

ภาคผนวก ช
เอกสารสอบเทียบเครื่องมือ

รายการใบรับรองสอบเทียบ/ทวนสอบเครื่องมือประจำห้องปฏิบัติการ

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพอากาศ									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม	Mettler-Toledo	AB204-S / 1128312528	Mettler-Toledo (Thailand) Ltd.	23MM331	7 Apr 23	5 Apr 24	-
2	Analytical Balance (Readability 0.1 mg)		Mettler-Toledo	AB204-S/FACT / B108115858	Mettler-Toledo (Thailand) Ltd.	23MM332	7 Apr 23	5 Apr 24	-
3	Atomic Absorption Spectrometer (AAS)	สารตะกั่ว	Perkin Elmer	PinAAcle 900F / PFBS20031902	Perkin Elmer Co.,Ltd.	PM Service No. WO-01942593	26 Jan 23	25 Jan 24	-
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพน้ำ									
1	Atomic Absorption Spectrometer (AAS)	สารตะกั่ว	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC-ACL.No. 387/66	2 Feb 23	1 Feb 24	-

Due Date of Calibration* : กำหนดตามแผนการสอบเทียบประจำปี อย่างน้อยปีละ 1 ครั้ง



Cert.No.: 23MM331
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S
Serial No. : 1128312528
ID No. : UAE.AIR.019/2550
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room 2
Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Suwit Imjai
Approved by :
() Ponthippa Tameyakul
(✓) Malee Butkruea
Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95 %

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

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-00150C-1
Procedure used :-

Cert.No.: 23MM331
Page: 2 of 3

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

Condition of this result of calibration

1. Reference standard instruments :-

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

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

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

Range capacity : 0 g to 220 g **Resolution** 0.0001 g

Before Adjustment :

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
100	99.9999	+0.0001	0.19	2.03
200	200.0001	-0.0001	0.29	2.00

After Adjustment :

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

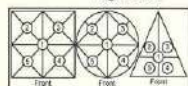
Applied Weight	Standard Deviation of Reading (g)
(g)	
100	0.00007
200	0.00007

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-00150C-1

Cert.No.: 23MM331
Page: 3 of 3



Maximum difference between off-center and central loading
(g)
0.0005

2. Effect of off center loading

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

Position 1	Position 2	Position 3	Position 4	Position 5
(g)	(g)	(g)	(g)	(g)
-0.0001	-0.0002	+0.0004	-0.0001	-0.0006

3. Departure from nominal value

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
Unload	0.0000	0.0000	0.15	2.13
0.1	0.0999	+0.0001	0.15	2.13
1	0.9999	+0.0001	0.15	2.13
5	4.9999	+0.0001	0.15	2.13
10	9.9999	+0.0001	0.15	2.11
20	20.0000	0.0000	0.15	2.11
50	50.0000	0.0000	0.16	2.06
70	69.9999	+0.0001	0.18	2.04
100	99.9999	+0.0001	0.19	2.03
150	150.0003	-0.0003	0.29	2.00
200	200.0005	-0.0005	0.29	2.00

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

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Cert.No.: 23MM332
Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance
Manufacturer : Mettler Toledo
Model : AB204-S /FACT
Serial No. : B108115858
ID No. : UAE.AIR.018/2555
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Balance Room 2
Received order : 07 April 2023
Calibration Date : 07 April 2023
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %
Calibrated by : Suwit Imjai
Approved by :
() Ponthippa Tameyakul
(✓) Malee Butkruea
Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95 %

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-2
Cert.No.: 23MM332
Page: 2 of 3

Procedure used :-

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

Condition of this result of calibration

1. Reference standard instruments:-

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

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

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

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
100	100.0002	-0.0002	0.21	2.06
200	200.0003	-0.0003	0.29	2.00

After Adjustment :

1. Determination of the standard deviation of weighing machine

(n = 10)

Applied Weight (g)	Standard Deviation of Reading (g)
100	0.00009
200	0.00007

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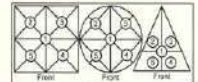


Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0015OC-2
Cert.No.: 23MM332
Page: 3 of 3

Result of calibration

2. Effect of off center loading

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



Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	Maximum difference between off-center and central loading (g)
+0.0001	-0.0003	-0.0003	+0.0006	+0.0002	0.0005

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.18	2.17
0.1	0.0999	+0.0001	0.18	2.17
1	0.9998	+0.0002	0.18	2.17
5	5.0000	0.0000	0.18	2.17
10	10.0000	0.0000	0.18	2.17
20	20.0000	0.0000	0.18	2.15
50	50.0001	-0.0001	0.19	2.11
70	70.0001	-0.0001	0.20	2.07
100	100.0002	-0.0002	0.21	2.06
150	150.0004	-0.0004	0.29	2.00
200	200.0005	-0.0005	0.29	2.00

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

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PinAAcle 900F Preventive Maintenance Report

