</b>	
<b>Aquion System</b>			
This certificate is to verify that the instrument referenced below by serial number meets or exceeds all Thermo Scientific functional specification and release requirements.			
Instrument Serial Number:	221280114	Firmware Version:	3.1.0
Instrument Module Type:	22175-60018	<b>Aquion Final Test</b>	
<input checked="" type="checkbox"/> Pump Calibration, Ripple and Accuracy		<input checked="" type="checkbox"/> Injection Valve Precision	
<input checked="" type="checkbox"/> Suppressor Current, Cal and Accuracy		<input checked="" type="checkbox"/> Relay and TTL I/O Test	
<input checked="" type="checkbox"/> Column Heater, Cal and Check		<input checked="" type="checkbox"/> Injection Valve Functionality	
<input checked="" type="checkbox"/> Detector Heater, Cal and Accuracy		<input checked="" type="checkbox"/> Leak Sensors	
<input checked="" type="checkbox"/> Conductivity Detector Cal, Noise and Linearity		<input checked="" type="checkbox"/> Leak Detection Accuracy	
<input checked="" type="checkbox"/> Degass Calibration		<input checked="" type="checkbox"/> Eluent Generator Calibration	
Tester's Signature:	Angel Ruiz	Date:	22 Dec 2022
		60-095656 Rev B	

## Aquion Pump Summary Test Report

Instrument Name	Model	Serial Number	Moduleware
Pump	Aquion	221280114	3.1.0
Detector		221260053	

Sequence Name: 1\_Aquion\_Pump\_FQO  
Sequence Run Date: 22 Dec 2022  
Sequence Comment: Aquion Pump Test Final

Flow Accuracy Test				
Test Run	Pressure	Measured	Flow Rate	Accuracy
Flow Accuracy: 1mL/min	2132	0.9988	0.115%	Pass
Flow Accuracy: 2mL/min	2467	1.9980	0.098%	Pass

Pressure Ripple Test				
Test Run	Pressure	Measured	Pressure Ripple	
Flow Accuracy: 1mL/min	2132	0.080%	≤ 0.30%	Pass
Flow Accuracy: 2mL/min	2467	0.121%	Pass	Pass

Angel Ruiz  
Test Technician

22 Dec 2022

Date

## Aquion Detector Summary Test Report

Instrument Name	Model	Serial Number	Moduleware
Pump	Aquion	221280114	3.1.0
Detector		221260053	

Sequence Name: 2\_Aquion\_Detector\_FQO  
Sequence Run Date: 22 Dec 2022  
Sequence Comment: AQUION Final Test Detector

Dummy Load				
Test Run	Cell Heater	Measured	Background Signal	
Cell Dummy Load and Warm up	34.8 - 35.2	Pass	18.9 - 23.1	Pass
	35.016	Pass	20.211	Pass

Detector Noise & Drift Test				
Test Run	Background Signal	Measured	Drift	Noise
Cell DI Water Noise and Drift	0.05 - 0.60 µS	Pass	≤ 10.0 nS/hour	≤ 0.2 nS
	0.090 µS	Pass	4.715 nS/hour	0.139 nS
			Pass	Pass

Detector Linearity Test				
Test Run	Correlation Coefficient	Measured	%RSD	Calibration Curve
Cell Linearity Test 5 ppm	≥ 0.999	Pass	≤ 5.0 %	Slope
	0.99998	Pass	4.30	Offset
			Pass	0.000
				0.553

Injector Precision Test				
Test Run	Average	%RSD	Retention Time	
Injector Precision: 50 ppm	2.576 µS*min	0.106%	Average	Max-Min
			0.373 min	0.0100 min
			Pass	Pass

Angel Ruiz  
Test Technician

22 Dec 2022

Date



# Thermo Aquion System Calibration Summary

Instrument Name	Model	Serial Number	Moduleware	Calibration	Value
Module	Aquion	221280114	3.1.0	Column Calibration	12/22/2022

Column Heater	Column Calibration	0.000
	Electrical Offset	1.96
	Heater Offset	1.02

Pump	Pressure Calibration	12/22/2022
	Pressure Transducer Offset	1576.00
	Pressure Transducer Slope	0.363
	Flow Rate Calibration	12/22/2022
	Flow Rate Parameter	5.4
	Flow Rate Nominal Speed	3845
	Flow Rate Slope	0.93

Detector	Detector Calibration	12/22/2022
	Fine Offset	251260.77
	Fine Slope	0.000000025
	Mid-Range Offset	28004.72
	Mid-Range Slope	0.000000409
	Coarse Offset	17014.44
	Coarse Slope	0.000002016
	Cell Constant	153.13

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Electrical and Electronic Products Restriction of Hazardous Substances Management Measures  
For applicable products, the Hazardous Substance Information Table is located at:  
<http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html>



Harikul Science Co., Ltd.  
694 Soi Ratchadriwet 24, Pracharabamphen,  
Samsaenok, HuaiKhwang, Bangkok 10310  
Tel: 0-2274-2456 Fax: 0-2274-2443  
Email: info@harikul.com www.harikul.com

CERT No.: HS-T0591

Certificate of Calibration

Calibration Date: 1 Sep 22

Submitted by: C.E.M TECHNOLOGY (THAILAND) Co., LTD.

219/43 Moo 12, Petchkasem Road, Omnoi, Krathumban, Probe

Samutsakom 74130

Model : YSI 5000

S/N : 18L109487

Probe : YSI 5010

S/N : 22G100123

ID NO. :

Air Temp ref : S/N: E00522

Barometric ref : S/N: E00522

Water Temp ref : S/N: 11431

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Technician : Kittipong M.

## Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.09	(PASS)	-
Measurement 8 (mg/l)	9.09	(PASS)	-
Measurement 9 (mg/l)	9.09	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.09	mg/l
Inaccuracy	0.00	mg/l

Overall Status (PASS)

## Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

*[Signature]*

Technician Signature

*[Signature]*

Laboratory Manager



## Calibration Result

Instruments Information			
Calibration Package Number	TR2022001		
Instruments Type	Gas Chromatograph		
Serial Number	481774	Model	KONIK GC 4000B
Installation Date	End of Warranty		
S.O. Number	P.O. Number		
Firmware Version	DPFC Rom Ver.		
Left Injection	-	Right Injector	S/SL
Left DPFC	-	Right DPFC	-
Left Detector	-	Right Detector	FID
Left DGFC	-	Right DGFC	-
Auxiliary Detector	-	Valve/Valve Oven	-
Last Validation	December 21, 2022	Next Validation	December 21, 2023
Last Preventive Maintenance	December 21, 2022	Next Preventive Maintenance	December 21, 2023
Data System Type	N2000	Data System Version	3.1.1

Gases Information			
Injector		Detector	
Left Carrier	-	Right Carrier	Helium, 3.0mL/min
Left Detector	-	Right Detector	FID
Gas 1	-	Gas 1 (Hydrogen)	Hydrogen, 40mL/min
Gas 2	-	Gas 2 (Make-up)	Nitrogen, 30mL/min
Gas 3	-	Gas 3 (Air)	Air Zero, 350mL/min

Service Engineer Signature: \_\_\_\_\_

(Teerapon Tawonwong)

Date: \_\_\_\_\_

21.12.2022



# CERTIFICATE OF System Validation

This certificate was provided by Amani Corporation limited. To certifies that the instruments referenced below have passed system Validation tests and complies with the requirements of the specified set of test

Validation Package Number : TR2022001  
 Instruments : GC  
 Model : KONIK GC 4000B  
 Serial No : 481774  
 Location : C.E.M. Technology (Thailand) Co., Ltd.

Amani Corporation Limited

December 21, 2022

Service Engineer : \_\_\_\_\_  
 (Teerapon Tawonwong)

## Gases Flow Rate Validation Result

Carrier Gases			
Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
25	25.0	24.0-26.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
Detector Gases			
Reference Gas			
Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
Low	9.3	8.0-12.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
High	46.7	45.0-55.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
Make-up Gas			
Set point (mL/min)	Measured (mL/min)	Criteria (mL/min)	Status
Low	9.7	8.0-12.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail
High	31.3	28.0-32.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail

Service Engineer Signature:

(Teerapon Tawonwong)

Date:

21.12.2022

Calibration Result

Page 2 of 1

## Temperature Validation Result

Injector Temperature			
Set point (°C)	Measured (°C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	
Detector Temperature			
Block Temp			
Set point (°C)	Measured (°C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	
Transfer Temp			
Set point (°C)	Measured (°C)	Status	Note
60 +/- 1.0	60.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	
Column Oven			
Set point (°C)	Measured (°C)	Status	Note
40 +/- 1	40.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	RTD OFFSET = 6.2
120 +/- 1	120.0	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Fail	

Service Engineer Signature:

(Teerapon Tawonwong)

Date:

21.12.2022


Calibration Result

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## Parts Referenced

Part	Description	Note
Analytical Column	Capillary Column RTX-5 Film : 0.25 um Length : 7 Meter Diameter : 0.32 mmID	Reference With : Restek
Standard Sample	FID Performance Evaluation Sample Kit	Manufactured By Agilent Technologies. 5080-8842 Lot: 0006604151
Sample Injection	Syringe 10 ul	Manufactured By SGE




Service Engineer Signature:  (Teerapon Tawonwong)

Date: 21.12.2022

## Operating Condition

Parameter	Condition
<b>Environmental</b>	Temperature 25.0 °C Relative Humidity 45.7 °C  <b>Gases</b> - Carrier Gas : Helium = 1ml/min - Hydrogen = 35 ml/min - Air = 350 ml/min - Make-up Gas: Nitrogen = 30ml/min  <b>Oven</b> - Initial Temperature = 50°C - Initial Time = 1 minute - Ramp 1 = 20 °C/minute - Final Temperature = 200°C - Final Time = 1 minute
<b>Instrument Condition</b>	<b>Injector</b> - Operating Mode = Split - Temperature = 230 °C - Split Flow 40. ml/min - Purge Flow rate = 5 ml/min  <b>Detector</b> - Base Temperature = 250 °C - Detector Signal Range = 10°  <b>Injected Volume</b> - 1 µl + needle of Test Mixture

Service Engineer Signature:  (Teerapon Tawonwong)

Date: 21.12.2022





## Certificate of Calibration

**Equipment:** Cooled Incubator  
**Model:** KB 240  
**Serial No.(or ID):** 20180000012164 (WW-16-001)  
**Manufacturer:** Binder  
**Condition:** In Condition  
**Shelves(pc.):** 3

**Customer:** C.E.M Technology (Thailand) Co., Ltd.  
31/8 Moo 13, Tambon Raikhing,  
Amphur Sampran, Nakhonpathom 73210 Thailand.

**Environment Condition:** Temperature: 22 °C ± 1.9 °C  
Humidity: 72 %RH ± 6.2 %RH  
Voltage: 229 VAC ± 3.1 VAC

**Calibration Place:** C.E.M Technology (Thailand) Co., Ltd. ( Laboratory Room )  
219/43 Moo 12 Petchkasem Road,  
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

**Calibration By:** Mr. Suphanimit Khamnonphoem  
**Calibration Date:** 15 February 2023  
**The Method used:** In house method, CAL-WI-16, base on TLAS-G20  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10220016

(Mr. Suphanimit Khamnonphoem)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

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

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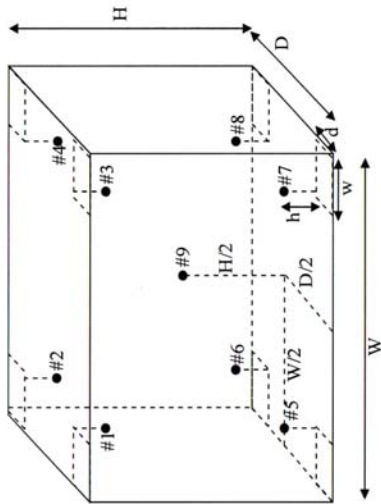
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Certificate No.: C31230380

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### Standard Installation Locations

Volume (Calibration Zone)= 125 (Liters)

Inside chamber: W = 65 (cm) D = 49 (cm) H = 79 (cm)

Standard Locations (#1, #2, #3, #4): w = 7 (cm) d = 5 (cm) h = 8 (cm)

Standard Locations (#5, #6, #7, #8): w = 7 (cm) d = 5 (cm) h = 8 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

### Definitions

**Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.

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

**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe. **Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

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CAL-FM-C31-10: 12 Sep 2022



### Calibration Results: Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured Temperature (°C)	Correction of UUC, (°C)	Uncertainty (± °C)
#1	20.20	0.20	0.34
#2	20.07	0.07	0.37
#3	20.02	0.02	0.36
#4	19.96	-0.04	0.41
#5	20.07	0.07	0.35
#6	20.10	0.10	0.33
#7	19.84	-0.16	0.37
#8	20.08	0.08	0.36
#9	20.09	0.09	0.34

### Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	20.20	20.07	20.02	19.96	20.07	20.10	19.84	20.08	20.09	0.41

### Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.30	0.27	0.80

Note: \* Maximum uncertainty of the each position

### The End of Certificate



### Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

Decision rule: ☐ Choice A Binary Statement for Simple Acceptance Rule (w = 0), Specific Risk < 50% PFA.

☒ Choice B Non-binary statement with guard band (w = 1 U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.

☐ Choice C Customer defined, Customers may define arbitrary multiple of r to have applied as guard band (w = r U).  
; PFA – Probability of False Accept



(Mr. Udon Sirichana)  
Authorized signatory

### Without adjustment

Desired Temperature : 20.0 °C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured (°C)	Correction of UUC, (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	20.20	0.20	0.34	1.0	Pass
#2	20.07	0.07	0.37	1.0	Pass
#3	20.02	0.02	0.36	1.0	Pass
#4	19.96	-0.04	0.41	1.0	Pass
#5	20.07	0.07	0.35	1.0	Pass
#6	20.10	0.10	0.33	1.0	Pass
#7	19.84	-0.16	0.37	1.0	Pass
#8	20.08	0.08	0.36	1.0	Pass
#9	20.09	0.09	0.34	1.0	Pass

Correction of UUC: \* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

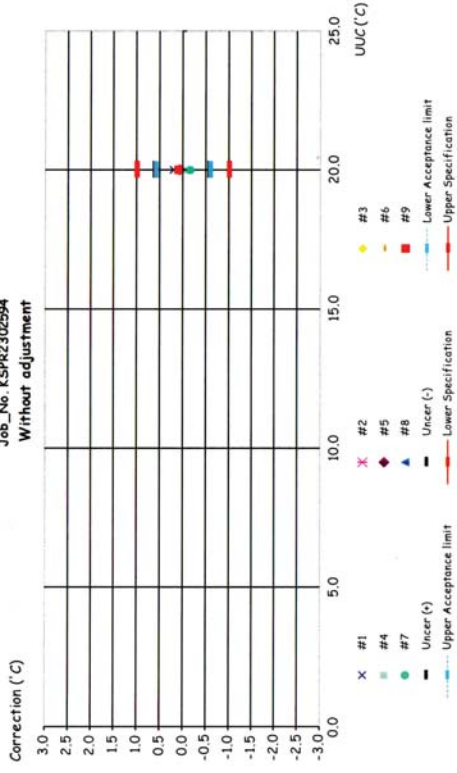
### The End of Statements of Conformity



Corr\_Distribution & Max\_Measurement Uncertainty

Job\_No. KSPR2302594

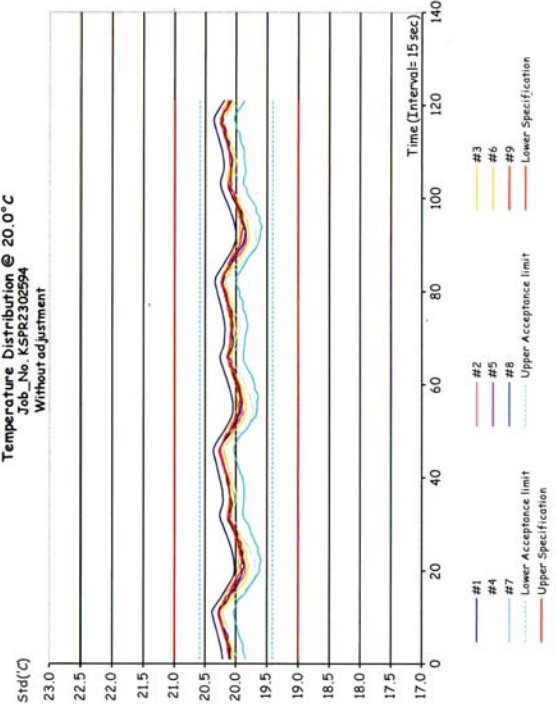
Without adjustment



Temperature Distribution @ 20.0°C

Job\_No. KSPR2302594

Without adjustment



## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302594

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: KB 240

หมายเลขเครื่อง: 20180000012164 ( WW-16-001 )

ตรวจสอบ (รับ)	รวมการตรวจเช็ค		ตรวจสอบ (ส่ง)		หมายเหตุ
	15 Feb 2023		15 Feb 2023		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
<b>General</b>					
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การทำงาน ฟัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	6. สภาพ Lever of Ventilation valve	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพ Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr. Suphanimit Khamnonphoom  
Service Engineer





## Certificate of Calibration

**Equipment:** Hot Air Oven  
**Model:** UF 55  
**Serial No.(or ID):** B219.0142 ( WW-05-002 )  
**Manufacturer:** Memmert  
**Condition:** In Condition  
**Shelves(pc.):** 2

**Customer:** C.E.M Technology (Thailand) Co., Ltd.  
31/8 Moo 13, Tambon Raikhing,  
Amphur Sampran, Nakhonpathom 73210 Thailand.