Company Name: คู่มือการบำรุงรักษา อุปกรณ์ เอนจิเนียริ่ง คอนโซลแอนด์

Instrument Location: 3 ชั้น อาคาร 41 ถนนสุขุมวิท แขวงบางจาก

เขตพระโขนง กรุงเทพมหานคร 10260

Instrument Serial No.: PFBS20031902

Date: 26-Jan-2023

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PinAAcle 900F Preventive Maintenance (PM)

Company Name:	คู่มือการบำรุงรักษา อุปกรณ์ เอนจิเนียริ่ง คอนโซลแอนด์		
Address (Instrument Location):	3 ชั้น อาคาร 41 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพฯ 10260		
Serial Number:	PFBS20031902	PM Number:	1/2
Customer Name (if applicable):	K.Satids	Telephone Number:	095-558-0049
Customer Support Engineer Name:	Pattayut W.	Service Order Number:	WO-01942593
Date PM Performed: (DD-MM-YY)	Jan 26, 2023	Next PM Due Date: (DD-MM-YY)	Jul 26, 2023
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	PerkinElmer
09370145 Rev.9	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
80501096	Fan Filters	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N3301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

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

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

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Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

4. Electrical:

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

5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect optics. Clean or replace if necessary.

6. Gasses:

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

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Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-056
N1013002	1.0A Neutral density filter	1	MG2-258
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

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7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 533.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	1.0154	0.9746	Passed
0.2 A ND Filter	± 5% from Cert.	0.1806	0.1840	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0007	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

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8.4 D₂ Background Compensation with Copper

Description: Verifies the instrument's ability to compensate for background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0015	Passed

8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0003	Passed

8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0005	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	-	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3372	Passed

10. Review:

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

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Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.	
This PinAAcle 900F Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 29-Jan-2023 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 26-Jan-2023 (DD-MMM-YYYY)

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Atomic Absorption/FIAS 100/400 Preventive Maintenance (PM)

Company Name:	บริษัท เบรินเอลเมอร์ จำกัด (มหาชน)		
Address (Instrument Location):	3 ซอย อุบลราช 41 ถนนอุบลราช แขวงบางจาก เขตบางเขน กรุงเทพมหานคร 10260		
Room Number:	-		
Asset Number (if applicable):	100S20040201	Customer System ID:	-
Service Engineer Name:	Pattayut W.	Service Order Number:	WO-01942594
Date PM Performed: (DD-MMM-YYYY)	26-Jan-2023	Next PM Due Date: (DD-MMM-YYYY)	26-Jul-2023

Part Number	Release	Publication Date	PerkinElmer®
09376005	C	January 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the Atomic Absorption/FIAS 100/400 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

Always check with the customer before making any changes that may affect the customer's analysis or calibration.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Firmware Version	Configuration Notes

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MMYY)
B050 2706	Fan Filter	1	N/A	

Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MMYY)
	Digital Volt Meter	1	N/A	

Additional Reagents and Standards Required for PM

Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MMYY)

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Procedure Checklist

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

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.

☒ Is the Working Environment Acceptable? If not, document.

☒ Visual Damage (if yes, describe)

- ☒ Check incoming AC line voltage for proper levels and grounding.
☒ Verify Voltage switch on back of instrument is correct.
☒ Perform general inspection of system for cleanliness. Clean if needed.
☒ Gas supply cylinders secured, lines leak checked and argon or nitrogen supply pressure verified (45 – 58 psi).
☒ Inspect the customer log book and make any appropriate PM entries.
☒ Fan checked and filter cleaned
☒ Heating mantle or Universal Cell Holder checked

2. Instrument components

- ☒ Non-return valve checked/repaired/replaced if needed (B019 8111). Clean the valve if there is any liquid in it. Replace the rubber sleeve (B013 5123) if it is worn. Check the flow meter for any signs of fluid in it. Clean the flow meter if needed.
☒ Verify condition of pump pressure adjustment levers (B050 7794 - look for cracks or problems with the springs), pump rollers (B300 0251 check for wear), and thumb screws (B050 7796).
☒ Check the Multiport valve for proper switching, flow, and insure there are no leaks. Clean valve parts and replace o-rings if needed (large o-ring: B050 1250, small o-ring: B004 5095). Use a squirt bottle & fishing line to try to dislodge clogs.
☒ Firmware Version checked. Latest is 2.20.

3. Mixing/Separation Assembly & Pump Tubing:

- ☒ Mixing separator assembly checked
☒ Filter/membrane checked (E050 8306)
☒ Condition of the pump tubing (replace if necessary), correct pump tubing for the solutions being run. Make sure the correct magazines are being used, B050 7791 for 0.13 – 1.80 mm tubing; B050 7792 for 1.80 – 3.18 mm tubing.

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Additional Comments


Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for FIAS 100/400 have been completed.

This FIAS 100/400 Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:		Date:
Authorized Customer Representative:	สาธิต	Date:

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4. Cell, Cell Windows, Transfer Line:

- ☒ Cell checked
☒ Cell windows checked
☒ Transfer line checked for moisture (If moisture is a problem, the Nafion dryer might be needed)

5. Operational Tests:

- ☒ Run DI water through the carrier/reductant/sample system. Verify smooth flow of liquid throughout without leaks. Replace tubing & fittings if needed.

6. Review:

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

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Document History

Revision	Description of Change	Page(s)	Date
A	First release		May 2008
B	Addition of Batch/Lot Number, Expiration Date, and Report Fields.	2,7	February 2009
C	Update to new format	All	January 2013

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Service Report

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-01042593	Preventive Maintenance	Contract	09/10/2023 14:59 u.	AA5320001	TF 262001950
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Pathayut Wannongka	SC-002542367	31/09/2024	N/A	N/A	
LID Number					
N/A					
Equipment Location			Bill To Name		
170/9 Rama 9 Road, Bangkok 10310, Thailand			PerkinElmer (Thailand) Co., Ltd.		
PerkinElmer (Thailand) Co., Ltd.			PerkinElmer (Thailand) Co., Ltd.		
PerkinElmer (Thailand) Co., Ltd.			PerkinElmer (Thailand) Co., Ltd.		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
Khum Sakdi	090-9830000	N/A	ksakdi@perkinelmer.com	PPO-210800168	

Work Description	
PM PerkinElmer 5000 511 below list: - Clean injector and exterior cover - Calibrate nitrogen detector - Perform performance test - All of above are pass	
Start Date	End Date
08/09/2023	29/09/2023

Tools Used					
Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used				
Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details				
Part Number	Part Description	Start Date	Quantity	
SV000613	Preventive maintenance	28/09/2023	4	
SV000612	Service Travel		3	

Work Complete	Customer Signature	Technician Signature
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	 Please Date and Sign: 27/10/2023 Pathayut Wannongka	 27/10/2023 Pathayut Wannongka
PM/CO/SP Left with Customer		
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		

Terms & Conditions

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เอกสารไม่ควบคุม

Service Report

Work Order Number	Activity Code	Billing Type	Requested Start Date	Model	Serial Number
WO-01042594	Preventive Maintenance	Contract	09/10/2023 14:59 u.	FA5100	10050004001
Service Representative Name	Contract Number	Expiry Date	Equipment ID	System ID	
Pathayut Wannongka	SC-002542367	31/09/2024	N/A	N/A	
LID Number					
N/A					
Equipment Location			Bill To Name		
170/9 Rama 9 Road, Bangkok 10310, Thailand			PerkinElmer (Thailand) Co., Ltd.		
PerkinElmer (Thailand) Co., Ltd.			PerkinElmer (Thailand) Co., Ltd.		
PerkinElmer (Thailand) Co., Ltd.			PerkinElmer (Thailand) Co., Ltd.		
Customer Contact	Phone Number	Fax Number	Email	Purchase Order	
Khum Sakdi	090-9830000	N/A	ksakdi@perkinelmer.com	PPO-210800168	

Work Description	
PM FA5100 1.0 below list: - Clean exterior cover, magazine, pump roller, fuel parts valve and chamber - Replace new tube - Perform performance test with Hg - All of above are pass	
Start Date	End Date
29/09/2023	29/09/2023

Tools Used					
Quantity	Calibrated Tool	Description	Serial Number	Last Calibration Date	Next Calibration Date
*** No Calibrated Tools Used ***					

Material Used				
Part Number	Part Description	Note	Lot/Serial Number	Quantity
*** No Parts Used ***				

Labour Details				
Part Number	Part Description	Start Date	Quantity	
SV000613	Preventive maintenance	28/09/2023	3	

Work Complete	Customer Signature	Technician Signature
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	 Please Date and Sign: 27/10/2023 Pathayut Wannongka	 27/10/2023 Pathayut Wannongka
PM/CO/SP Left with Customer		
Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		

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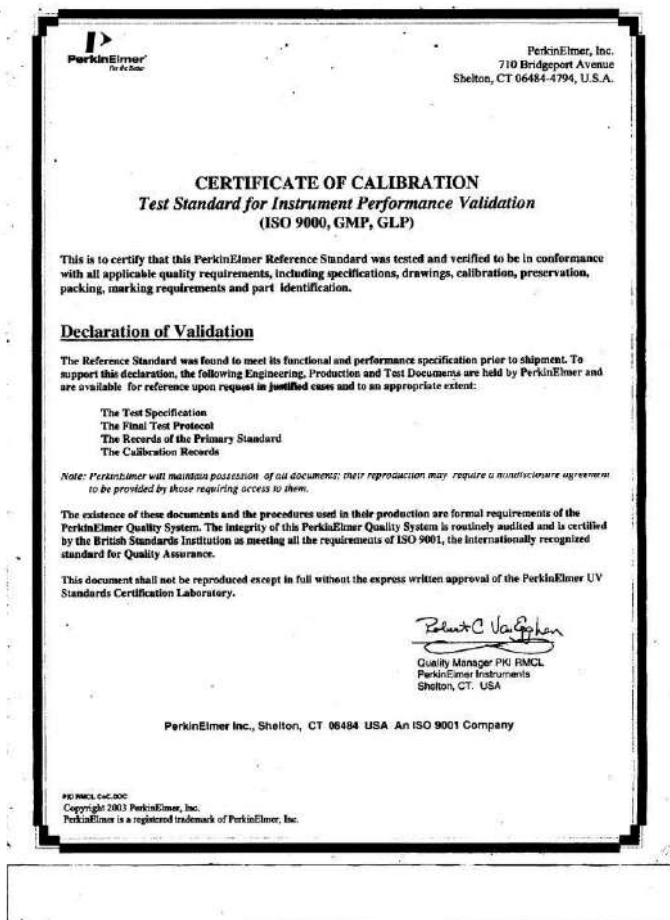
เอกสารไม่ควบคุม