**Environment Condition:** Temperature: 26 °C ± 1.2 °C  
Humidity: 55 %RH ± 5.4 %RH  
Voltage: 226 VAC ± 2.6 VAC

**Calibration Place:** C.E.M Technology (Thailand) Co., Ltd. ( Laboratory Room )  
219/43 Moo 12 Petchkasam Road,  
Omnoi Krathum Baen, Samut Sakhon 74130 Thailand

**Calibration By:** Mr. Apiwit Chaosap  
**Calibration Date:** 15 February 2023  
**The Method used:** In house method, CAL-WI-16, base on TLAS-G20  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC RT Co., Ltd. Certificate No. C10220016

  
(Mr. Apiwit Chaosap)  
**Person in charge**

  
(Mr. Udon Srichana)  
**Authorized signatory**

This certificate is issued in 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 in the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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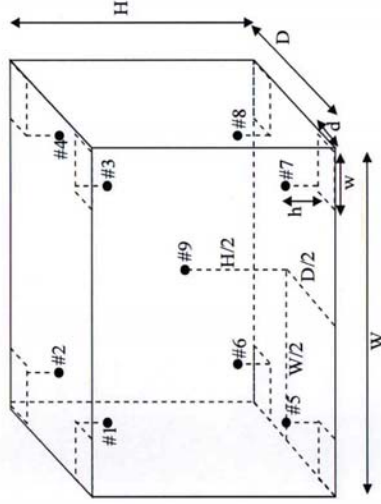
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CAL-FM-C31-10: 12 Sep 2022



Certificate No.: C31230315

Page: 2 of 4



### Standard Installation Locations

Volume (Calibration Zone)= 21 (Liters)

Inside chamber: W = 40 (cm) D = 33 (cm) H = 40 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	1	2	3	4	5	6	7	8	9

### Definitions

**Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.

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

**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the

measured temperature at the reference location which are observed at same time or at close observation time as

possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference

probe is preferably located in the geometric center of the chamber.

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

**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

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

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.08	0.08	0.39
#2	103.99	-0.01	0.39
#3	104.30	0.30	0.39
#4	104.24	0.24	0.39
#5	104.33	0.33	0.39
#6	104.22	0.22	0.39
#7	103.71	-0.29	0.39
#8	104.24	0.24	0.39
#9	104.36	0.36	0.39

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
104.0	104.0	104.0	104.08	103.99	104.30	104.24	104.33	104.22	103.71	104.24	104.36	0.39

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.70	0.07	0.76

Note: \* Maximum uncertainty of the each position



Without adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	179.63	-0.37	0.46
#2	179.69	-0.31	0.45
#3	180.34	0.34	0.45
#4	180.23	0.23	0.45
#5	180.59	0.59	0.45
#6	180.23	0.23	0.45
#7	179.42	-0.58	0.48
#8	180.28	0.28	0.45
#9	180.67	0.67	0.46

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
180.0	180.0	180.0	179.63	179.69	180.34	180.23	180.59	180.23	179.42	180.28	180.67	0.48

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.41	0.15	1.54

Note: \* Maximum uncertainty of the each position

The End of Certificate





Refer to Certificate No.: C31230315 Page: 1 of 2

## Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The correction of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, TLAS-G20. Therefore, those parameters have not been assessed separately.

### Tolerance and Decision rules:

Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

- Decision rule :** ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk < 50% PFA.  
☒ Choice B Non-binary statement with guard band ( $w = 1$  U), Pass or Fail Specific Risk < 2.5% PFA and Condition Pass or Condition Fail Specific Risk < 50% PFA.  
☐ Choice C Customer defined, Customers may define arbitrary multiple of  $r$  to have applied as guard band ( $w = r$  U).  
; PFA – Probability of False Accept

  
(Mr. Udon Srichana)  
Authorized signatory

## Without adjustment

Desired Temperature : 104.0 °C Tolerances : 1.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured (°C)	Correction of UUC. (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	104.08	0.08	0.39	1.0	Pass
#2	103.99	-0.01	0.39	1.0	Pass
#3	104.30	0.30	0.39	1.0	Pass
#4	104.24	0.24	0.39	1.0	Pass
#5	104.33	0.33	0.39	1.0	Pass
#6	104.22	0.22	0.39	1.0	Pass
#7	103.71	-0.29	0.39	1.0	Pass
#8	104.24	0.24	0.39	1.0	Pass
#9	104.36	0.36	0.39	1.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

DKSH Measurement Unit Ltd. Co., Ltd.  
DKSH Temperature Calibration Unit  
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C31-10: 12 Sep 2022



Refer to Certificate No.: C31230315 Page: 2 of 2

## Statements of conformity:(Cont.) Without adjustment (Cont.)

Desired Temperature : 180.0 °C Tolerances : 2.0 °C

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured (°C)	Correction of UUC.* (°C)	Guard band (W) (± °C)	Tolerance (± °C)	Conformity
#1	179.63	-0.37	0.46	2.0	Pass
#2	179.69	-0.31	0.45	2.0	Pass
#3	180.34	0.34	0.45	2.0	Pass
#4	180.23	0.23	0.45	2.0	Pass
#5	180.59	0.59	0.45	2.0	Pass
#6	180.23	0.23	0.45	2.0	Pass
#7	179.42	-0.58	0.48	2.0	Pass
#8	180.28	0.28	0.45	2.0	Pass
#9	180.67	0.67	0.46	2.0	Pass

Correction of UUC.\* = Measured Temperature - Desired Temperature

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

## The End of Statements of Conformity

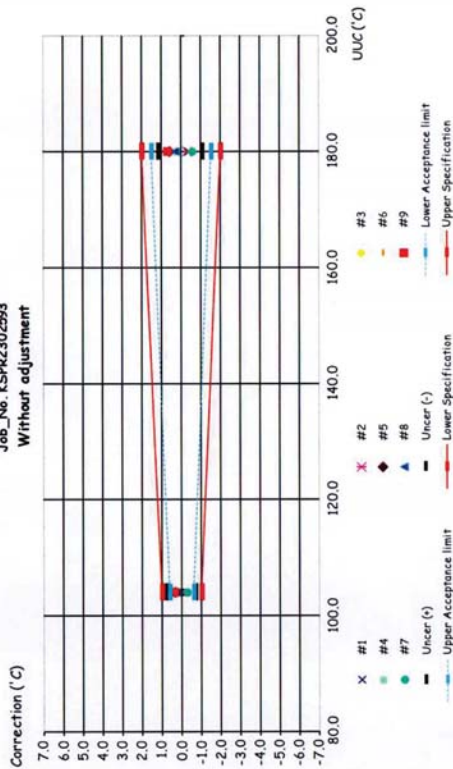
DKSH Measurement Unit Ltd. Co., Ltd.  
DKSH Temperature Calibration Unit  
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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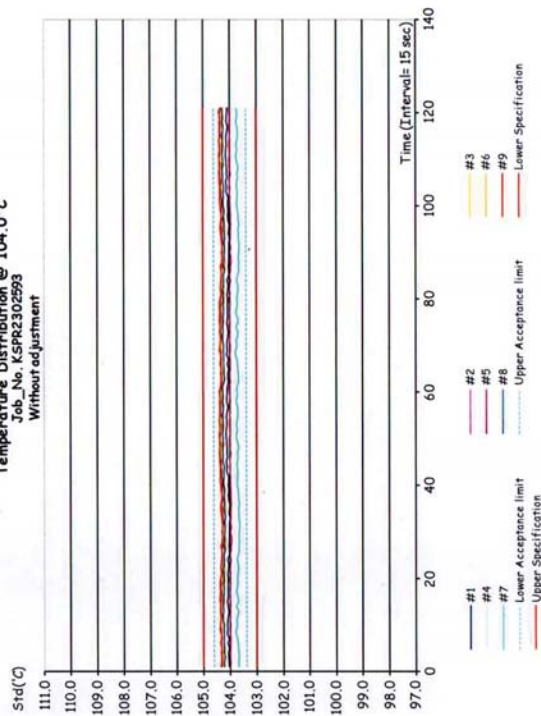
CAL-FM-C31-10: 12 Sep 2022



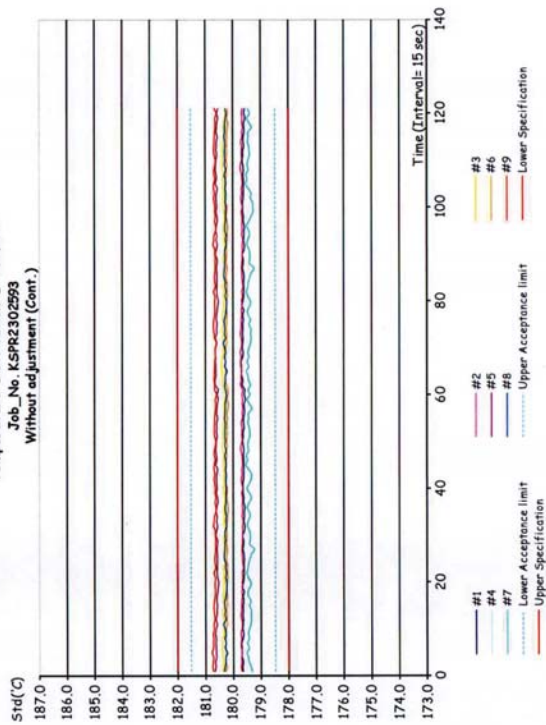
Corr\_Distribution & Max\_Measurement Uncertainty  
Job\_No. KSPR2302593  
Without adjustment



Temperature Distribution @ 104.0°C  
Job\_No. KSPR2302593  
Without adjustment



Temperature Distribution @ 180.0°C  
Job\_No. KSPR2302593  
Without adjustment (Cont.)





## ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: KSPR2302593

รุ่น: UF 55

ชนิดเครื่อง: Hot Air Oven

หมายเลขเครื่อง: B219.0142 (WW-05-002)

ตรวจสอบ (รับ)	รายการตรวจสอบ	ตรวจสอบ (ส่ง)		หมายเหตุ
		15 Feb 2023	ผ่าน/ไม่ผ่าน	
ปกติ	ไม่ปกติ	ปกติ	ไม่ปกติ	
<b>General</b>				
<input checked="" type="checkbox"/>	1. สายไฟ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	2. การทำงาน Main Switch	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	3. การทำงาน Selector Key	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	4. การแสดงผล Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	5. การทำงาน ฟัดลม	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	6. สวิท Lever of Ventilation valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	7. สวิท Lever door open / close	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	8. สวิท Door seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	9. การทำงานของระบบ Safety	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	10. การทำงานของระบบทำความเย็น	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	11. การทำงานของระบบทำความร้อน	<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	12. สภาพตัวเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ:

Mr. Apiwit Chaosap  
Service Engineer

DKSH Thailand Co., Ltd.  
2533 หมู่ 10 ตำบลบางพลีใหญ่ อำเภอบางพลี จังหวัดสมุทรปราการ 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/industrial-thailand

Delivering Growth - in Asia and Beyond.

# CAL

Calibratech Co., Ltd.

7/106-7 Moo 2, Sukhprachasan 3 Rd., Banggood, Pakkred, Northaburi 11120  
Tel: (02) 964-0211 Fax: (02) 964-5155, e-mail: calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NS-CAL-TIS 17025  
CALIBRATION 0036

## Certificate of Calibration

Page : 1 of 2

Certificate No. : 66-420017-1

Submitted by : C.E.M Technology (Thailand) Co., Ltd.

219/43 Moo.12 Petchkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment : pH Meter with electrode

pH meter

Manufacturer : Thermo Scientific Model : VERSA STAR PRO

Range : N/A pH Resolution : 0.01 pH

Serial No. : 12260 ID No. : WW-03-001

Electrode

Model : 9156BNWP Serial No. : VV1-15843

Environment : On site calibration was carried out at the Laboratory C.E.M Technology (Thailand) Co., Ltd.

Ambient Temperature : (22.0 to 22.6) °C

Relative Humidity : (55 to 58) %

Date of Received : 13 February 2023

Date of Calibration : 13 February 2023

Date of Issue : 18 February 2023

Calibrated by : Bunjerd Masri

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
400005	SG-E-00473/64	27 Aug 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 :   
( Bunjerd Masri )  
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

Certificate of Calibration

Certificate of Calibration

Certificate No. : 66-420017-1 Page : 2 of 2

Certificate No. : 66-400084-1 Page : 1 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	177.4	0.1	0.12
	0.0000	7	7.00	0.0	0.0	0.086
	-177.4800	10	10.00	-177.4	-0.1	0.12

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%

- o10 -



Approved by :   
( Bunjerd Masri )  
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 66-400084-1

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 )
120	25.004	25.0	0.0	0.19

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 -

*(Signature)*



Bangkok High Lab Co.,Ltd.

4/176 Soi Ladplakao 66, Ladplakao Rd., Anusawari, Bangkok, Bangkok 10220

Tel: (662) 971-5800 Fax: (662) 971-5300

Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



NSC-TS-17025  
CALIBRATION 0366

## CERTIFICATE OF CALIBRATION

Certificate No : S2022/168

Page : 1/5

Order No : 316/2022

Customer : C.E.M Technology (Thailand) Co., Ltd

Address : 219/43 Moo 12 Phet Kasem Rd., Omnoi, Krathum Baen, Chachoengsao 24000

Instrument : UV/VIS spectrophotometer

Manufacture : MERCK

Model : Prove100

Serial Number : 1714112078

Environment : Temperature (26.6 - 26.4) °C

: Humidity (58 - 60) %RH

Received Date : September 29, 2022

Calibration Date : September 29, 2022

Issued Date : October 3, 2022

Calibrate Status : No Adjustment

Calibration Area : Customer area

Roomname : Laboratory Room of C.E.M Technology (Thailand) Co., Ltd

Calibrated By : JEERAPAT  
( Mr. Jeerapat Thaepphaisun )  
Calibration Engineer

Approved By : *(Signature)*  
( Mr. Wanchai Meesiri )  
Manager



Bangkok High Lab Co., Ltd.  
4/176 Soi Ladplakao 66, Ladplakao Rd., Anusawari, Bangkok, Bangkok 10220  
Tel: (662) 971-5800  
Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



NSC-TIS-TIS 17025  
CALIBRATION 0366

Certificate No : S2022/168  
Page : 2/5

## 1. Photometric Accuracy

CRMs: Neutral Density Glass Filters  
Traceability: Traceable to NIST, U.S.A. through Neutral density filters NIST SRM 930e & 1930, Double Aperture method through Sarna certificate report no. 108644

Spectral slit width : 4.00 nm

1.1 Reading scale at 420.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty $\pm$ (A)
0.0000	0.000	0.0000	0.0028
0.4965	0.495	0.0015	0.0044
0.9630	0.960	0.0030	0.0038
2.0356	2.030	0.0056	0.0064

1.2 Reading scale at 440.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty $\pm$ (A)
0.0000	0.000	0.0000	0.0028
0.4870	0.485	0.0020	0.0040
0.9433	0.942	0.0013	0.0040
1.9665	1.970	-0.0035	0.0064

1.3 Reading scale at 465.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty $\pm$ (A)
0.0000	0.000	0.0000	0.0028
0.4535	0.454	-0.0005	0.0034
0.8780	0.879	-0.0010	0.0040
1.8424	1.840	0.0024	0.0060

1.4 Reading scale at 546.1 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty $\pm$ (A)
0.0000	0.000	0.0000	0.0028
0.4706	0.469	0.0016	0.0028
0.9094	0.909	0.0004	0.0028
1.8755	1.875	0.0005	0.0064



Bangkok High Lab Co., Ltd.  
4/176 Soi Ladplakao 66, Ladplakao Rd., Anusawari, Bangkok, Bangkok 10220  
Tel: (662) 971-5800  
Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



NSC-TIS-TIS 17025  
CALIBRATION 0366

Certificate No : S2022/168  
Page : 3/5

1.5 Reading scale at 590.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty $\pm$ (A)
0.0000	0.000	0.0000	0.0028
0.4887	0.489	-0.0003	0.0029
0.9464	0.945	0.0014	0.0029
1.9021	1.899	0.0031	0.0061

1.6 Reading scale at 635.0 nm

Filter STDs (Abs) Certificate	Average Measured Value (A)	Correction (A)	Uncertainty $\pm$ (A)
0.0000	0.000	0.0000	0.0028
0.4634	0.463	0.0004	0.0030
0.8992	0.896	0.0032	0.0031
1.7824	1.776	0.0064	0.0062

## 2. Photometric Accuracy

CRMs: Potassium Dichromate in Perchloric acid

CRMs Serial Number: 15086

Traceability: Traceable to NIST, U.S.A. through crystalline potassium dichromate NIST SRM 935a through Sarna certificate report no. 88921

Blank Serial Number: 15178

Spectral slit width : 4.00 nm

Wavelength (nm)	Certificate (Abs)	Average Measured Value (A)	Correction (A)	Uncertainty $\pm$ (A)
235	0.0000	#N/A	#N/A	#N/A
	0.7340	#N/A	#N/A	#N/A
257	0.0000	#N/A	#N/A	#N/A
	0.8528	#N/A	#N/A	#N/A
313	0.0000	#N/A	#N/A	#N/A
	0.2873	#N/A	#N/A	#N/A
350	0.0000	#N/A	#N/A	#N/A
	0.6336	#N/A	#N/A	#N/A



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Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



Certificate No : S2022/168  
Page : 4/5

### 3. Wavelength Accuracy

Spectral slit width : 4.00 nm

3.1 CRMs: Holmium Glass Filter  
CRMs Serial Number: W184/H  
Traceability: Traceable to NIST Holmium oxide filter NIST SRM 2034, through Starna certificate report no. 108651

Filter STDs (nm) Certificate	Average Measured Value (nm)	Correction (nm)	Uncertainty ± (nm)
241.74	#N/A	#N/A	#N/A
279.44	#N/A	#N/A	#N/A
287.98	#N/A	#N/A	#N/A
334.10	333.3	0.80	0.12
361.00	360.2	0.80	0.12
418.61	418.2	0.41	0.12
453.63	452.6	1.03	0.12
460.05	459.4	0.65	0.12
536.66	536.0	0.66	0.12
637.98	637.4	0.58	0.12

3.2 CRMs: Didymium Glass Filter  
CRMs Serial Number: W184/D  
Traceability: Traceable to NIST Holmium oxide filter NIST SRM 2034, through Starna certificate report no. 108652

Filter STDs (nm) Certificate	Average Measured Value (nm)	Correction (nm)	Uncertainty ± (nm)
585.29	584.8	0.49	0.12
684.49	683.6	0.89	0.12
740.18	739.2	0.98	0.12
748.48	747.4	1.08	0.12
807.03	806.1	0.93	0.12
879.27	878.5	0.77	0.12



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Tel: (662) 971-5800  
Website: www.bangkokhighlab.com E-mail: info@bangkokhighlab.com



Certificate No : S2022/168  
Page : 5/5

### 4. \*Stray Light

CRMs: Potassium Chloride aqueous solution  
CRMs Serial Number: 5469  
Traceability: Traceable to NIST, U.S.A. potassium chloride NIST SRM2032, through Starna certificate report no. 88922

Spectral slit width : 4.00 nm

Wavelength (nm)	Certificate	Average Measured
201.28	>2A	#N/A
201.28	<1%T	#N/A

### 5. \*Spectral Resolution

CRMs: Toluene in Hexane  
CRMs Serial Number: 8697  
Traceability: Traceable to toluene in hexane NIST SRM2034, through Starna certificate report no. 88923

Spectral slit width (nm)	Abs Ratio
0.5	#N/A
1.0	#N/A
1.5	#N/A
2.0	#N/A
3.0	#N/A

Note : \* "Not TISI Accredited" in this certificate have been included for completeness

### Remarks:

Calibrate Method

- 1.1 Photometric and Wavelength accuracy: In-house method W-SER-001 based on ASTM E925-02 and ASTM E275-01
- 1.2 Stray light: Measuring the CRMs in both absorbance and transmittance unit at wavelength 201.23 nm. Base on European Pharmacopoeia V.6.19.3.1984
- 1.3 Spectral resolution: Measuring the CRMs. The maximum absorbance values were read at closest to 268.7nm and the minimum absorbance values were read at closest 267.0 nm. Refer to European Pharmacopoeia V.6.19.3.1984
2. N/A = not available.
3. Uncertainty of Measurement: The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.
4. This result of calibration was found accurate as shown on date and place of calibration only.
5. This report will certify of calibrated equipment only.

- End of Report -





## Certificate of Calibration

**Equipment:** Digital Thermometer with Sensor  
**Model:** TK 61  
**Serial No.:** 1P181269184  
**Manufacturer:** KIMO  
**Condition:** In Condition  
**Customer:** C.E.M Technology (Thailand) Co., Ltd.  
31/8 Moo 13, Tambon Raikhing,  
Amphur Sampran, Nakhonpathom 73210 Thailand.

**Environment Condition:** Temperature: 22 °C ± 3 °C  
Humidity: 50 %RH ± 20 %RH  
Voltage: 220 VAC ± 10 %  
**Calibration Place:** Thermo-Hygro Laboratory, DKSH Technology Limited.  
2533 Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260 Thailand  
**Calibration By:** Mr. Anat Karapitak  
**Calibration Date:** 16 February 2023  
**The Method used:** In house method, CAL-WI-19, by comparison with standard thermometer  
**Traceability:** This certificate is traceable to the International System of Unit maintained by  
National Institute of Metrology Thailand Certificate No. TT-0111-21

(Mr. Anat Karapitak)

Person in charge

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.  
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DKSH Technology (Thailand) Co., Ltd.  
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C15-14: 06 Dec 2022



Certificate No.: C15230305

Page: 2 of 2

### Calibration Results: Without Adjustment

Sensor Type: TC Type K

Channel: T1

Diameter (mm) 2 Length (mm): - Immersion (mm): 110

Calibrate Point (°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (± °C)
20.0	20.0021	19.6	0.4021	0.26
104.0	104.0036	103.2	0.8036	0.58
150.0	150.0018	149.8	0.2018	0.58
180.0	180.0039	179.9	0.1039	0.74

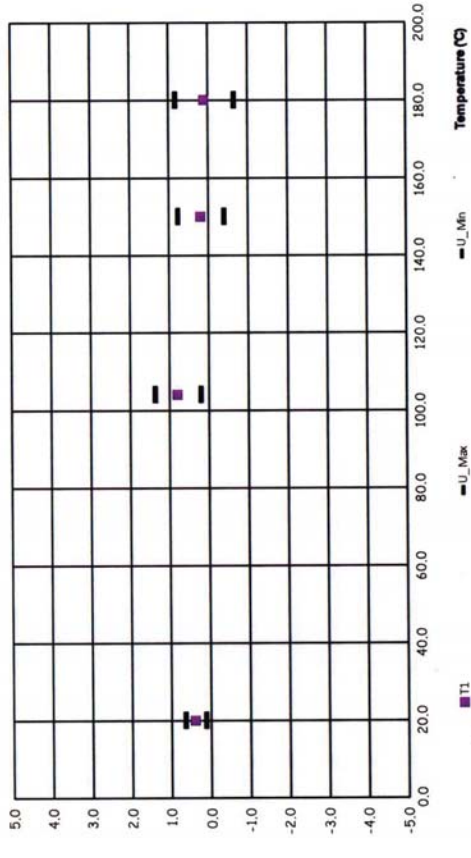
The End of Certificate

DKSH Technology (Thailand) Co., Ltd.  
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/certificate-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C15-14: 06 Dec 2022

Without Adjustment  
Job No.: KSPR2302595



## ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

ชนิดเครื่องมือ: Digital Thermometer with Sensor  
หมายเลขเครื่อง: IP181269184  
เลขที่ใบงาน: KSPR2302595  
รุ่น: TK 61

ตรวจสอบ (รับ)		รายการตรวจสอบ		ตรวจสอบ (ส่ง)		หมายเหตุ
16-Feb-2023	ไม่ปกติ	รายการตรวจสอบ		16-Feb-2023	ไม่ปกติ	
ปกติ	ไม่ปกติ	General		ปกติ	ไม่ปกติ	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ		<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input type="checkbox"/>	<input type="checkbox"/>	2. Adapter / Power supply 220 / 110 VAC		<input type="checkbox"/>	<input type="checkbox"/>	ไม่มี
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. การทำงาน Main Switch		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การทำงาน Selector Key		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การแสดงผล Display		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. Battery		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. สภาพตัวเครื่อง		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. สภาพ Sensor ( In / Ex )		<input checked="" type="checkbox"/>	<input type="checkbox"/>	

ข้อแนะนำ :

Mr. Anat Karapilak  
Service Engineer



THAI HEART CALIBRATION CO., LTD.

112/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280  
Tel: 0-2394-2162, 0-2757-8443; 0-2757-8496 Fax: 0-2757-8507



THAI HEART CALIBRATION CO., LTD.

112/1 Moo 5, Phraek Sa, Muang, Samut Prakan 10280  
Tel: 0-2394-2162, 0-2757-8443; 0-2757-8496 Fax: 0-2757-8507



ANAB  
ACCREDITED  
CALIBRATION LABORATORY  
AC-2695

## CERTIFICATE OF CALIBRATION

Certificate No.: T1-2103001/23

Page 1 of total 4 pages

Customer C.E.M TECHNOLOGY (THAILAND) CO., LTD.

219/43 Moo 12, Petchkasem Road, Omnoi,  
Krathumban, Samutsakorn 74130

Equipment Thermo Reactor  
Manufacturer Merck  
Serial No. 19490640  
Description Resolution of UUC : 1 °C

Model TR420  
ID No. WW-07-002

Environmental Conditions Ambient Temperature: 24.5 °C  
Relative Humidity: 41 %  
Atmospheric Pressure: -

Calibration Location Laboratory  
Received Date 21 March 2023  
Calibration Date 21 March 2023  
Date of Issue 22 March 2023  
Condition of Artifacts Used conditions but can be calibrated

Checked by 

Approved by 

Act as Technical Manager

Representative of Managing Director

( ) ( Krisyosl K. ) ( ) ( Sakda Y. )  
( ) ( Patiphan K. ) ( ) ( Onnapa P. )  
( ) ( Pongsak H. ) ( ) ( Nitiphong K. )  
( ) ( Kanung C. ) ( ) ( Nonthachai K. )  
( ) ( Pramong P. ) ( ) ( Noppol P. )

( Dr. Ekachai Purittitwong )

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FE-169

REV.02 02/24/21

Certificate No.: T1-2103001/23

Page 2 of total 4 pages

Reference Method :

- The calibration method used was CP-142 based on an in-house method.
- The temperature scale used was an ITS-90.
- This certificate can be traceable to the national standards, which is realized the shown measurement units according to the International System of Units (SI Units).

Reference Standard Instruments:

Type	Model	Serial No.	Cert. No.	Due Date	Traceability
Data Logger with Sensors	34972A/ 34901A	MY57010717/ MY59004982	10-1308001/22	Aug. 12, 2023	THC

Remark: This certificate is traceable to the International System of Unit (SI Unit) through:

- THC, Thai Heart Calibration Co., Ltd.

Calibrated by

Apisit

REV.02 02/24/21

FE-169



Certificate No.: TT-2103001/23

Page 3 of total 4 pages

Measurement Results:

(L)

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	148.1	150	-1.9	0.16	0.61
# 2	150	148.1	150	-1.9	0.15	
# 3	150	147.8	150	-2.2	0.11	
# 4	150	147.8	150	-2.2	0.18	
# 5	150	148.7	150	-1.3	0.13	
# 6	150	148.5	150	-1.5	0.21	
# 7	150	148.6	150	-1.4	0.14	
# 8	150	149.5	150	-0.5	0.18	
# 9	150	148.5	150	-1.5	0.13	
# 10	150	149.0	150	-1.0	0.15	
# 11	150	149.5	150	-0.5	0.24	
# 12	150	148.7	150	-1.3	0.15	

(R)

Hole No.	UUC Setting (°C)	Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Stability of UUC (± °C)	Uncertainty (± °C)
# 1	150	148.2	150	-1.8	0.12	0.61
# 2	150	148.0	150	-2.0	0.13	
# 3	150	148.5	150	-1.5	0.21	
# 4	150	149.0	150	-1.0	0.18	
# 5	150	149.6	150	-0.4	0.16	
# 6	150	149.3	150	-0.7	0.15	
# 7	150	148.4	150	-1.6	0.18	
# 8	150	148.6	150	-1.4	0.15	
# 9	150	148.4	150	-1.6	0.16	
# 10	150	148.6	150	-1.4	0.12	
# 11	150	149.2	150	-0.8	0.12	
# 12	150	148.5	150	-1.5	0.12	

UUC : Unit Under Calibration

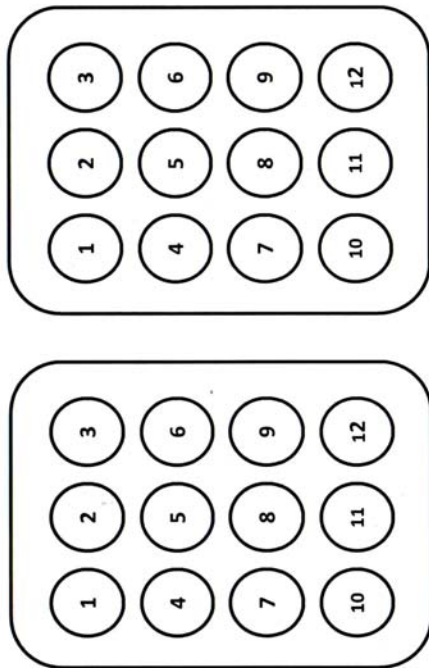
FE-169

Calibrated by Apisit  
REV.02 02/24/21

Certificate No.: TT-2103001/23

Page 4 of total 4 pages

Measurement Results (Cont.):



Front View L

Front View R

The above 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 -

FE-169

Calibrated by Apisit  
REV.02 02/24/21



## Certificate of Calibration

Certificate No. : 66-430007-1

Page : 1 of 2

Submitted by :

C.E.M Technology (Thailand) Co.,Ltd.

219/43 Moo.12 Peichkasem Rd, Omnoi, Krathumban, Samutsakorn 74130 (Head Office)

Equipment :

Digital Conductivity meter (Pocket)

Manufacturer : XS Instruments Model : PC 5

Serial No. : GB 0706/024 ID No. : WW-23-001

Environment :

On site calibration was carried out at the Laboratory C.E.M Technology (Thailand) Co.,Ltd.

Ambient Temperature (22.0 to 22.6) °C

Relative Humidity (55 to 58) %

Date of Received :

13 February 2023

Date of Calibration :

13 February 2023

Date of Issue :

18 February 2023

Calibrated by :

Bunjerd Masri

Calibration Method : In-house method CAL-M4301 direct measurement by conductivity buffer solution

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

Standard Buffer Solution

Material	Lot No.	Exp. Date	Traceability
84 µS/cm	7824	16 June 2025	National Institute of Standards and Technology (NIST), U.S.A., S.R.M.
1413 µS/cm	795891	17 February 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025
12.88 mS/cm	795893	14 February 2023	CPA Chem Ltd. Accredited to ISO 17034 and ISO/IEC 17025

Approved by :

(Bunjerd Masri)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

Certificate No. : 66-430007-1

Page : 2 of 2

Result of Calibration :

UUC Condition As-Received : Good

Function : Conductivity measurement

Before Adjustment

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty ( ± )	Unit
84*	116.4	-32.4	1.1	µS/cm
1413	1576	-163	9.0	µS/cm
12.88	15.27	-2.39	0.082	mS/cm

After Adjustment : at 84, 1413 µS/cm 12.880, 80 mS/cm

Standard Conductivity Solution	UUC Reading	Correction	Uncertainty ( ± )	Unit
84*	84.0	0.0	1.1	µS/cm
1413	1413	0	9.0	µS/cm
12.88	12.88	0.00	0.082	mS/cm

Remark

UUC : Unit Under Calibration

\* This parameter are out of accreditation's scope.

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%

-oOo-







## THAI CALIBRATION SERVICES CO., LTD.

198 Moo 9 Soi Raikang 30 Puttamonthon 5 Rd., Sampran, Nakornpathom 73210  
Tel. 0-3439-7682-5 Fax: 0-3439-7687  
www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S23031535

page 1 of 2

**Customer :** C.E.M. TECHNOLOGY (THAILAND) CO., LTD.

31/8 Moo 13 Raikang,  
Sampran, Nakornpathom 73210

**Equipment :** Non-automatic weighing instrument (Electronic instrument)

**Manufacturer :** Sartorius

**Model :** BSA224S-CW

**Order No. :** 66S0828-1

**Ambient temperature :** (24.1 ± 5.0) °C

**Relative humidity :** (47.5 ± 10.0) %

**Received date :** 03-Mar-2023

**Date of calibration :** 03-Mar-2023

**Date of issue :** 04-Mar-2023

**Condition of the balance :** Good working conditions

**Place of calibration :** กรุงเทพมหานคร

**ID No. :** CI-01-003

**Calibration method**

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

**Condition of reference standard weight**

**Instrument** **Nominal value** **Serial No.** **Certificate No.** **Due-date** **Density (kg/m<sup>3</sup>)**

1 Standard weight set 1 mg to 2 kg 15885+15849 M2210001S 8-Oct-2023 7950

**Traceability of the reference standard weight**

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC

accredited no. Calibration 0189.

Calibrated By :

Teerawat Inanom  
Technician

Approved By :

Chonlatee Pongwatvisanon  
Approved Signatory

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except with the prior written approval of the head of TCS calibration laboratory.

TCS-F-138 Issue 01/Rev.00/2 Jul 2018

No. 05234



## THAI CALIBRATION SERVICES CO., LTD.

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Tel. 0-3439-7682-5 Fax: 0-3439-7687  
www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S23031535

page 2 of 2

**The repeatability of indication**

Nominal Value ( mg )	Standard Deviation of reading ( mg )	Maximum difference between successive reading ( mg )	n
200000	0.04	0.1	5

**The effect of eccentric application of a load on the indication (test load : 100000 mg)**

Position	Balance Reading ( mg )
Point 1	100000.0
Point 2	99999.9
Point 3	100000.0
Point 4	100000.0
Point 5	100000.0
Eccentric Value	0.1



**The error of indication**

Nominal Value ( mg )	Value of Reference Standard Weight ( mg )	Balance Reading ( mg )	Correction ( mg )	Uncertainty (±) ( mg )	k
Unload	0.0	0.0	0.0	0.14	2.21
1000	1000.0	1000.0	0.0	0.14	2.20
2000	2000.0	2000.1	-0.1	0.14	2.20
5000	5000.0	5000.1	-0.1	0.14	2.18
10000	10000.0	10000.0	0.0	0.14	2.17
20000	20000.0	20000.0	0.0	0.15	2.14
50000	50000.0	50000.1	-0.1	0.15	2.11
100000	100000.0	99999.8	+0.2	0.18	2.04
120000	120000.0	119999.8	+0.2	0.22	2.00
150000	150000.0	149999.8	+0.2	0.24	2.00
200000	200000.0	199999.7	+0.3	0.27	2.00

Remark : Adjustment, Internal weight

**Uncertainty of measurement**

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor (k), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

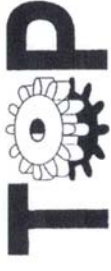
This report will certify of the calibrated equipment only.