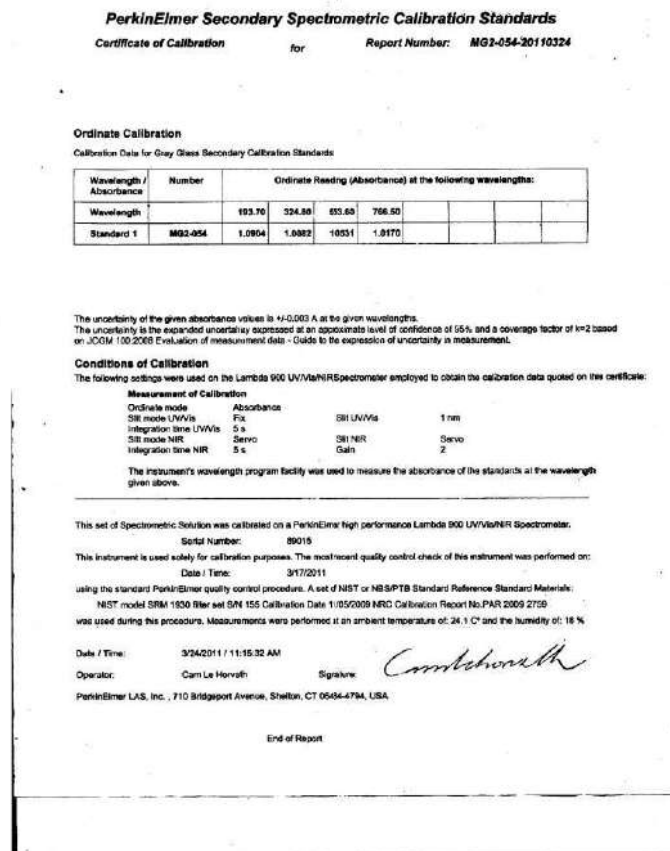
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เอกสารไม่ควบคุม



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CERTIFICATE OF CALIBRATION Test Standard for Instrument Performance Validation (ISO 9000, GMP, GLP)

This is to certify that this PerkinElmer Reference Standard was tested and verified to be in conformance with all applicable quality requirements, including specifications, drawings, calibration, preservation, packing, marking requirements and part identification.

Declaration of Validation

The Reference Standard was found to meet its functional and performance specification prior to shipment. To support this declaration, the following Engineering, Production and Test Documents are held by PerkinElmer and are available for reference upon request in justified cases and to an appropriate extent:

- The Test Specification
- The Final Test Protocol
- The Records of the Primary Standard
- The Calibration Records

Note: PerkinElmer will maintain possession of all documents; their reproduction may require a nondisclosure agreement to be provided by those requiring access to them.

The existence of these documents and the procedures used in their production are formal requirements of the PerkinElmer Quality System. The integrity of this PerkinElmer Quality System is routinely audited and is certified by the British Standards Institution as meeting all the requirements of ISO 9001, the internationally recognized standard for Quality Assurance.

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Robert C. Vaughan
Quality Manager PKI RMCL
PerkinElmer Instruments
Shelton, CT, USA

PerkinElmer Inc., Shelton, CT 06484 USA An ISO 9001 Company

PE RMCL CAC 0002
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Secondary Spectrometric Calibration Standards

Certificate of Calibration

Ordinate Calibration

Calibration Data for Secondary Calibration Standards:

Wavelength / Absorbance	Number	Ordinate Reading (Absorbance) at the following wavelengths:				
Wavelength		193.70	324.80	553.56	765.56	
Standard 1	M02-258	1.1704	1.0389	1.0154	0.8669	

The uncertainty of the given absorbance values is ± 0.003 A at the given wavelengths.
The uncertainty is the expanded uncertainty expressed at an approximate level of confidence of 95% and a coverage factor of k=2 based on JCGM 100:2008 Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

Conditions of Calibration

The following settings were used on the Lambda 900 UV/Vis/NIR Spectrometer employed to obtain the calibration data quoted on this certificate:

Measurement of Calibration			
Ordinate mode	Absorbance		
Slit mode UV/Vis	FN	Slit UV/Vis	1 nm
Integration time UV/Vis	5 s	Slit NIR	0.2 nm
Slit mode NIR	Slit	Gain	2
Integration time NIR	0 s		

The PerkinElmer "Certification Software" program - "Photometric Accuracy UV/Vis/NIR" enabled utilizing the instrument set-up parameters as outlined above was used to measure the absorbance of the standard at the prescribed wavelengths reflected in the Calibration Data grid.