--End--

TCS-F-138 Issue 01/Rev.00/2 Jul 2018

No. 05235





Trade & Engineering

## TSP High Volume Sampler TE-5000 TSP Sampler Verification

### Site Information

Location: - Site ID: - Date: 17 Oct 22  
Sampler: TE-5000 TSP Serial No: 3272 Tech: Tong.P

### Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 761.2  
Temperature (deg F): 77.5 Temperature (deg K): 298.4  
Average Press. (in Hg): 29.00 Corrected Average (mm Hg): 761.3  
Average Temp (Deg F): 77.4 Average Temp: (Deg K): 298.4

### Calibration Orifice

Make: Tisch Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date 12 December 2023

### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart) (corrected)	IC	Linear Regression
1	7.80	1.774	56.0	56.00	Slope: 29.2820
2	6.00	1.557	50.0	50.00	Intercept: 4.3066
3	4.90	1.408	46.0	46.00	Corr. Coeff: 0.9993
4	3.70	1.225	40.0	40.00	
5	3.10	1.122	37.0	37.00	# of Observations: 5

### Calculations

$$Qstd = 1/m[\text{sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = I[\text{sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Pstd = 760 mm Hg

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

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

Inter Average I (chart): 38.9  
Average Flow Calculation m3/min  
1.181694711  
Average Flow Calculation in cfm  
41.7265076  
Sample Time (Hrs): 24.0  
Total flow in 24 hours m3/min  
1701.640384  
Total flow in 24 hours cfm  
60086.17095

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

เอกสารการสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



Trade & Engineering  
TSP High Volume Sampler  
TE-5000 TSP Sampler Verification

Site Information

Location: - Date: 17 Oct 22  
Sampler: TE-5000 TSP Serial No: 3269 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 29.20 Corrected Pressure (mm Hg): 760.6  
Temperature (deg F): 77.1 Temperature (deg K): 298.2  
Average Press. (in Hg): 29.80 Corrected Average (mm Hg): 760.5  
Average Temp (Deg F): 77.9 Average Temp: (Deg K): 298.7

Calibration Orifice

Make: Tisch Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart) (corrected)	IC	Linear Regression
1	7.60	1.751	53.0	53.00	Slope: 28.3923
2	5.70	1.518	48.0	48.00	Intercept: 4.0489
3	4.50	1.350	43.0	43.00	Corr. Coeff: 0.9959
4	3.40	1.174	37.0	37.00	
5	2.80	1.067	34.0	34.00	# of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = [I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]]$$

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope

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

Tstd = 298 deg K  
Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

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

Enter Average I (chart): 38.0  
Average Flow Calculation m3/min  
1.194766279  
Average Flow Calculation in cfm  
42.18807427  
Sample Time (Hrs): 24.0  
Total flow in 24 hours m3/min  
1720.463442  
Total flow in 24 hours cfm  
60750.82695

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

Tisch Environmental 145 South Miami Ave, Cleves OH 45002 • 877.263.7610 • sales@tisch-env.com • www.tisch-env.com



Trade & Engineering  
TSP High Volume Sampler  
TE-5000 TSP Sampler Verification

Site Information

Location: - Date: 9 Jan 23  
Sampler: TE-5000 TSP Serial No: 3267 Tech: Tong.P

Site Conditions

Barometric Pressure (in Hg): 28.00 Corrected Pressure (mm Hg): 711.2  
Temperature (deg F): 76.0 Temperature (deg K): 297.6  
Average Press. (in Hg): 27.00 Corrected Average (mm Hg): 685.8  
Average Temp (Deg F): 75.0 Average Temp: (Deg K): 297.0

Calibration Orifice

Make: Tisch Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date 12 December 2023

Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart) (corrected)	IC	Linear Regression
1	6.80	1.604	62.2	60.21	Slope: 33.1580
2	5.00	1.377	55.5	53.73	Intercept: 7.5236
3	3.60	1.170	48.3	46.76	Corr. Coeff: 0.9980
4	3.10	1.086	45.1	43.66	
5	2.50	0.976	40.6	39.30	# of Observations: 5

Calculations

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$
$$IC = [I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]]$$

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

m = calibrator Qstd slope  
b = calibrator Qstd intercept

Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)

Tstd = 298 deg K  
Pstd = 760 mm Hg

For subsequent calculation of sampler flow:

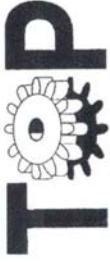
$$1/m([I] \text{Sqrt}(298/Tav)(Pav/760))-b$$

Enter Average I (chart): 44.0  
Average Flow Calculation m3/min  
1.035675716  
Average Flow Calculation in cfm  
36.57046973  
Sample Time (Hrs): 24.0  
Total flow in 24 hours m3/min  
1491.373032  
Total flow in 24 hours cfm  
52661.47642

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

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Trade & Engineering

## TSP High Volume Sampler

### TE-5000 TSP Sampler Verification

#### Site Information

Location: - Date: 9 Jan 23  
Sampler: TE-5000 TSP Serial No: 3265 Tech: Tong.P

#### Site Conditions

Barometric Pressure (in Hg): 28.00 Corrected Pressure (mm Hg): 711.2  
Temperature (deg F): 76.0 Temperature (deg K): 297.6  
Average Press. (in Hg): 27.00 Corrected Average (mm Hg): 685.8  
Average Temp (Deg F): 75.1 Average Temp: (Deg K): 297.1

#### Calibration Orifice

Make: Tisch Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date 12 December 2023

#### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart) (corrected)	IC (corrected)	Linear Regression Slope	Intercept	Corr. Coeff	# of Observations
1	9.80	1.924	65.1	63.02	43.1008	-19.2099	0.9957	5
2	8.00	1.739	58.4	56.53				
3	6.60	1.581	51.2	49.56				
4	6.10	1.520	48.0	46.47				
5	5.50	1.444	43.5	42.11				

#### Calculations

$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta)) - b]$   
 $IC = [I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]]$

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Pstd = 760 mm Hg  
For subsequent calculation of sampler flow:  
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

Inter Average I (chart): 44.0  
Average Flow Calculation m3/min  
1.416920496  
Average Flow Calculation in cfm  
50.03250272  
Sample Time (Hrs): 24.0  
Total flow in 24 hours m3/min  
2040.365514  
Total flow in 24 hours cfm  
72046.80391

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



Trade & Engineering

## TSP High Volume Sampler

### TE-5000 TSP Sampler Verification

#### Site Information

Location: - Date: 9 Jan 23  
Sampler: TE-5000 TSP Serial No: 3264 Tech: Tong.P

#### Site Conditions

Barometric Pressure (in Hg): 27.00 Corrected Pressure (mm Hg): 685.8  
Temperature (deg F): 75.0 Temperature (deg K): 297.0  
Average Press. (in Hg): 26.00 Corrected Average (mm Hg): 660.4  
Average Temp (Deg F): 74.2 Average Temp: (Deg K): 296.6

#### Calibration Orifice

Make: Tisch Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date 12 December 2023

#### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart) (corrected)	IC (corrected)	Linear Regression Slope	Intercept	Corr. Coeff	# of Observations
1	6.80	1.577	62.1	59.09	33.1580	7.2943	0.9980	5
2	5.00	1.354	55.4	52.71				
3	3.60	1.150	48.2	45.86				
4	3.10	1.068	45.0	42.82				
5	2.50	0.960	40.5	38.53				

#### Calculations

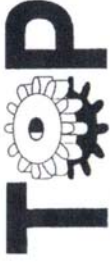
$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta)) - b]$   
 $IC = [I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]]$

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Pstd = 760 mm Hg  
For subsequent calculation of sampler flow:  
 $1/m((I)[\text{Sqrt}(298/Tav)(Pav/760)] - b)$

Inter Average I (chart): 44.0  
Average Flow Calculation m3/min  
1.019916094  
Average Flow Calculation in cfm  
36.01398589  
Sample Time (Hrs): 24.0  
Total flow in 24 hours m3/min  
1468.679175  
Total flow in 24 hours cfm  
51860.13967

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





Trade & Engineering

TSP High Volume Sampler

TE-5000 TSP Sampler Verification

#### Site Information

Location: - Date: 9 Jan 23  
Sampler: TE-5000 TSP Serial No: 3263 Tech: Tong.P

#### Site Conditions

Barometric Pressure (in Hg): 28.00 Corrected Pressure (mm Hg): 711.2  
Temperature (deg F): 76.0 Temperature (deg K): 297.6  
Average Press. (in Hg): 26.00 Corrected Average (mm Hg): 660.4  
Average Temp (Deg F): 75.1 Average Temp: (Deg K): 297.1

#### Calibration Orifice

Make: Tisch Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date 12 December 2023

#### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart) (corrected)	IC (corrected)	Linear Regression
1	5.80	1.482	60.0	58.08	Slope: 28.6275
2	4.00	1.233	53.0	51.31	Intercept: 15.8460
3	2.60	0.996	46.0	44.53	Corr. Coeff: 0.9996
4	2.10	0.896	43.0	41.62	
5	1.50	0.759	38.5	37.27	# of Observations: 5

#### Calculations

$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$   
 $IC = [I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]]$

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Pstd = 760 mm Hg  
For subsequent calculation of sampler flow:  
 $1/m[(I[\text{Sqrt}(298/Tav)(Pav/760)])-b]$

inter Average I (chart): 44.0  
Average Flow Calculation m3/min  
1.264452021  
Average Flow Calculation in cfm  
31.12270125  
Sample Time (Hrs): 24.0  
Total flow in 24 hours m3/min  
1269.208672  
Total flow in 24 hours cfm  
44816.6898

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

Tisch Environmental 145 South Miami Ave, Cleves OH 45002 • 877.263.7610 • sales@tisch-env.com • www.tisch-env.com



Trade & Engineering

TSP High Volume Sampler

TE-5000 TSP Sampler Verification

#### Site Information

Location: - Date: 9 Jan 23  
Sampler: TE-5000 TSP Serial No: 3262 Tech: Tong.P

#### Site Conditions

Barometric Pressure (in Hg): 29.00 Corrected Pressure (mm Hg): 736.6  
Temperature (deg F): 76.0 Temperature (deg K): 297.6  
Average Press. (in Hg): 27.00 Corrected Average (mm Hg): 685.8  
Average Temp (Deg F): 75.8 Average Temp: (Deg K): 297.5

#### Calibration Orifice

Make: Tisch Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date 12 December 2023

#### Calibration Information

Plate or Test #	H2O (in)	Qstd (m3/min)	I (chart) (corrected)	IC (corrected)	Linear Regression
1	6.20	1.792	62.0	61.08	Slope: 37.2576
2	6.40	1.584	55.0	54.18	Intercept: -5.2773
3	5.00	1.401	48.0	47.29	Corr. Coeff: 0.9987
4	4.50	1.330	45.0	44.33	
5	3.90	1.239	41.0	40.39	# of Observations: 5

#### Calculations

$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$   
 $IC = [I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]]$

Qstd = standard flow rate  
IC = corrected chart response  
I = actual chart response  
m = calibrator Qstd slope  
b = calibrator Qstd intercept  
Ta = actual temperature during calibration (deg K)  
Pa = actual pressure during calibration (mm Hg)  
Tstd = 298 deg K  
Pstd = 760 mm Hg  
For subsequent calculation of sampler flow:  
 $1/m[(I[\text{Sqrt}(298/Tav)(Pav/760)])-b]$

inter Average I (chart): 44.0  
Average Flow Calculation m3/min  
1.264452021  
Average Flow Calculation in cfm  
44.64872898  
Sample Time (Hrs): 24.0  
Total flow in 24 hours m3/min  
1820.810911  
Total flow in 24 hours cfm  
64294.16973

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

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## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 4 October 2022  
Sampler: TE-6070 PM10 Serial No: 3482 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 28.00 Corrected Pressure (mm Hg): 760.1  
Temperature (deg F): 77.9 Temperature (deg K): 298.5  
Average Press. (in Hg): 29.00 Corrected Average (mm Hg): 760.4  
Average Temp. (deg F): 77.4 Average Temp. (deg K): 298.2

### Calibration Office

Make: Tisch Environmental, Inc.  
Model: TE-5028A Qstd Slope: 1.58304  
Serial#: 1179 Qstd Intercept: -0.01520  
Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart) (corrected)	IC	Linear Regression	# of Observations:
1	7.70	1.108	58.0	36.35	Slope 32.7750	5
2	5.90	0.971	52.0	32.59	Intercept 0.3409	
3	4.70	0.868	46.0	28.83	Corr. Coeff 0.9987	
4	3.90	0.791	42.0	26.32	SFR 1.131	
5	2.90	0.684	36.0	22.56	SSP 59.72	

### Calculations

$$Qa = 1/m(\sqrt{(H2O)(Ta/Pa)}) - b$$
$$IC = I(\sqrt{(Ta/Pa)})$$

$$SFR = 1.13(Ps/Pa)(Ta/Ts)$$
$$SSP = (m \cdot SFR + b)(\sqrt{(Pa/Ta)})$$

Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope

SFR = sampler set point flow rate  
SSP = sampler chart set point  
m = sampler slope

Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
For subsequent calculation of sampler flow:

Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure (mm Hg)

Average I (chart): 55.6  
Average Flow over Sample (m3/min): 1.051981946  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min): 1514.854003  
Total flow over sample (CFM): 53489.49483

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



## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 4 October 2022  
Sampler: TE-6070 PM10 Serial No: 3286 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 27.00 Corrected Pressure (mm Hg): 760.1  
Temperature (deg F): 77.6 Temperature (deg K): 298.3  
Average Press. (in Hg): 30.00 Corrected Average (mm Hg): 761.2  
Average Temp. (deg F): 77.9 Average Temp. (deg K): 298.5

### Calibration Office

Make: Tisch Environmental, Inc.  
Model: TE-5028A Qstd Slope: 1.58304  
Serial#: 1179 Qstd Intercept: -0.01520  
Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart) (corrected)	IC	Linear Regression	# of Observations:
1	7.50	1.093	56.0	35.08	Slope 31.5206	5
2	5.90	0.971	51.0	31.95	Intercept 0.9099	
3	4.60	0.858	45.0	28.19	Corr. Coeff 0.9973	
4	3.80	0.781	40.0	25.06	SFR 1.131	
5	2.90	0.684	36.0	22.55	SSP 58.36	

### Calculations

$$Qa = 1/m(\sqrt{(H2O)(Ta/Pa)}) - b$$
$$IC = I(\sqrt{(Ta/Pa)})$$

$$SFR = 1.13(Ps/Pa)(Ta/Ts)$$
$$SSP = (m \cdot SFR + b)(\sqrt{(Pa/Ta)})$$

Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope

SFR = sampler set point flow rate  
SSP = sampler chart set point  
m = sampler slope

Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
For subsequent calculation of sampler flow:

Average I (chart): 55.4  
Average Flow over Sample (m3/min): 1.071752758  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min): 1543.323972  
Total flow over sample (CFM): 54494.76945

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





## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 10 January 2023  
Sampler: TE-6070 PM10 Serial No: 3260 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 27.00 Corrected Pressure (mm Hg): 685.8  
Temperature (deg F): 75.5 Temperature (deg K): 297.2  
Average Press. (in Hg): 26.40 Corrected Average (mm Hg): 670.6  
Average Temp. (deg F): 75.0 Average Temp. (deg K): 296.9

### Calibration Office

Make: Tisch Environmental, Inc. Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	8.10	1.193	59.2	38.97	Slope 31.6154
2	6.30	1.053	54.2	35.68	Intercept 1.8101
3	5.10	0.949	49.2	32.39	Corr. Coeff 0.9952
4	4.30	0.872	44.1	29.03	SFR 1.106
5	3.10	0.742	38.0	25.01	SSP 55.87

# of Observations: 5

### Calculations

$$Qa = 1/m(\sqrt{(H2O)(Ta/Pa)})-b$$
$$IC = I(\sqrt{(Ta/Pa)})$$

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

Tav = daily average temperature  
Pav = daily average pressure

SFR = sampler set point flow rate  
SSP = sampler chart set point  
m = sampler slope

Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure (mm Hg)

Average I (chart): 53.1  
Average Flow over Sample (m3/min): 1.060313912  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min): 1526.852034  
Total flow over sample (CFM): 53913.14532

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



## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: - Date: 4 October 2022  
Sampler: TE-6070 PM10 Serial No: 3211 Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 26.54 Corrected Pressure (mm Hg): 760.4  
Temperature (deg F): 77.9 Temperature (deg K): 298.5  
Average Press. (in Hg): 29.45 Corrected Average (mm Hg): 759.8  
Average Temp. (deg F): 77.0 Average Temp. (deg K): 298.0

### Calibration Office

Make: Tisch Environmental, Inc. Qstd Slope: 1.58304  
Model: TE-5028A Qstd Intercept: -0.01520  
Serial#: 1179 Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression
1	7.30	1.079	55.0	34.46	Slope 30.9235
2	5.50	0.938	50.0	31.33	Intercept 1.6630
3	4.30	0.830	44.0	27.57	Corr. Coeff 0.9941
4	3.70	0.771	41.0	25.69	SFR 1.131
5	2.80	0.672	35.0	21.93	SSP 58.48

# of Observations: 5

### Calculations

$$Qa = 1/m(\sqrt{(H2O)(Ta/Pa)})-b$$
$$IC = I(\sqrt{(Ta/Pa)})$$

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

SFR = sampler set point flow rate  
SSP = sampler chart set point  
m = sampler slope

Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure (mm Hg)

Average I (chart): 55.1  
Average Flow over Sample (m3/min): 1.062113613  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min): 1529.443603  
Total flow over sample (CFM): 54004.65361

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





## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: -  
Sampler: TE-6070 PM10 Serial No: 1313

Date: 10 January 2023  
Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 28.10  
Temperature (deg F): 76.2  
Average Press. (in Hg): 27.00  
Average Temp. (deg F): 75.4

Corrected Pressure (mm Hg): 713.7  
Temperature (deg K): 297.6  
Corrected Average (mm Hg): 685.8  
Average Temp. (deg K): 297.1

### Calibration Orifice

Make: Tisch Environmental, Inc.  
Model: TE-5028A  
Serial#: 1179

Qstd Slope: 1.58304  
Qstd Intercept: -0.01520  
Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression	# of Observations:
1	8.80	1.220	59.9	38.68	Slope 33.6928	5
2	7.00	1.089	54.9	35.45	Intercept -1.8198	
3	5.80	0.992	49.9	32.22	Corr. Coeff 0.9945	
4	5.00	0.922	44.8	28.93	SFR 1.087	
5	3.80	0.805	38.7	24.99	SSP 53.92	

### Calculations

$$Qa = 1/m(\sqrt{(H_2O)(Ta/Pa)}) - b$$
$$IC = I(\sqrt{(Ta/Pa)})$$

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

Tav = daily average temperature  
Pav = daily average pressure

Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope  
b = calibrator intercept

Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure (mm Hg)  
For subsequent calculation of sampler flow:

Average I (chart): 34.5  
Average Flow over Sample (m3/min): 0.727985358  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min): 1048.298915  
Total flow over sample (CFM): 37015.43469

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



## PM10 High Volume Sampler Verification

### Site Information

Location: - Site ID: -  
Sampler: TE-6070 PM10 Serial No: 1239

Date: 10 January 2023  
Tech: Tong P.

### Site Conditions

Barometric Pressure (in Hg): 27.00  
Temperature (deg F): 75.6  
Average Press. (in Hg): 26.50  
Average Temp. (deg F): 75.2

Corrected Pressure (mm Hg): 685.8  
Temperature (deg K): 297.2  
Corrected Average (mm Hg): 673.1  
Average Temp. (deg K): 297.0

### Calibration Orifice

Make: Tisch Environmental, Inc.  
Model: TE-5028A  
Serial#: 1179

Qstd Slope: 1.58304  
Qstd Intercept: -0.01520  
Calibration Due Date: 12 Dec 23

### Calibration Data

Plate or Test #	In H2O	Qa (m3/min)	I (chart)	IC (corrected)	Linear Regression	# of Observations:
1	8.60	1.229	59.7	39.30	Slope 33.1155	5
2	6.80	1.094	54.7	36.01	Intercept -0.8080	
3	5.60	0.994	49.7	32.72	Corr. Coeff 0.9947	
4	4.80	0.921	44.6	29.36	SFR 1.110	
5	3.60	0.799	38.5	25.35	SSP 54.60	

### Calculations

$$Qa = 1/m(\sqrt{(H_2O)(Ta/Pa)}) - b$$
$$IC = I(\sqrt{(Ta/Pa)})$$

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

Qa = actual flow rate  
IC = corrected chart response  
m = calibrator slope  
b = calibrator intercept

Ta = actual temperature (deg K)  
Pa = actual pressure (mm Hg)  
Ts = Average temperature (deg K)  
Ps = Average pressure (mm Hg)  
For subsequent calculation of sampler flow:

Average I (chart): 50.1  
Average Flow over Sample (m3/min): 1.029348739  
Enter Total Time (Hrs): 24.0  
Total flow over sample (m3/min): 1482.262184  
Total flow over sample (CFM): 52338.6777

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

# Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-006 Page : 1/1

**Analyzer Instruments**  
Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental  
Model : 48C Serial No. : 508011064

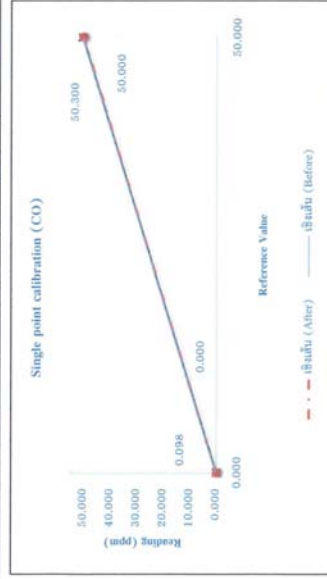
**Environmental**  
Temperature : 24.9 °C  
Humidity : 41.3 %RH

**Calibration System**  
**Calibrator Units**  
Gas Calibration : Thermo Environmental : API  
Model : 146C : 701  
Serial No. : 514811458 : 179

**Standard Gas**  
NO Conc. : 2 ppm : CC750227  
SO2 Conc. : 2 ppm : 21-Nov-23  
CO Conc. : 50 ppm

## Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
CO	0.098	0.000	0.10	50.3	50.000	0.30
	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :  
(Mr. Teeg Pima)

# Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22 Certificate No. : 0822-004 Page : 1/1

**Analyzer Instruments**  
Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental  
Model : 48C Serial No. : 508011069

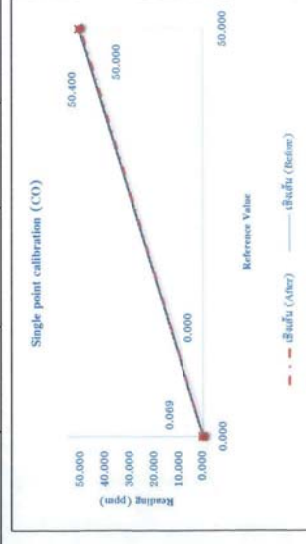
**Environmental**  
Temperature : 25.2 °C  
Humidity : 51.2 %RH

**Calibration System**  
**Calibrator Units**  
Gas Calibration : Thermo Environmental : API  
Model : 146C : 701  
Serial No. : 514811458 : 179

**Standard Gas**  
NO Conc. : 2 ppm : CC750227  
SO2 Conc. : 2 ppm : 21-Nov-23  
CO Conc. : 50 ppm

## Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
CO	0.069	0.000	0.07	50.4	50.000	0.40
	0.000	0.000	0.00	50.0	50.000	0.00



Calibrated by :  
(Mr. Teeg Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 11-Mar-23 Certificate No. : 0323-001 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental  
 Model : 48C Serial No. : 65775350

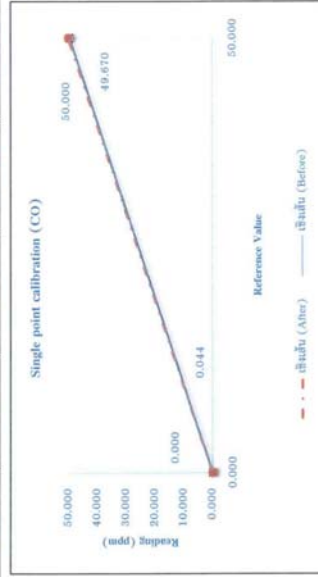
**Environmental**  
 Temperature : 24.3 °C  
 Humidity : 51.4 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental Zero Air Generator : API  
 Model : 146C Model : 701  
 Serial No. : 514811458 Serial No. : 179

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	0.044	0.000	0.04	49.670	50.000	-0.66
	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by :

(Mr. Tong Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 22-Jul-23 Certificate No. : 0723-001 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental  
 Model : 48C Serial No. : 508011061

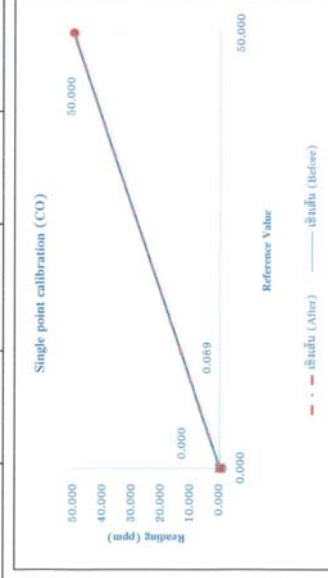
**Environmental**  
 Temperature : 24.2 °C  
 Humidity : 55.0 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental Zero Air Generator : API  
 Model : 146C Model : 701  
 Serial No. : 514811438 Serial No. : 179

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	0.089	0.000	0.09	50.2	50.000	0.40
			After			
CO	0.009	0.000	0.09	50.0	50.000	0.00



Calibrated by :

(Mr. Tong Pima)



## Certificate of Analyzer Performance Testing

Calibrated Date : 21-Jan-23 Certificate No. : 0123-003 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : CO Analyzer Manufacturer : Thermo Environmental  
 Model : 48C Serial No. : 71021-367

**Environmental**  
 Temperature : 26.4 °C  
 Humidity : 52.7 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental : API  
 Model : 146C : 701  
 Serial No. : 514811458 : 179

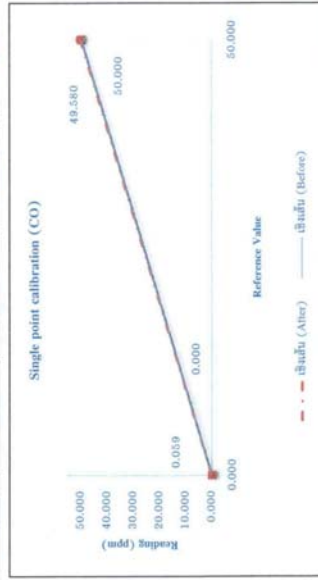
**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm

Zero Air Generator : API  
 Model : 701  
 Serial No. : 179

Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
CO	Before					
	0.039	0.000	0.00	49.580	50.000	-0.84
CO	After					
	0.000	0.000	0.00	50.000	50.000	0.00



Calibrated by : *Tanji*  
(Mr. Yong Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Apr-23 Certificate No. : 0423-003 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental  
 Model : 43C Serial No. : 69858-364

**Environmental**  
 Temperature : 25.2 °C  
 Humidity : 52.3 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental : API  
 Model : 146C : 701  
 Serial No. : 514811458 : 179

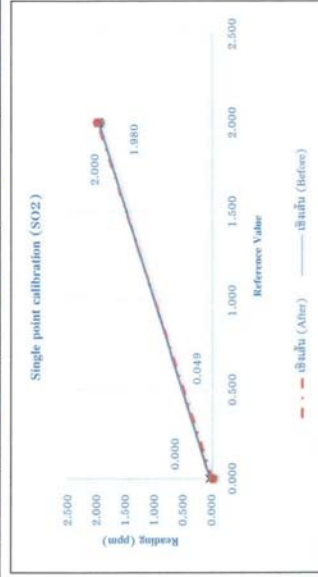
**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm

Zero Air Generator : API  
 Model : 701  
 Serial No. : 179

Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
SO2	Before					
	0.049	0.000	0.03	1.98	2.000	-1.00
SO2	After					
	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by : *Tanji*  
(Mr. Yong Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 1-Sep-22 Certificate No. : 0925-001 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : SO2 Analyzer  
 Model : 43C  
 Manufacturer : Thermo Environmental  
 Serial No. : 70852-267

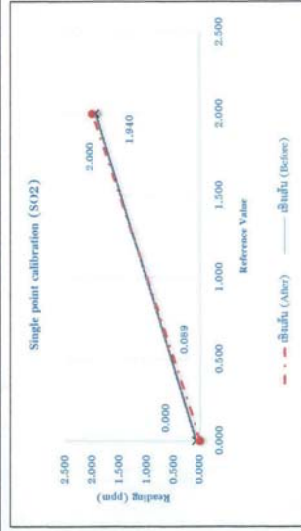
**Environmental**  
 Temperature : 25.2 °C  
 Humidity : 52.0 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental  
 Model : 146C  
 Serial No. : 514811458  
 Zero Air Generator : API  
 Model : 701  
 Serial No. : 179

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CCT50227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
Before						
SO2	0.089	0.000	0.09	1.94	2.000	-0.06
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by : *Taylor*  
(Mr. Tong Pinn)

## Certificate of Analyzer Performance Testing

Calibrated Date : 3-Oct-22 Certificate No. : 1025-001 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : SO2 Analyzer  
 Model : 43C  
 Manufacturer : Thermo Environmental  
 Serial No. : C71163568-340

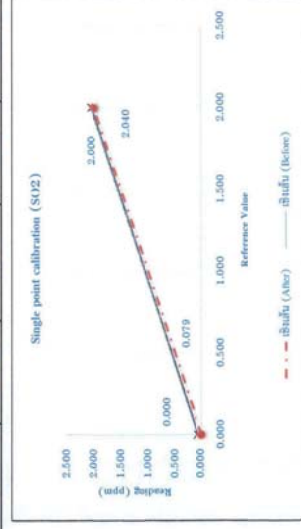
**Environmental**  
 Temperature : 24.1 °C  
 Humidity : 52.1 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental  
 Model : 146C  
 Serial No. : 514811458  
 Zero Air Generator : API  
 Model : 701  
 Serial No. : 179

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO2 Conc. : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CCT50227  
 Expire Date : 21-Nov-23

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)	Reading Value (ppm)	Expected Value (ppm)	Drift (ppm)
Before						
SO2	0.079	0.000	0.08	2.04	2.000	0.04
After						
SO2	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by : *Taylor*  
(Mr. Tong Pinn)

## Certificate of Analyzer Performance Testing

Calibrated Date : 26-Aug-23 Certificate No. : 0823-004 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : SO2 Analyzer Manufacturer : Thermo Environmental  
 Model : 43C Serial No. : 43C-77419-385

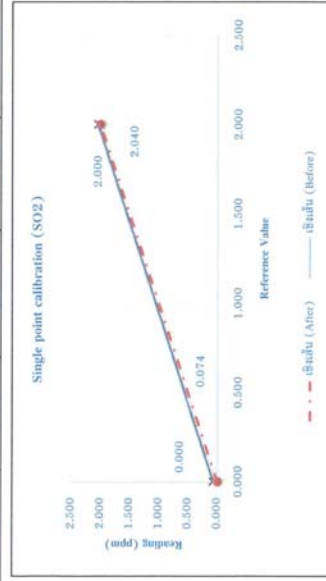
**Environmental**  
 Temperature : 25.1 °C  
 Humidity : 46.2 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental : API  
 Model : 146C : 701  
 Serial No. : 514811458 : 179

**Standard Gas**  
 NO Conc. : 2 ppm : CC750227  
 SO2 Conc. : 2 ppm : 21-Nov-23  
 CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
SO2	Before					
	0.074	0.000	0.07	2.04	2.000	2.00
SO2	After					
	0.000	0.000	0.00	2.00	2.000	0.00



Calibrated by :

(Mr. Tong Pima)

## Certificate of Analyzer Performance Testing

Calibrated Date : 4-Jul-23 Certificate No. : 0723-001 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : NO/NOx Analyzer Manufacturer : Thermo Environmental  
 Model : 42C Serial No. : 63470-339

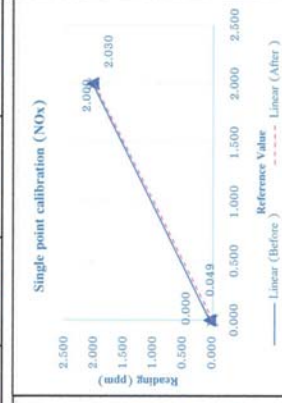
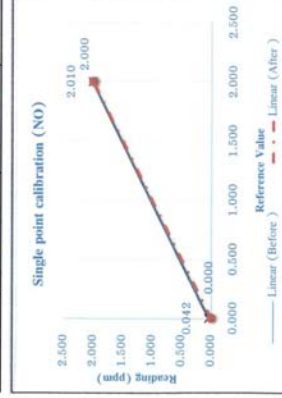
**Environmental**  
 Temperature : 25.1 °C  
 Humidity : 40.4 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental : API  
 Model : 146C : 701  
 Serial No. : 514811458 : 179

**Standard Gas**  
 NO Conc. : 2 ppm : CC750227  
 SO2 : 2 ppm : 21-Nov-23  
 CO Conc. : 50 ppm

### Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
NO	Before					
	0.042	0.000	0.04	2.01	2.00	0.50
NOx	Before					
	0.049	0.000	0.05	2.03	2.00	1.50
NO	After					
	0.000	0.000	0.00	2.00	2.00	0.00
NOx	After					
	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by :

(Mr. Tong Pima)



# Certificate of Analyzer Performance Testing

Calibrated Date : 1-Apr-23 Certificate No. : 0423-004 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : NO/NO<sub>x</sub>/NO<sub>x</sub> Analyzer  
 Model : 42C  
 Manufacturer : Thermo Environmental  
 Serial No. : 72454-371