This set of Spectrometric Solution was calibrated on a PerkinElmer high performance Lambda 900 UV/Vis/NIR Spectrometer.

Serial Number: 88015

This instrument is used solely for calibration purposes. The most recent quality control check of this instrument was performed on:

Date / Time: 9/16/2013

Using the standard PerkinElmer quality control procedure. A set of NIST or NBS/PTB Standard Reference Standard Materials:

NIST model SRM 1930 Silver nitrate 5N 155 Calibration Date 01/09/2012 NRC Calibration Report No. PAR 2012 2856

was used during this procedure. Measurements were performed at an ambient temperature of 20.3 °C and the humidity of: 22 %

Date / Time: 11/23/2013 / 1:14:02 PM

Operator: Cam Le Hanaeth

Signature: *Cam Le Hanaeth*

PerkinElmer LAS, Inc., 710 Bridgeport Avenue, Shelton, CT 06484-4794, USA

End of Report

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CERTIFICATE OF CALIBRATION Test Standard for Instrument Performance Validation (ISO 9000, GMP, GLP)

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Robert C. Vaughan
Quality Manager PKI RMCL
PerkinElmer Instruments
Shelton, CT, USA

PerkinElmer Inc., Shelton, CT 06484 USA An ISO 9001 Company

PE RMCL CAC 0002

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PerkinElmer TruQ

PerkinElmer Number: N9200163
Element and Matrix: 1000 µg/mL Copper in 2% HNO₃
Starting Material: Copper Metal
Starting Material Lot No: 06201C
Density: 1.012 g/mL @ 20°C

Lot No: 26-57CUY1
Certification Date: JUL -- 2022
Expiration Date: JAN 30 2024

Trace Metallic Impurities in the Actual Solution via ICP / ICP-MS Analysis:

Element	µg/mL	Element	µg/mL	Element	µg/mL	Element	µg/mL	Element	µg/mL
Ag	0.002	Dy	<0.001	Li	<0.005	Pt	<0.001	Tb	<0.001
Al	<0.003	Er	<0.001	Lu	<0.001	Rb	<0.001	Tc	<0.001
As	<0.002	Eu	<0.001	Mg	<0.002	Rh	<0.001	Th	<0.001
Au	<0.002	Fe	<0.004	Mn	<0.001	Rn	0.002	Ti	<0.001
B	<0.002	Ga	<0.001	Mo	<0.001	Ru	<0.001	Tl	<0.001
Ba	<0.001	Gd	<0.001	Na	9.55	Sb	<0.001	Tm	<0.001
Be	<0.001	Ge	<0.002	Nb	<0.001	Se	<0.001	U	<0.001
Bi	<0.001	Hf	<0.001	Nd	<0.001	Sn	<0.003	V	<0.001
Ca	0.005	Hg	<0.001	Ni	<0.001	Si	<0.1	W	<0.001
Cd	<0.001	Ho	<0.001	P	<0.2	Sm	<0.001	Y	<0.001
Ce	<0.001	In	<0.001	Pb	0.001	Sn	<0.001	Yb	<0.001
Cu	<0.001	Ir	<0.001	Pd	<0.001	Sr	<0.001	Zn	<0.005
Cr	<0.001	K	<0.1	Pr	<0.001	Ta	<0.001	Zr	<0.001
Cs	<0.001	La	<0.001						

Traceability Documentation for solution scenarios:

Certified Value: 1001 µg/mL ± 5 µg/mL (refer to side 2)

Certified Value is Traceable to: NIST SRM #3114

* Classical Wet Assay: 1000 µg/mL

Method: EDTA titration using PAN as indicator. EDTA standardized against Pb(NO₃)₂ NIST SRM #628.

* Instrument Analysis using ICP Spectrometer: 1001 µg/mL

via NIST SRM #3114

We guarantee that our PerkinElmer TruQ Atomic Spectroscopy Standards are stable and accurate to $\pm 0.5\%$ of certified concentration until the expiration date, provided the standards are kept tightly capped and stored under normal laboratory conditions. This value the sum of cumulative errors associated with the analytical determinations, pipetting, and diluting to final volume. For these solutions we use High purity acids, ASTM Type 1 water (18 megohm double deionized), and leached, triple-rinsed bottles. All glassware used class A.

Certifying Officer: *Y. Parikh*
Yogesh Parikh, Senior Spectroscopist

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Request No. 25-66 / 0323

MTC. ACL. No. 387 / 66

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer "Agilent Technologies"
Model AA240FS, Serial No. MY13160001
2. Working standard solution "Inorganic Ventures"
Multi Analyte Custom Grade Solution, Lot No. S2-MEB708640
SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.
3. Soi Udomsuk41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer
(WI-500-02-30)

2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-313)

CALIBRATION RANGE: 0.02,0.10,0.30,0.50,0.70 mg/l at 228.8 nm Cd, 0.10,0.20,0.30,0.50,0.70 mg/l at 357.9 nm Cr,
0.05,0.10,0.30,0.50,0.70 mg/l at 324.7 nm Cu, 0.10,0.30,0.50,0.70,1.00 mg/l at 248.3 nm Fe, 0.20,0.50,0.70,1.00,1.50 mg/l
at 217.0 nm Pb, 0.05,0.10,0.30,0.50,0.70 mg/l at 279.5 nm Mn, 0.10,0.30,0.50,0.70,1.00 mg/l at 232.0 nm Ni,
0.05,0.10,0.30,0.50,0.70 mg/l at 213.9 nm Zn