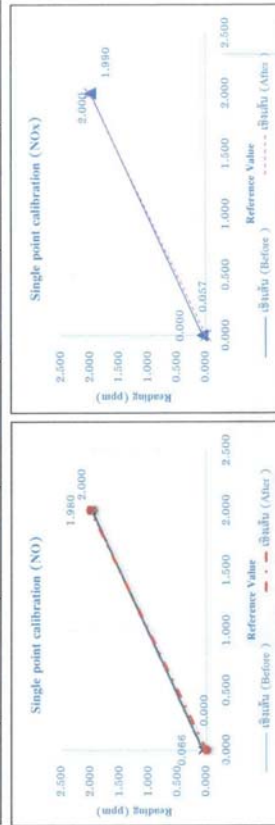
**Environmental**  
 Temperature : 25.2 °C  
 Humidity : 52.3 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental  
 Model : 146C  
 Serial No. : 514811458  
 Zero Air Generator : API  
 Model : 701  
 Serial No. : 179

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO<sub>2</sub> : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

## Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.046	0.000	0.07	1.98	2.00	-1.00
NO <sub>x</sub>	0.057	0.000	0.06	1.99	2.00	-0.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO <sub>x</sub>	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by : *Tayfun*  
(Mr. Tayfun Pinar)

# Certificate of Analyzer Performance Testing

Calibrated Date : 11-Mar-23 Certificate No. : 0323-003 Page : 1/1

**Analyzer Instruments**  
 Analyzer Type : NO/NO<sub>x</sub>/NO<sub>x</sub> Analyzer  
 Model : 42C  
 Manufacturer : Thermo Environmental  
 Serial No. : 58926-320

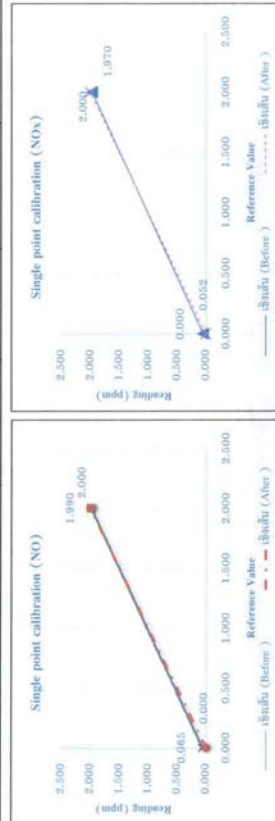
**Environmental**  
 Temperature : 24.3 °C  
 Humidity : 51.4 %RH

**Calibration System**  
**Calibrator Units**  
 Gas Calibration : Thermo Environmental  
 Model : 146C  
 Serial No. : 514811458  
 Zero Air Generator : API  
 Model : 701  
 Serial No. : 179

**Standard Gas**  
 NO Conc. : 2 ppm  
 SO<sub>2</sub> : 2 ppm  
 CO Conc. : 50 ppm  
 Cylinder No. : CC750227  
 Expire Date : 21-Nov-23

## Calibration Check

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
Before						
NO	0.065	0.000	0.07	1.99	2.00	-0.50
NO <sub>x</sub>	0.052	0.000	0.05	1.97	2.00	-1.50
After						
NO	0.000	0.000	0.00	2.00	2.00	0.00
NO <sub>x</sub>	0.000	0.000	0.00	2.00	2.00	0.00



Calibrated by : *Tayfun*  
(Mr. Tayfun Pinar)

**Certificate of Analyzer Performance Testing**

Calibrated Date : 30-Jan-23 Certificate No. : 0123-001  
Page : 1/1

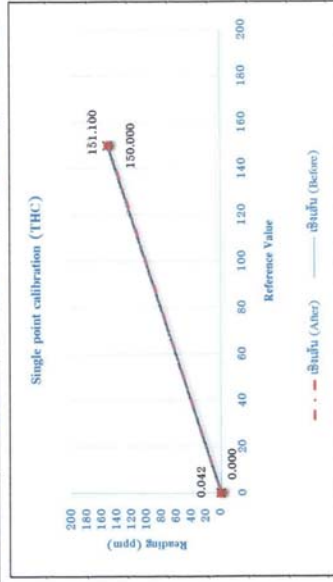
**Analyzer Instruments**  
Analyzer Type : THC Analyzer  
Model : 51 Manufacturer : Thermo Environmental  
Serial No. : 51HT-73244-373

**Environmental**  
Temperature : 24.7 °C  
Humidity : 54.4 %RH

**Calibration System**  
**Calibrator Units**  
Gas Calibration : Thermo Environmental  
Model : 146C Zero Air Generator : API  
Serial No. : 514811458 Model : 701  
Standard Gas : 150 ppm Cylinder No. : 21W281046  
Propane Conc. : 26-Sep-25

**Calibration Check**

Gas	Zero			Span		
	Reading Value (ppm)	Expected Value (ppm)	Drift (%)	Reading Value (ppm)	Expected Value (ppm)	Drift (%)
THC	0.042	0.000	0.042	151	150	0.733
THC	0.000	0.000	0.000	150	150	0.000



Calibrated by : *Tong*  
(Mr. Tong Piima)

เอกสารทดสอบเทียบเครื่องเมื่อตรวจวัดระดับเสียงในบรรยากาศ

## Certificate of Calibration

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**SERIAL No.** : 150009  
**ID No.** : CEM-SI-09  
**SUBMITTED BY** : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
 219/43 MOO 12, PETCHKASEM RD., OMNOI,  
 KRATHUMBAN SAMUTSAKORN 74130

**CALIBRATED BY** :   
**CALIBRATION DATE** : 9-May-23

**APPROVED BY** :   
**ISSUED DATE** : 9-May-23

## Calibration Report

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**ID No.** : CEM-SI-09  
**RECEIVED DATE** : 4-May-23  
**AMBIENT TEMPERATURE** : 22 °C ± 3 °C  
**RELATIVE HUMIDITY** : 50%RH ± 20%RH  
**SERIAL NUMBER** : 150009  
**CALIBRATION DATE** : 9-May-23

### CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR. THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.
- REFERENCE STANDARD INSTRUMENTS :-

**INSTRUMENT** **MODEL** **SERIAL No.** **CERTIFICATE No.** **DUE DATE**  
 1) MULTIFUNCTION 1986 01827 EEL BP 55/0974 12-Jan-24  
 SOUND CALIBRATOR.

- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO :-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE				
FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00		0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50
2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE				
FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50
3. SOUND LEVEL LINEARITY TEST AT 1000 Hz				
STANDARD APPLIED (dB)		UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74		74.0	0.0	0.50
84		84.0	0.0	0.50
94		94.0	0.0	0.50
104		104.1	-0.1	0.50
114		114.2	-0.2	0.50

UUC\* : UNIT UNDER CALIBRATION  
 THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%


END OF CALIBRATION REPORT



## Certificate of Calibration

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**SERIAL No.** : 150008  
**ID No.** : CEM-SI-08  
**SUBMITTED BY** : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
 219/43 MOO 12, PETCHKASEM RD., OMNOI,  
 KRATHUMBAN SAMUTSAKORN 74130

**CALIBRATED BY** :   
**CALIBRATION DATE** : 9-May-23

**APPROVED BY** :   
**ISSUED DATE** : 9-May-23

## Calibration Report

**EQUIPMENT** : SOUND LEVEL METER  
**MANUFACTURER** : ACO  
**MODEL** : TYPE 6226  
**ID No.** : CEM-SI-08  
**RECEIVED DATE** : 4-May-23  
**AMBIENT TEMPERATURE** : 22 °C ± 3 °C  
**RELATIVE HUMIDITY** : 50%RH ± 20%RH  
**SERIAL NUMBER** : 150008  
**CALIBRATION DATE** : 9-May-23

### CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR. THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.
- REFERENCE STANDARD INSTRUMENTS :-

**INSTRUMENT** **MODEL** **SERIAL No.** **CERTIFICATE No.** **DUE DATE**  
 1) MULTIFUNCTION 1986 01827 EEL BP 55/0974 12-Jan-24  
 SOUND CALIBRATOR.

- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO :-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE				
FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE				
FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz			
STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

UUC\* : UNIT UNDER CALIBRATION  
 THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

## Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER  
 MANUFACTURER : ACO  
 MODEL : TYPE 6226  
 SERIAL No. : 122024  
 ID No. : CEM-SI-04  
 SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
 219/43 MOO 12, PETCHKASEM RD., OMNOI,  
 KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY :   
 CALIBRATION DATE : 9-May-23

APPROVED BY :   
 ISSUED DATE : 9-May-23

## Calibration Report

EQUIPMENT : SOUND LEVEL METER  
 MANUFACTURER : ACO  
 MODEL : TYPE 6226  
 ID No. : CEM-SI-04  
 RECEIVED DATE : 4-May-23  
 AMBIENT TEMPERATURE : 22 °C ± 3 °C  
 RELATIVE HUMIDITY : 50%RH ± 20%RH

### CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR.
- THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION
- REFERENCE STANDARD INSTRUMENTS :

1) MULTIFUNCTION : MODEL 1986 SERIAL No. 01827 CERTIFICATE No. EEL BP 55/0974 DUE DATE 12-Jan-24

- SOUND CALIBRATOR.
- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO :-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE			
FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)
125.00	-16.10	-15.80	-0.30
250.00	-8.60	-8.10	-0.50
500.00	-3.20	-3.0	-0.20
1000.00	0.00	0.00	0.0
2000.00	1.20	0.90	0.3
			UNCERTAINTY OF MEASUREMENT (±dB)
			0.50
			0.50
			0.50
			0.50
			0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE			
FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)
125.00	-0.20	0.1	-0.3
250.00	0.00	0.5	-0.5
500.00	0.00	0.3	-0.3
1000.00	0.00	0.0	0.0
2000.00	-0.20	-0.4	0.2
			UNCERTAINTY OF MEASUREMENT (±dB)
			0.50
			0.50
			0.50
			0.50
			0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz			
STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

UUC\* : UNIT UNDER CALIBRATION  
 THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226  
SERIAL No. : 060210  
ID No. : CEM-SI-03  
SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
219/43 MOO 12, PETCHKASEM RD., OMNOI,  
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY :   
CALIBRATION DATE : 9-May-23

APPROVED BY :   
ISSUED DATE : 9-May-23

Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226  
ID No. : CEM-SI-03  
RECEIVED DATE : 4-May-23  
AMBIENT TEMPERATURE : 22 °C ± 3 °C  
RELATIVE HUMIDITY : 50%RH ± 20%RH  
SERIAL NUMBER : 060210  
CALIBRATION DATE : 9-May-23

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR.  
THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT MODEL SERIAL No. CERTIFICATE No. DUE DATE  
1) MULTIFUNCTION 1986 01827 EEL BP 55/0974 12-Jan-24  
SOUND CALIBRATOR.

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO :-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE			
FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)
125.00	-16.10	-15.80	-0.30
250.00	-8.60	-8.10	-0.50
500.00	-3.20	-3.0	-0.20
1000.00	0.00	0.00	0.0
2000.00	1.20	0.90	0.3
			UNCERTAINTY OF MEASUREMENT (±dB)
			0.50
			0.50
			0.50
			0.50
			0.50

2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE			
FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)
125.00	-0.20	0.1	-0.3
250.00	0.00	0.5	-0.5
500.00	0.00	0.3	-0.3
1000.00	0.00	0.0	0.0
2000.00	-0.20	-0.4	0.2
			UNCERTAINTY OF MEASUREMENT (±dB)
			0.50
			0.50
			0.50
			0.50
			0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz			
STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

UUC\* : UNIT UNDER CALIBRATION  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.


END OF CALIBRATION REPORT



## Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER  
 MANUFACTURER : ACO  
 MODEL : TYPE 6226  
 SERIAL No. : 090057  
 ID No. : CEM-SI-02  
 SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
 219/43 MOO 12, PETCHKASEM RD., OMNOI,  
 KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY :   
 CALIBRATION DATE : 9-May-23

APPROVED BY :   
 AUDIT P.  
 ISSUED DATE : 9-May-23

## Calibration Report

EQUIPMENT : SOUND LEVEL METER  
 MANUFACTURER : ACO  
 MODEL : TYPE 6226  
 ID No. : CEM-SI-02  
 RECEIVED DATE : 4-May-23  
 AMBIENT TEMPERATURE : 22 °C ± 3°C  
 RELATIVE HUMIDITY : 50%RH ± 20%RH  
 SERIAL NUMBER : 090057  
 CALIBRATION DATE : 9-May-23

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR.  
 THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.  
 2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT MODEL SERIAL No. CERTIFICATE No. DUE DATE  
 1) MULTIFUNCTION 1986 01827 EEL BP 55/0974 12-Jan-24  
 SOUND CALIBRATOR.  
 3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
 4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
 5. THIS CERTIFICATE IS TRACEABLE TO :-  
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR).

### RESULT OF CALIBRATION :

WITHOUT ADJUSTMENT

#### 1. A-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-16.10	-15.80	-0.30	0.50
250.00	-8.60	-8.10	-0.50	0.50
500.00	-3.20	-3.0	-0.20	0.50
1000.00	0.00	0.00	0.0	0.50
2000.00	1.20	0.90	0.3	0.50

#### 2. C-WEIGHTING ACOUSTIC FREQUENCY RESPONSE

FREQUENCY (Hz)	STANDARD EXPECTED READING (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
125.00	-0.20	0.1	-0.3	0.50
250.00	0.00	0.5	-0.5	0.50
500.00	0.00	0.3	-0.3	0.50
1000.00	0.00	0.0	0.0	0.50
2000.00	-0.20	-0.4	0.2	0.50

#### 3. SOUND LEVEL LINEARITY TEST AT 1000 Hz

STANDARD APPLIED (dB)	UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74	74.0	0.0	0.50
84	84.0	0.0	0.50
94	94.0	0.0	0.50
104	104.1	-0.1	0.50
114	114.2	-0.2	0.50

UUC\* : UNIT UNDER CALIBRATION


THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

Certificate of Calibration

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226  
SERIAL No. : 060209  
ID No. : CEM-SI-01  
SUBMITTED BY : C.E.M TECHNOLOGY (THAILAND) CO.,LTD.  
219/43 MOO 12, PETCHKASEM RD., OMNOI,  
KRATHUMBAN SAMUTSAKORN 74130

CALIBRATED BY :   
CALIBRATION DATE : 9-May-23

APPROVED BY :   
ISSUED DATE : 9-May-23

Calibration Report

EQUIPMENT : SOUND LEVEL METER  
MANUFACTURER : ACO  
MODEL : TYPE 6226  
ID No. : CEM-SI-01  
RECEIVED DATE : 4-May-23  
AMBIENT TEMPERATURE : 22 °C ± 3°C  
RELATIVE HUMIDITY : 50%RH ± 20%RH  
SERIAL NUMBER : 060209  
CALIBRATION DATE : 9-May-23

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO IEC 61672-2:2003-04 AGAINST MULTIFUNCTION SOUND CALIBRATOR.  
THIS INSTRUMENT WAS PERFORMED SELF-CALIBRATION BY CALIBRATOR FROM CUSTOMER AT 114 Hz BEFORE CALIBRATION.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No.	CERTIFICATE No.	DUE DATE
1) MULTIFUNCTION SOUND CALIBRATOR.	1986	01827	EEL BP.55/0974	12-Jan-24

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO :-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH THAILAND INSTITUTE OF SCIENTIFIC AND  
TECHNOLOGICAL RESEARCH (TISTR).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

FREQUENCY (Hz)	STANDARD EXPECTED		UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
	READING (dB)				
125.00	-16.10		-16.80	-0.30	0.50
250.00	-8.60		-8.10	-0.50	0.50
500.00	-3.20		-3.0	-0.20	0.50
1000.00	0.00		0.00	0.0	0.50
2000.00	1.20		0.90	0.3	0.50

FREQUENCY (Hz)	STANDARD EXPECTED		UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
	READING (dB)				
125.00	-0.20		0.1	-0.3	0.50
250.00	0.00		0.5	-0.5	0.50
500.00	0.00		0.3	-0.3	0.50
1000.00	0.00		0.0	0.0	0.50
2000.00	-0.20		-0.4	0.2	0.50

3. SOUND LEVEL LINEARITY TEST AT 1000 Hz				
STANDARD APPLIED (dB)		UUC READING (dB)	CORRECTION (dB)	UNCERTAINTY OF MEASUREMENT (±dB)
74		74.0	0.0	0.50
84		84.0	0.0	0.50
94		94.0	0.0	0.50
104		104.1	-0.1	0.50
114		114.2	-0.2	0.50

UUC\* : UNIT UNDER CALIBRATION  
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY  
A COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%

END OF CALIBRATION REPORT

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-8 Job No. : 66S0330 Page : 1 of 2

Customer : C.E.M Technology (Thailand) Co.,Ltd.  
 Address : 31/9 Moo 13, Raikhing, Samphran,  
 Nakhornpathom 73210  
 Location : Laboratory

Equipment : Sound Level Meter Ambient temperature :  $(20 \pm 2) ^\circ\text{C}$   
 Manufacturer : Scarlet Tech Relative humidity :  $(50 \pm 15) \%$   
 Model : ST-11D Atmospheric pressure : -  
 Serial No. : 820892 Date of received : 08-Mar-2023  
 Identity No. : NS-12-003 Date of calibration : 10-Mar-2023  
 Range : See to Data Date of issued : 13-Mar-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.31/0664	15-Jun-2023

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

- National Institute of Metrology Thailand. (NIMT).