CALIBRATION DATE : 2 February 2023

REFERENCE MATERIAL : Traceable to NIST "Carlo Erba", "PanReac AppliChem"

Cadmium Lot No. 1152457, Chromium Lot No. 1193249, Copper Batch No. T117098A, Iron Batch No. T126087A,
Lead Lot No. 1227873, Manganese Batch No. T109228A, Nickel Batch No. T270178A, Zinc Batch No. T20140A

AMBIENT CONDITIONS : Temperature 22 °C Relative humidity 58 %

The Atomic Absorption Spectrophotometer has been calibrated against Reference
Material traceable to National Institute of Standards and Technology (NIST) by The Analytical Chemistry
Laboratory. The results are attached herewith.

Calibrated by : Miss Danal Srithongkum
(Mr. Danal Srithongkum)

Approved by : Miss Sudatta Deawong
(Miss Sudatta Deawong)
Senior Technical Officer
Acting Director of Analytical Chemistry Laboratory
Ref. 2015266012600366001
Issued Date : 15 February 2023

The results relate only to the items tested/calibrated or value assigned.
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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

2. Precision

Element	Conc. (mg/l)	Absorbance										Ave. Abs.	SD	%SD
Cd	0.02	0.0085	0.0084	0.0090	0.0089	0.0089	0.0090	0.0086	0.0092	0.0090	0.0089	0.009	0.0003	2.88
	0.30	0.0993	0.1001	0.1007	0.1004	0.1004	0.0995	0.0997	0.0998	0.0999	0.0996	0.100	0.0005	0.45
	0.70	0.2238	0.2229	0.2244	0.2249	0.2243	0.2233	0.2235	0.2231	0.2251	0.2248	0.224	0.0007	0.33
Cr	0.10	0.0088	0.0087	0.0094	0.0086	0.0086	0.0091	0.0099	0.0095	0.0076	0.0085	0.009	0.0006	7.25
	0.30	0.0257	0.0265	0.0265	0.0270	0.0266	0.0258	0.0261	0.0262	0.0274	0.0262	0.026	0.0006	2.25
	0.70	0.0573	0.0590	0.0580	0.0576	0.0578	0.0579	0.0593	0.0599	0.0586	0.0594	0.058	0.0009	1.51
Cu	0.05	0.0083	0.0084	0.0084	0.0075	0.0086	0.0086	0.0081	0.0080	0.0087	0.0092	0.008	0.0005	5.45
	0.30	0.0430	0.0444	0.0426	0.0429	0.0435	0.0432	0.0428	0.0441	0.0427	0.0434	0.043	0.0006	1.41
	0.70	0.0981	0.0992	0.0990	0.0997	0.0977	0.0986	0.0990	0.0982	0.0988	0.0980	0.099	0.0006	0.63
Fe	0.10	0.0109	0.0104	0.0087	0.0100	0.0087	0.0094	0.0102	0.0092	0.0094	0.0100	0.010	0.0007	7.53
	0.50	0.0456	0.0442	0.0450	0.0444	0.0450	0.0455	0.0455	0.0441	0.0446	0.0444	0.045	0.0006	1.27
	1.00	0.0904	0.0901	0.0891	0.0876	0.0873	0.0901	0.0876	0.0886	0.0879	0.0901	0.089	0.0012	1.38
Pb	0.20	0.0093	0.0099	0.0104	0.0102	0.0104	0.0109	0.0102	0.0103	0.0115	0.0117	0.010	0.0007	6.85
	0.70	0.0344	0.0336	0.0336	0.0328	0.0338	0.0346	0.0336	0.0331	0.0343	0.0350	0.034	0.0007	2.02
	1.50	0.0709	0.0718	0.0706	0.0713	0.0698	0.0718	0.0712	0.0713	0.0715	0.0719	0.071	0.0006	0.90
Mn	0.05	0.0115	0.0130	0.0131	0.0127	0.0135	0.0136	0.0124	0.0133	0.0124	0.0130	0.013	0.0006	4.88
	0.30	0.0709	0.0700	0.0714	0.0704	0.0700	0.0705	0.0714	0.0698	0.0694	0.0700	0.070	0.0007	0.96
	0.70	0.1619	0.1633	0.1646	0.1638	0.1646	0.1614	0.1632	0.1614	0.1636	0.1652	0.163	0.0014	0.83
Ni	0.10	0.0113	0.0105	0.0113	0.0111	0.0110	0.0113	0.0117	0.0112	0.0107	0.0117	0.011	0.0004	3.45
	0.50	0.0509	0.0517	0.0508	0.0502	0.0517	0.0516	0.0516	0.0523	0.0518	0.0503	0.051	0.0007	1.36
	1.00	0.0997	0.1006	0.1006	0.1006	0.0996	0.0998	0.1007	0.1000	0.1013	0.0999	0.100	0.0006	0.53
Zn	0.05	0.0315	0.0309	0.0322	0.0304	0.0329	0.0312	0.0313	0.0319	0.0308	0.0311	0.031	0.0007	2.35
	0.30	0.1705	0.1728	0.1688	0.1693	0.1711	0.1704	0.1704	0.1707	0.1708	0.1688	0.170	0.0012	0.70
	0.70	0.3559	0.3572	0.3548	0.3560	0.3559	0.3550	0.3579	0.3552	0.3574	0.3573	0.356	0.0011	0.31