Calibrated By : *Mr. Boonyarit Auejirakarn*  
 Reviewed By : ☐ Mr. Sompong Srisert  
☒ Ms. Natthaprakarn Thammaphan  
 Approved By : ☐ Ms. Bhacharin Phannangkaw (MD)  
☒ Mr. Boonyarit Auejirakarn

The reported expanded uncertainty is based uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence approximately 95%.  
 This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.1	0.1	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
B	94	93.8	-0.2	0.00
	104	103.7	-0.3	0.00
	114	113.7	-0.3	0.00
Z	94	93.9	-0.1	0.00
	104	103.9	-0.1	0.00
	114	113.9	-0.1	0.00

UUC\* = Unit Under Calibration

- The End -



## CERTIFICATE OF CALIBRATION

Certificate No.: 66S0330-6 Job No.: 66S0330 Page: 1 of 2

Customer : C.E.M Technology (Thailand) Co.,Ltd.  
 Address : 31/9 Moo 13, Raikhing, Samphran,  
 Nakhornpathom 73210  
 Location : Laboratory

Equipment : Sound Level Meter Ambient temperature :  $(20 \pm 2) ^\circ\text{C}$   
 Manufacturer : Scarlet Tech Relative humidity :  $(50 \pm 15) \%$   
 Model : ST-11D Atmospheric pressure : -  
 Serial No. : 820891 Date of received : 08-Mar-2023  
 Identity No. : NS-12-002 Date of calibration : 10-Mar-2023  
 Range : See to Data Date of issued : 13-Mar-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EELBP.31/0664	15-Jun-2023

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

- National Institute of Metrology Thailand. (NIMT).

Calibrated By : *Mr. Boonyarit Auejirakarn*  
 Reviewed By : *Mr. Sompong Srisert*  
 Approved By : *Ms. Bhacharin Phannangkaew (MD)*  
*Mr. Boonyarit Auejirakarn*

The reported expanded uncertainty is based uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence approximately 95%. This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

## Continuation of Calibration Report

Certificate No.: 66S0330-6 Job No.: 66S0330

Page: 2 of 2

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	114.0	0.0	0.20
B	94	94.4	0.4	0.20
	104	104.0	0.0	0.20
	114	113.8	-0.2	0.20
Z	94	94.0	0.0	0.20
	104	104.0	0.0	0.20
	114	113.8	-0.2	0.20

UUC\* = Unit Under Calibration

- The End -



# SMART TECH CALIBRATION & SERVICES CO., LTD.

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,  
THANYABURI, PATHUM THANI 12110, THAILAND  
Tel : +662-114-3148 Email : stcal.mt@gmail.com Website : stc-call.com



## Certificate of Calibration

Certificate No. STCR-2303048-18  
Work Order No. STCR-2303048  
Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.  
31/8 Moo.13 Raikhing Sub-district, Samphran District, Nakhonpathom, 73210

Equipment Name : Sound Level Meter  
Manufacturer : Scarlett Tech  
Model : ST-250  
Serial Number : 10340893  
Control Number : NS-09-004  
Received Date : Mar 25, 2023  
Calibration Date : Mar 27, 2023  
Recommended Due Date : Mar 27, 2024  
Calibration Method : Calibration Procedure No. CPE-04-01

Environmental Conditions  
Ambient Temperature : (25 ± 2) °C  
Ambient Relative Humidity : (50 ± 15) %RH  
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal  
Calibration Result : See data attached

- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.
- The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
- The working standard is indicated in page 2 of this certificate.
- This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co.,Ltd.
- This results of this report only to the items calibrated.

Date of Issue : Mar 30, 2023  
Calibrated by : S. Sompoch  
Approved by :



@smarttechcal

# Calibration Report

Smart Tech Calibration & Services Co.,Ltd.

Certificate No.: STCR-2303048-18

Page 2 of 3

## Standards Equipment Used

Equipment Name : Sound Calibrator  
Serial No. : N975186  
Certificate No. : 551220085447862  
Due Date : Nov 2, 2023  
Traceability to : ANAB : AC-1969.20

## Traceability

This calibration is traceable to the International System of Unit via :  
- ANAB : The ANSI National Accreditation Bord.



# Calibration Report

Smart Tech Calibration & Services Co.,Ltd.

Certificate No.: STCR-2303048-18

Page 3 of 3

UUC Range : (28 to 133) dB  
Resolution : 0.1 dB  
Results of Calibration: [ ] Without adjustment [ ✓ ] With adjustment  
Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
Auto	94.07 dB	97.1 dB	94.1 dB	-0.03 dB	0.40 dB
	114.05 dB	116.9 dB	113.8 dB	0.25 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
Auto	94.07 dB	97.1 dB	94.1 dB	-0.03 dB	0.40 dB
	114.05 dB	116.9 dB	113.8 dB	0.25 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



SMART TECH CALIBRATION & SERVICES CO., LTD.

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,  
THANYABURI, PATHUM THANI 12110, THAILAND  
Tel : +662-114-3148 Email : stcsmtd@gmail.com Website : stc-call.com



## Certificate of Calibration

Certificate No. STCR-2303048-17  
Work Order No. STCR-2303048

Page 1 of 3

Customer Name : CEM Technology Thailand Co., Ltd.  
31/8 Moo.13 Raikhing Sub-district, Samphran District, Nakhonpathom, 73210

Equipment Name : Sound Level Meter  
Manufacturer : Scarlett Tech  
Model : ST-25D  
Serial Number : 10340892  
Control Number : NS-09-003  
Received Date : Mar 25, 2023  
Calibration Date : Mar 27, 2023  
Recommended Due Date : Mar 27, 2024  
Calibration Method : Calibration Procedure No. CPE-04-01

### Environmental Conditions

Ambient Temperature : (25 ± 2) °C  
Ambient Relative Humidity : (50 ± 15) %RH  
Calibration Place : Permanent Calibration Laboratory

Condition as received : Normal

Calibration Result : See data attached

- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.
- The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
- The working standard is indicated in page 2 of this certificate.
- This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co.,Ltd.
- This results of this report only to the items calibrated.

Date of Issue : Mar 30, 2023

Calibrated by : S. Sompoch

Approved by :



(Mr. Sator Wongkham)  
Laboratory Manager



@smarttechcal





# Calibration Report

Smart Tech Calibration & Services Co.,Ltd.

Certificate No.: STCR-2303048-17

Page 2 of 3

## Standards Equipment Used

Equipment Name: Sound Calibrator  
Serial No.: N975186  
Certificate No.: 551220085447862  
Due Date: Nov 2, 2023  
Traceability to: ANAB : AC-1969.20

## Traceability

This calibration is traceable to the International System of Unit via :  
- ANAB : The ANSI National Accreditation Bord.



# Calibration Report

Smart Tech Calibration & Services Co.,Ltd.

Certificate No.: STCR-2303048-17

Page 3 of 3

UUC Range : (28 to 133) dB  
Resolution : 0.1 dB  
Results of Calibration: [ ] Without adjustment [ ✓ ] With adjustment  
Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
Auto	94.07 dB	92.9 dB	94.1 dB	-0.03 dB	0.40 dB
	114.05 dB	112.6 dB	113.9 dB	0.15 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
Auto	94.07 dB	92.9 dB	94.1 dB	-0.03 dB	0.40 dB
	114.05 dB	112.7 dB	113.9 dB	0.15 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

**Request No.** 21-65/0714

**MTC No.** EEL. BP. 77/0865

## CALIBRATION CERTIFICATE

**Submitted by** : C.E.M. TECHNOLOGY (THAILAND) CO., LTD.  
**Address** : 31/8 Moo. 13 Raikhing Samphan Nakhonparthom 73210.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

### Instrument Calibrated :

Description	: Sound Level Meter	<b>Ambient Environment</b>
Manufacturer	: BSWA	Temperature : $(23 \pm 3) ^\circ\text{C}$
Model	: BSWA 309	Relative Humidity : $(50 \pm 15) \%$
Serial No.	: 590101 (NS-04-002)	Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$
Microphone	: MP309 No.395615	
Preamplifier	: BSWA MA231T No.590614	

### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistomphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt** : 24 Aug. 2022

**Date of Calibration** : 19-21 Sep. 2022

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

FM.BLMTC.002 Rev.4

<b>Head Office</b>	<b>Office/Laboratory</b>	<b>Office</b>
35 Mu.3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand Tel. (66) 0 2577 9000 Fax. (66) 0 2577 9009 E-mail : rumpai@tistr.or.th Website:www.tistr.or.th	Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand Tel. (66) 0 2323 1672-80 ext. 115, 116 Fax. (66) 0 2323 9165 E-mail : mtc@tistr.or.th	196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217 Fax. (66) 0 2579 8592 E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

**Request No.** 21-65/0714

**MTC No.** EEL. BP. 77/0865

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tamoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

**Date of Calibration** : 19-21 Sep. 2022

2 / 9

The results relate only to the items tested/calibrated or value assigned.  
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FM.BLMTC.002 Rev.4

<b>Head Office</b>	<b>Office/Laboratory</b>	<b>Office</b>
35 Mu.3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand Tel. (66) 0 2577 9000 Fax. (66) 0 2577 9009 E-mail : rumpai@tistr.or.th Website:www.tistr.or.th	Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road, Amphoe Muang, Changwat Samutprakan 10280, Thailand Tel. (66) 0 2323 1672-80 ext. 115, 116 Fax. (66) 0 2323 9165 E-mail : mtc@tistr.or.th	196 Phahonyothin Road, Chatuchak, Bangkok 10900, Thailand Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217 Fax. (66) 0 2579 8592 E-mail : sumalee@tistr.or.th

### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.91	113.7	113.9	0.0	1.0	0.30	N/A

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
19.3	0.10	N/A

#### 2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighing	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	10.1	0.10	N/A
C-Weight	14.6	0.10	N/A
Flat	20.9	0.10	N/A

### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.0	0.1	0.1	1.5	0.45	0.6
1 000	-0.4	-0.4	-0.4	1.0	0.45	0.6
8 000	-0.6	-0.6	-0.1	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	0.0	0.0	2.0	0.20	0.6
125	-0.1	0.0	0.0	1.5	0.20	0.6
250	-0.1	0.0	0.0	1.5	0.20	0.6
500	-0.1	0.0	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.0	0.0	2.0	0.20	0.6
4 000	-0.1	-0.1	0.0	3.0	0.20	0.6
8 000	-0.5	-0.5	0.0	5.0	0.20	0.7





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### 5. Long-term stability

Time	Measured Value	Deviated value	Acceptance limit class 2	Uncertainty	Maximum-permitted uncertainty of measurement
	(dB)	(dB)	(±dB)	(±dB)	(±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

### 6. Frequency and time weightings at 1 kHz

#### 6.1 Frequency weightings at 1 kHz

Frequency	Measured value	Deviated value	Acceptance limit class 2	Uncertainty	Maximum-permitted uncertainty of measurement
Weighting	(dB)	(dB)	(±dB)	(±dB)	(±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

#### 6.2 Time weightings at 1 kHz

Frequency	Measured value	Deviated value	Acceptance limit class 2	Uncertainty	Maximum-permitted uncertainty of measurement
Weighting	(dB)	(dB)	(±dB)	(±dB)	(±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Lsq	94.0	0.0	0.1	0.20	0.2

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### 7. Level linearity on the reference level range

Anticipated value	Measured value	Deviated value	Acceptance limit class 2	Uncertainty	Maximum-permitted uncertainty of measurement
(dB)	(dB)	(dB)	(±dB)	(±dB)	(±dB)
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3

Date of Calibration : 19-21 Sep. 2022

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### 7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
49	48.9	-0.1	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.1	0.1	1.1	0.30	0.3
28	28.1	0.1	1.1	0.30	0.3
27	27.1	0.1	1.1	0.30	0.3
26	26.1	0.1	1.1	0.30	0.3
25	25.2	0.2	1.1	0.30	0.3

### 8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
23-135	94.0	94.0	0.0	1.1	0.30	0.3

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### 8. Level linearity including the level range control

At reference level at 5 dB greater than the signal level that first clause an indication of under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
23-135	28.0	28.0	0.0	1.1	0.30	0.3

### 9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	131.0	0.0	±1.0	0.20	0.3
	2	113.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	104.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	124.6	0.0	±1.0	0.20	0.3
	2	105.0	0.0	+1.0; -5.0	0.20	0.3
	0.25	95.8	-0.2	+1.5; -5.0	0.20	0.3

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#### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	130.4	130.1	-0.3	3.0	0.20	0.35
Positive half cycle	129.4	129.2	-0.2	2.0	0.20	0.35
Negative half cycle	129.4	129.2	-0.2	2.0	0.20	0.35

#### 11. Overload indication

Measured value (dB)	Deviated value (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Positive	Negative			
133.5	133.5		1.5	0.20	0.25

#### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	134.0	0.0	0.3	0.10	0.1
End	134.0				

Calibrated by :

Approved by :

(Mr. Tawikiat Iamsamran)

(Mr. Prawate Klauypa)  
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 19-21 Sep. 2022

Date of Issue : 22 Sep. 2022

Ref : 2011265082403762002

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0714

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#### CALIBRATION CERTIFICATE

Submitted by : C.E.M. TECHNOLOGY (THAILAND) CO., LTD.

Address : 31/8 Moo. 13 Raikhing Samphan Nakhonparthom 73210.

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

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

#### Instrument Calibrated :

Description : Sound Level Meter  
Manufacturer : BSWA  
Model : BSWA 309  
Serial No. : 590014 (NS-04-001)  
Microphone : MP309 No.395600  
Preamplifier : BSWA MA231T No.590612

#### Ambient Environment

Temperature : (23 ± 3) °C  
Relative Humidity : (50 ± 15) %  
Ambient Pressure : (101.325 ± 1.5) kPa

#### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY4042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 24 Aug. 2022

Date of Calibration : 19-21 Sep. 2022

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9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 19-21 Sep. 2022

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**1. Absolute Sensitivity**

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
	Before adjust	After adjust				
113.91	113.8	113.9	0.0	1.0	0.30	N/A

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

**2. Self-generated noise****2.1 Normal test**

Measured value (dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
19.8	0.10	N/A

**2.2 The microphone of the sound level meter was replaced by electrical signal input device**

Frequency	Measured value (dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Weighting			
A-Weight	12.5	0.10	N/A
C-Weight	16.0	0.10	N/A
Flat	22.7	0.10	N/A

Date of Calibration : 19-21 Sep. 2022

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### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	-0.1	0.0	1.5	0.45	0.6
1 000	-0.2	-0.2	1.0	0.45	0.6
8 000	-0.3	-0.4	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	0.0	0.0	2.0	0.20	0.6
125	-0.1	0.0	1.5	0.20	0.6
250	-0.1	0.0	1.5	0.20	0.6
500	-0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.0	1.0	0.20	0.6
2 000	0.0	0.0	2.0	0.20	0.6
4 000	-0.1	0.0	3.0	0.20	0.6
8 000	-0.5	-0.5	5.0	0.20	0.7

### 5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

### 6. Frequency and time weightings at 1 kHz

#### 6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

#### 6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2



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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
134	134.0	0.0	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	63.9	-0.1	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3

Date of Calibration : 19-21 Sep. 2022

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NSG-TISTR-TS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0714

MTC No. EEL. BP. 76/0865

7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
49	48.9	-0.1	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.1	0.1	1.1	0.30	0.3
28	28.1	0.1	1.1	0.30	0.3
27	27.1	0.1	1.1	0.30	0.3
26	26.2	0.2	1.1	0.30	0.3
25	25.2	0.2	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
25-137	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 19-21 Sep. 2022

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### 8. Level linearity including the level range control

At reference level at 5 dB greater than the signal level that first clause an indication of under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
25-137	30.0	30.0	0.0	1.1	0.30	0.3

### 9. Tone burst response

Time	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	133.0	0.0	±1.0	0.20	0.3
	2	115.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	106.8	-0.2	+1.5; -5.0	0.20	0.3
Slow	200	126.5	-0.1	±1.0	0.20	0.3
	2	106.9	-0.1	+1.0; -5.0	0.20	0.3
	200	127.0	0.0	±1.0	0.20	0.3
SEL	2	107.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	97.8	-0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 19-21 Sep. 2022

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### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	132.4	132.1	-0.3	3.0	0.20	0.35
Positive half cycle	131.4	131.3	-0.1	2.0	0.20	0.35
Negative half cycle	131.4	131.3	-0.1	2.0	0.20	0.35

### 11. Overload indication

Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	135.5	0.0	1.5	0.20
135.5				0.25

### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	136.0				
End	136.0	0.0	0.3	0.10	0.1

Calibrated by :

*T. H. 9*

(Mr. Tawikiat Iamsamran)

Approved by :

*Prasert Kiatyapa*

(Mr. Prasert Kiatyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 19-21 Sep. 2022

Date of Issue : 22 Sep. 2022

Ref : 2011265082403762001

End of Certificate

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## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0330-1 Job No. : 66S0330 Page : 1 of 2

Customer : C.E.M Technology (Thailand) Co.,Ltd.  
Address : 31/9 Moo 13, Raikhing, Samphran,  
Nakhornpathom 73210  
Location : Laboratory  
Equipment : Sound Level Meter Ambient temperature :  $(20 \pm 2) ^\circ\text{C}$   
Manufacturer : ACO Relative humidity :  $(50 \pm 15) \%$   
Model : 6236 Atmospheric pressure : -  
Serial No. : 222196 Date of received : 08-Mar-2023  
Identity No. : NS-03-026 Date of calibration : 10-Mar-2023  
Range : See to Data Date of issued : 13-Mar-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EELBP.31/0664	15-Jun-2023

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

- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn Approved By : [ ] Ms. Bhacharin Phanangkaew (MD)  
Reviewed By : [ ] Mr. Sompong Srisert [x] Mr. Boonyarit Auejirakarn  
[x] Ms. Natthaparakarn Thammaphan

The reported expanded uncertainty is based uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence approximately 95%.  
This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

## Continuation of Calibration Report

Certificate No. : 66S0330-1 Job No. : 66S0330 Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.1	0.1	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20
C	94	94.0	0.0	0.20
	104	103.8	-0.2	0.20
	114	113.7	-0.3	0.20
Z	94	94.0	0.0	0.20
	104	103.8	-0.2	0.20
	114	113.6	-0.4	0.20

UUC\* = Unit Under Calibration

- The End -

## CERTIFICATE OF CALIBRATION

Certificate No. : 66S0205-4 Job No. : 66S0205 Page : 1 of 2

Customer : C.E.M Technology (Thailand) Co.,Ltd.

Address : 31/9 Moo 13, Raikhing, Samphan,  
Nakhornpathom 73210

Location : Laboratory

Equipment : Sound Level Meter Ambient temperature :  $(20 \pm 2) ^\circ\text{C}$   
Manufacturer : ACO Relative humidity :  $(50 \pm 15) \%$   
Model : 6236 Atmospheric pressure : -  
Serial No. : 222187 Date of received : 03-Feb-2023  
Identity No. : NS-03-017 Date of calibration : 07-Feb-2023  
Range : See to Data Date of issued : 09-Feb-2023

Calibration Method : This instrument was calibrated by comparison measurement with sound level calibrator, according to in house calibration method.

### Reference Standard Instruments :

Equipment	Model	Serial No.	Certification No.	Due Date
Sound Level Calibrator	8930B	2000210	EEL.BP.31/0664	15-Jun-2023

Traceability : This certification is traceable to the International System of Unit maintained at :  
- National Institute of Metrology Thailand, (NIMT).

Calibrated By : Mr. Boonyarit Auejirakarn

Approved By :

Reviewed By : [ ] Mr. Sompong Srisert

[ ] Ms. Natthaprakarn Thammaphan

[ ] Ms. Bhacharin Phanangkaew (MD)

[ ] Mr. Boonyarit Auejirakarn

The reported expanded uncertainty is based uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence approximately 95%.  
This result relates only to the item calibrated. The certificate shall not be reproduced except in full, without the written approval of the calibration director.

Rev. 08-Jun-2019

FM-FCS-040

## Continuation of Calibration Report

Certificate No. : 66S0205-4 Job No. : 66S0205 Page : 2 of 2

Result of Calibration : Without Adjustment

Function : Sound Level Measurement

Calibration Range : @ 1 kHz

Resolution : 0.1 dB / 1 dB

Response	Standard Setting (dB)	UUC Reading (dB)	Error Value (dB)	Uncertainty (+/-dB)
A	94	94.2	0.2	0.20
	104	104.0	0.0	0.20
	114	113.9	-0.1	0.20
B	94	94.2	0.2	0.20
	104	104.1	0.1	0.20
	114	113.8	-0.2	0.20
Z	94	94.2	0.2	0.20
	104	104.1	0.1	0.20
	114	113.8	-0.2	0.20

UUC\* = Unit Under Calibration

- The End -





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL.BP. 17/1165

## CALIBRATION CERTIFICATE

**Submitted by** : C.E.M. TECHNOLOGY (THAILAND) CO., LTD.  
**Address** : 31/8 Moo 13, Raikhing, Samphan, Nakhornpathom 73210.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :		Ambient Environment
Description	: Sound Level Meter	Temperature : (23 ± 3) °C
Manufacturer	: ACO	Relative Humidity : (50 ± 15) %
Model	: 6236	Ambient Pressure : (101.325 ± 1.5) kPa
Serial No.	: 222128 (NS-03-013)	
Microphone	: Type 7052NR No.84161	
Preamplifier	: -	

### Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 2 Nov. 2022

Date of Calibration : 3 Nov. 2022

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL.BP. 17/1165

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
11. Digital Multimeter Agilent 34401A S/N MY44005560.
12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

### Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 3 Nov. 2022

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### 1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.97	113.3	114.0	0.0	1.0	0.30	N/A

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.2 dB.

### 2. Self-generated noise

#### 2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.6	0.10	N/A

#### 2.2 The microphone of the sound level meter was replaced by electrical signal input device

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	16.9	0.10	N/A
C-Weight	21.7	0.10	N/A
Flat	26.0	0.10	N/A

### 3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.0	0.0	1.5	0.45	0.6
1 000	-0.4	-0.4	1.0	0.45	0.6
8 000	-4.3	-4.4	5.0	0.45	0.7

### 4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	-0.4	0.0	2.0	0.20	0.6
125	-0.4	0.1	1.5	0.20	0.6
250	-0.3	0.1	1.5	0.20	0.6
500	-0.2	-0.1	1.5	0.20	0.6
1 000	0.0	-0.1	1.0	0.20	0.6
2 000	0.0	0.0	2.0	0.20	0.6
4 000	-0.2	-0.2	3.0	0.20	0.6
8 000	-0.2	-0.5	5.0	0.20	0.7

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Begin	94.0	0.0	0.3	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.0	0.0	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ( $\pm$ dB)	Uncertainty ( $\pm$ dB)	Maximum-permitted uncertainty of measurement ( $\pm$ dB)
122	122.1	0.1	1.1	0.30	0.3
121	121.1	0.1	1.1	0.30	0.3
120	120.1	0.1	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	88.9	-0.1	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.3	0.3	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.8	-0.2	1.1	0.30	0.3
59	58.8	-0.2	1.1	0.30	0.3
54	53.8	-0.2	1.1	0.30	0.3
49	48.8	-0.2	1.1	0.30	0.3



### 7. Level linearity on the reference level range (cont.)

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
44	43.9	-0.1	1.1	0.30	0.3
39	38.8	-0.2	1.1	0.30	0.3
34	34.1	0.1	1.1	0.30	0.3
33	33.2	0.2	1.1	0.30	0.3
32	32.2	0.2	1.1	0.30	0.3
31	31.3	0.3	1.1	0.30	0.3
30	30.4	0.4	1.1	0.30	0.3

### 8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	94.0	94.0	0.0	1.1	0.30	0.3
30-120	94.0	94.0	0.0	1.1	0.30	0.3
20-110	94.0	94.0	0.0	1.1	0.30	0.3
20-100	94.0	93.9	-0.1	1.1	0.30	0.3

Date of Calibration : 3 Nov. 2022

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### 8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45.0	45.0	0.0	1.1	0.30	0.3
30-120	35.0	35.0	0.0	1.1	0.30	0.3
20-110	25.0	25.6	0.6	1.1	0.30	0.3
20-100	25.0	25.6	0.6	1.1	0.30	0.3
20-90	25.0	25.5	0.5	1.1	0.30	0.3
20-80	25.0	25.7	0.7	1.1	0.30	0.3

### 9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.0	0.0	±1.0	0.20	0.3
	2	98.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	89.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	109.5	-0.1	±1.0	0.20	0.3
	2	89.9	-0.1	+1.0; -5.0	0.20	0.3
	200	109.9	-0.1	±1.0	0.20	0.3
SEL	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 3 Nov. 2022

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



NSC-TIS-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0074

MTC No. EEL. BP. 17/1165

#### 10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.7	0.3	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20	0.35
Negative half cycle	124.4	124.2	-0.2	2.0	0.20	0.35

#### 11. Overload indication

Measured value (dB)	Deviated value (dB)		Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Positive one-half cycle	Negative one-half cycle			
130.0	130.0	0.0	1.5	0.20	0.25

#### 12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.3	0.10	0.1
End	129.0				

Calibrated by:  (Mr. Pannasit Phasingsri)

Approved by:  (Mr. Pannasit Phasingsri)

Director

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 3 Nov. 2022

Date of Issue : 3 Nov. 2022

Ref : 2011265110204749001

End of Certificate

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FM.BLMTC.002 Rev.4

เอกสารทดสอบเทียบเครื่องมือตรวจวัดความถี่เสียง



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT  
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Certificate No.: CP20230148EA  
Operation No.: CP2023020060

### Certificate of Calibration

Equipment: Vibration Meter

Manufacturer: InstanTel

Model/Type: Micromate

Serial No.: UM16048

ID No.: VB-01-003

Customer: C.E.M. Technology (Thailand) Co.,Ltd.

Address: 31/8 Moo 13 T.Rai Khung, A.Sam Phran,  
Nakorn Phatom 73210

Received Date: 28 February 2023

Calibrated Date: 7 - 9 March 2023

Issued Date: 14 March 2023

Calibrated by: Ms. Juntaporn Kunhakom

Approved by:   
( Mr. Sittichai Swaksuriyavong )  
Group Manager

This report was prepared electronically using applicable electronic signature. Printing or copy of file are considered as a copy of the document.

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor (k) providing a level of confidence of approximately 95%. This certificate may not be reproduced other than in full, except with the prior written approval of the Electrical and Electronics Institute, Foundation for Industrial Development.



ELECTRICAL AND ELECTRONICS INSTITUTE  
FOUNDATION FOR INDUSTRIAL DEVELOPMENT

Certificate No.: CP20230148EA

### Calibration Report

Equipment: Vibration Meter  
Manufacturer: InstanTel  
Model: Micromate  
Serial No.: UM16048  
ID No.: VB-01-003  
Ambient Temperature: ( 23 ± 5 )°C  
Relative Humidity: ( 50 ± 15 )%

Method of Calibration :-

In-house method : CC-SV004 by comparison with standard accelerometer.

Condition of this result of calibration

1. Reference standards instrument :-

#### Instrument

Model	Serial No.	Cert. No.	Due Date
8305-001	30120	AV-0013-21	30-May-2023
2525	3016651	AV-0007-22	9-Jun-2023
3560-C	2705645	CO20230003EA	25-Dec-2023
HMT331	K3810009	CD20220120EA	22-Apr-2023

Transmitter

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

3. This certification is traceable to the international system of unit maintained at :-

- National Institute of Metrology (Thailand)





Certificate No.:

CP20230148EA

### Calibration Report

Result of Calibration:-

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.008	10.554	0.546	1.50	Longitudinal (L)
5.0	10.000	10.004	10.514	0.510	1.50	
6.3	10.000	10.007	10.633	0.626	1.50	
8.0	10.000	10.008	10.365	0.357	1.50	
10.0	10.000	10.006	10.341	0.335	1.50	
12.5	10.000	9.997	10.262	0.265	1.50	
16.0	10.000	9.998	10.262	0.264	1.50	
	20.000	19.997	20.548	0.551	1.50	
	30.000	29.995	30.786	0.791	1.50	
	50.000	49.992	51.153	1.161	1.50	
20.0	10.000	10.003	10.294	0.291	1.50	
25.0	10.000	10.000	10.341	0.341	1.50	
31.5	10.000	10.010	10.372	0.362	1.50	
40.0	10.000	9.998	10.420	0.422	1.50	
50.0	10.000	10.017	10.428	0.411	1.50	
52.0	10.000	10.001	10.522	0.521	1.50	
63.0	10.000	10.010	10.688	0.678	1.50	
80.0	10.000	10.004	10.680	0.676	1.50	

Certificate No.:

CP20230148EA

### Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	9.970	10.853	0.883	1.50	Transverse (T)
5.0	10.000	9.998	10.869	0.871	1.50	
6.3	10.000	10.000	10.901	0.901	1.50	
8.0	10.000	10.003	10.538	0.535	1.50	
10.0	10.000	10.000	10.467	0.467	1.50	
12.5	10.000	10.004	10.412	0.408	1.50	
16.0	10.000	10.001	10.428	0.427	1.50	
	20.000	19.997	20.761	0.764	1.50	
	30.000	29.995	31.031	1.036	1.50	
	50.000	49.978	51.516	1.538	1.50	
20.0	10.000	10.008	10.491	0.483	1.50	
25.0	10.000	10.000	10.475	0.475	1.50	
31.5	10.000	10.008	10.530	0.522	1.50	
40.0	10.000	10.004	10.609	0.605	1.50	
50.0	10.000	9.994	10.593	0.599	1.50	
52.0	10.000	10.001	10.688	0.687	1.50	
63.0	10.000	10.008	10.845	0.837	1.50	
80.0	10.000	10.008	10.940	0.932	1.50	





Certificate No.:

CP20230080EA

### Calibration Report

**Equipment:**

**Manufacturer:**

**Model:**

**Serial No.:**

**ID No.:**

**Ambient Temperature:**

**Relative Humidity:**

**Method of Calibration :-**

In-house method : CC-SV004 by comparison with standard accelerometer.

**Condition of this result of calibration**

1. Reference standards instrument :-

**Instrument**

1) Standard Accelerometer

2) Measuring Amplifier

3) PULSE Multi-analyzer system

4) Humidity and Temperature

Transmitter

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

3. This certification is traceable to the international system of unit maintained at :-

- National Institute of Metrology (Thailand)

Vibration Meter

Instantel

Micromate

UM15904

V8-01-002

( 23 ± 5 ) °C

( 50 ± 15 ) %

Certificate No.:

CP20230080EA

### Calibration Report

**Result of Calibration:-**

Function : Frequency response and Linearity test at 16 Hz

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	9.997	10.514	0.517	1.50	Longitudinal (L)
5.0	10.000	10.027	10.908	0.881	1.50	
6.3	10.000	10.015	10.813	0.798	1.50	
8.0	10.000	10.027	10.489	0.462	1.50	
10.0	10.000	9.986	10.483	0.497	1.50	
12.5	10.000	10.003	10.341	0.338	1.50	
16.0	10.000	9.984	10.215	0.231	1.50	
	20.000	20.025	20.248	0.223	1.50	
	30.000	29.981	30.298	0.317	1.50	
20.0	50.000	49.922	50.507	0.585	1.50	
	10.000	9.996	10.199	0.203	1.50	
	25.0	10.000	9.980	0.211	1.50	
31.5	10.000	9.974	10.183	0.209	1.50	
40.0	10.000	10.006	10.270	0.264	1.50	
50.0	10.000	10.000	10.199	0.199	1.50	
52.0	10.000	10.013	10.286	0.273	1.50	
63.0	10.000	9.976	10.325	0.349	1.50	
80.0	10.000	9.976	10.317	0.341	1.50	





Certificate No.:

CP20230080EA

### Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	10.055	10.656	0.601	1.50	Transverse (T)
5.0	10.000	10.015	10.593	0.578	1.50	
6.3	10.000	9.979	10.743	0.764	1.50	
8.0	10.000	10.034	10.412	0.378	1.50	
10.0	10.000	9.969	10.341	0.372	1.50	
12.5	10.000	9.990	10.254	0.264	1.50	
16.0	10.000	9.998	10.238	0.240	1.50	
	20.000	19.983	20.304	0.321	1.50	
	30.000	29.995	30.455	0.460	1.50	
	50.000	50.007	50.633	0.626	1.50	
20.0	10.000	10.027	10.238	0.211	1.50	
25.0	10.000	9.984	10.183	0.199	1.50	
31.5	10.000	9.986	10.199	0.213	1.50	
40.0	10.000	9.994	10.215	0.221	1.50	
50.0	10.000	9.976	10.231	0.255	1.50	
52.0	10.000	9.980	10.286	0.306	1.50	
63.0	10.000	9.970	10.380	0.410	1.50	
80.0	10.000	9.994	10.467	0.473	1.50	

#### Remark

1. UUC: Unit Under Calibration
2. The coverage factor  $k = 2.00$

-- End of Report --

Certificate No.:

CP20230080EA

### Calibration Report

Function : Frequency response and Linearity test at 16 Hz (Cont.)

Frequency (Hz)	Nominal (mm/s)	Standard (mm/s)	UUC (mm/s)	Deviation (mm/s)	Uncertainty ± (%)	Direction
4.0	10.000	9.966	9.718	-0.248	1.50	Vertical (V)
5.0	10.000	10.028	10.223	0.195	1.50	
6.3	10.000	9.969	10.388	0.419	1.50	
8.0	10.000	10.006	10.041	0.035	1.50	
10.0	10.000	9.993	9.971	-0.022	1.50	
12.5	10.000	9.979	9.947	-0.032	1.50	
16.0	10.000	10.004	10.049	0.045	1.50	
	20.000	19.969	20.012	0.043	1.50	
	30.000	29.981	29.888	-0.093	1.50	
	50.000	49.978	49.868	-0.110	1.50	
20.0	10.000	10.015	10.152	0.137	1.50	
25.0	10.000	9.977	9.655	-0.322	1.50	
31.5	10.000	10.014	10.081	0.067	1.50	
40.0	10.000	10.020	10.238	0.218	1.50	
50.0	10.000	10.031	10.380	0.349	1.50	
52.0	10.000	9.982	10.294	0.312	1.50	
63.0	10.000	9.987	10.428	0.441	1.50	
80.0	10.000	9.994	10.751	0.757	1.50	

#### Remark

1. UUC: Unit Under Calibration
2. The coverage factor  $k = 2.00$

-- End of Report --

## Calibration Certificate

Part Number: 721A2601  
 Description: Micromate with DIN Geophone  
 Serial Number: UM20453  
 Calibration Date: April 21, 2023  
 Calibration Reference Equipment: SRV-AFR 71417401  
 \*Calibrated with Geo UM6231

*Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.*

*Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.*

*The environment in which this product was calibrated is maintained within the operating specifications of the instrument.*

*Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.*

Calibrated By: Yaksh Patel

**Instantel** 309 Leggett Drive, Ottawa, Ontario, K2K 3A3 (613) 592-4642

Frequency Response of UM20453 (As Found)