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

CALIBRATION DATA

1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
Absorbance	0.0020	0.0000	0.0008	3.0000	-0.0003	0.0021	-0.0016	-0.0022
	0.0015	0.0006	0.0005	0.0009	-0.0014	0.0018	0.0002	-0.0023
	0.0014	0.0006	0.0010	0.0009	0.0015	0.0008	-0.0004	-0.0015
	0.0021	-0.0008	0.0013	0.0010	0.0005	0.0005	-0.0008	-0.0004
	0.0020	-0.0012	0.0004	3.0003	-0.0004	0.0001	-0.0021	-0.001
	0.0021	-0.0011	0.0011	3.0003	0.0006	0.0009	-0.0002	-0.0013
	0.0017	-0.0009	0.0001	0.0015	0.0010	0.0007	0.0001	-0.0016
	0.0024	-0.0012	0.0004	0.0002	0.0008	-0.0005	-0.0012	-0.0019
	0.0011	-0.0002	0.0015	0.0004	0.0004	0.0008	-0.0003	-0.0017
	0.0017	0.0000	0.0009	3.0004	0.0001	0.0015	-0.0009	-0.0024
	0.0019	-0.0004	0.0004	3.0000	0.0006	0.0010	-0.0005	-0.0016
	0.0016	-0.0025	0.0003	3.0005	0.0009	-0.0004	-0.0013	-0.0016
	0.0018	-0.0014	0.001	0.0009	-0.0006	0.0010	-0.0001	-0.0017
	0.0019	-0.0006	0.0011	0.0008	0.0011	0.0004	-0.0003	-0.0005
	0.0024	0.0003	0.0005	0.0012	-0.0002	0.0012	-0.0006	-0.0011
	0.0023	-0.0012	0.0006	0.0007	0.0002	0.0014	-0.0012	-0.0013
	0.0020	-0.0014	0.0009	0.0018	0.0003	0.0012	-0.0012	-0.0013
	0.0010	-0.0015	0.0002	3.0004	0.0017	0.0011	-0.0018	-0.0013
	0.0016	-0.0011	0.0013	3.0003	0.0007	0.0026	-0.0006	-0.0006
	0.0001	-0.0007	0.0009	-0.0003	0.0008	0.0008	0.0000	-0.0001
Average Absorbance	0.002	-0.001	0.001	0.900	0.000	0.001	-0.001	-0.001

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

3. Trueness

3.1 Reading on wavelength- Cadmium (Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.02002	0.021	0.001	4.90	± 0.005
	0.30030	0.298	-0.002	0.77	± 0.005
	0.70070	0.675	-0.026	3.67	± 0.008

3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1001	0.101	0.001	0.90	± 0.009
	0.3003	0.295	-0.007	2.43	± 0.012
	0.7007	0.648	-0.053	7.52	± 0.023

3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.050	0.046	-0.004	8.00	± 0.003
	0.300	0.289	-0.011	3.67	± 0.009
	0.700	0.674	-0.026	3.71	± 0.020

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INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

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FMBL.MTC.002 Rev.4

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.095	-0.005	5.00	± 0.014
	0.500	0.474	-0.026	5.20	± 0.016
	1.000	0.950	-0.050	5.00	± 0.029

3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.200	0.207	0.007	3.50	± 0.014
	0.700	0.673	-0.027	3.86	± 0.030
	1.500	1.417	-0.083	5.53	± 0.061

3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.04095	0.046	-0.004	7.91	± 0.005
	0.29970	0.294	-0.0057	1.90	± 0.007
	0.69930	0.694	-0.0053	0.76	± 0.014

Continue 5 / 5

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Request No. 25-66 / 0323

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MTC. ACL. No. 387 / 66

3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.1001	0.103	0.003	2.90	± 0.013
	0.5005	0.501	0.001	0.10	± 0.018
	1.0010	0.987	-0.014	1.40	± 0.032

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.046	-0.004	8.00	± 0.013
	0.300	0.311	0.011	3.67	± 0.013
	0.700	0.665	-0.035	5.00	± 0.019

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of $k = 2$ which gives a level of confidence of approximately 95%.

Calibrated by 1. Danai Srithongkum
(Mr. Danai Srithongkum)
2. Atipat
(Mr. Atipat Ratana)

Approved by Supada Deangdang
(Miss Supada Deangdang)
Senior Technical Officer
Acting Director of
Analytical Chemistry Laboratory
Issued Date : 15 February 2023

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE
End of Certificate

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List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Lead	Tisch Environmental,Inc.	TE-5025A 3383	Jiranatee Associates Co., Ltd.	CL-003-65	26 Jul 22	25 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Lead	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1401	9 May 23	8 May 24	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Lead	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1858	2 Jun 23	1 Jun 24	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Lead	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778106	UAE Consultant Co.,Ltd.	24012023	24 Jan 23	23 Jan 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778107	UAE Consultant Co.,Ltd.	2202023	22 Feb 23	21 Feb 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778108	UAE Consultant Co.,Ltd.	28032023	28 Mar 23	27 Mar 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778109	UAE Consultant Co.,Ltd.	28032023	28 Feb 23	27 Feb 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778110	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636462	UAE Consultant Co.,Ltd.	28032023	28 Mar 23	27 Mar 24	-
11	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1200636463	UAE Consultant Co.,Ltd.	24012023	24 Jan 23	23 Jan 24	-
12	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497724	UAE Consultant Co.,Ltd.	22022023	22 Feb 23	21 Feb 24	-
13	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497725	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497726	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-
15	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201778105	UAE Consultant Co.,Ltd.	13022023	13 Feb 23	12 Feb 24	-
16	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
17	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-0607415779	UAE Consultant Co.,Ltd.	03052023	3 May 23	2 May 24	-
18	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-0611116459	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-
19	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-62236-334	UAE Consultant Co.,Ltd.	03052023	3 May 23	2 May 24	-
20	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 43C-76465-383	UAE Consultant Co.,Ltd.	25042023	25 Apr 23	24 Apr 24	-
21	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 43C-65007-345	UAE Consultant Co.,Ltd.	07032023	7 Apr 23	6 Apr 24	-
22	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 0517512002	UAE Consultant Co.,Ltd.	04042023	4 Apr 23	3 Apr 24	-
23	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43C 0517512003	UAE Consultant Co.,Ltd.	19042023	19 Apr 23	18 Apr 24	-
24	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387061	UAE Consultant Co.,Ltd.	17012023	17 Jan 23	16 Jan 24	-
25	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387062	UAE Consultant Co.,Ltd.	07032023	7 Mar 23	6 Mar 24	-
26	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387063	UAE Consultant Co.,Ltd.	07042023	7 Apr 23	6 Apr 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
27	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i CM22387064	UAE Consultant Co.,Ltd.	14022023	14 Feb 23	13 Feb 24	-
28	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
29	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140003	UAE Consultant Co.,Ltd.	18012023	18 Jan 23	17 Jan 24	-
30	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540068	UAE Consultant Co.,Ltd.	21022023	21 Feb 23	20 Feb 24	-
31	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540069	UAE Consultant Co.,Ltd.	14032023	14 Mar 23	13 Mar 24	-
32	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YN43AG7T	UAE Consultant Co.,Ltd.	14032023	14 Mar 23	13 Mar 24	-
33	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
34	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48CTL-65506-348	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
35	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140004	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
36	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920018	UAE Consultant Co.,Ltd.	20032023	20 Mar 23	19 Mar 24	-
37	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920019	UAE Consultant Co.,Ltd.	03042023	3 Apr 23	2 Apr 24	-
38	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920020	UAE Consultant Co.,Ltd.	21022023	21 Feb 23	20 Feb 24	-
39	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1182920021	UAE Consultant Co.,Ltd.	15052023	15 May 23	14 May 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
40	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
41	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 VUPVTC21	UAE Consultant Co.,Ltd.	25012023	25 Jan 23	24 Jan 24	-
42	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 PDXEGXF7	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
43	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 SSGEYBJ	UAE Consultant Co.,Ltd.	25012503	25 Jan 23	24 Jan 24	-
44	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 VW2FY3R3	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
45	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 T4FG19AN	UAE Consultant Co.,Ltd.	20022023	20 Feb 23	19 Feb 24	-
46	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 HAMEHU5M	UAE Consultant Co.,Ltd.	25012023	25 Jan 23	24 Jan 24	-
47	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 RTHK2PDH	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
48	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 93JN1MN9	UAE Consultant Co.,Ltd.	15022023	15 Feb 23	14 Feb 24	-
49	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 KWWV1R96	UAE Consultant Co.,Ltd.	15022023	15 Feb 23	14 Feb 24	-
50	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 RATFJBXS	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
51	Total Hydrocarbons Analyzer	Total Hydrocarbons	HORIBA	APHA-370 GY21PTED	UAE Consultant Co.,Ltd.	20022023	20 Feb 23	19 Feb 24	-
52	Standard Gas	Total Hydrocarbons	Air Liquide	CC143232	Air Liquide	E03AI99E15A006C	16 Oct 20	16 Oct 28	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35 44783	Innovative Instrument Co.,Ltd.	23-ACT-114	4 Aug 23	3 Aug 24	-
2	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT1 0007302	Larson Davis-A PCB Piezotronics Div.	2023003657	23 Mar 23	22 Mar 25	-
3	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT1 0007310	Larson Davis-A PCB Piezotronics Div.	2023003673	24 Mar 23	23 Mar 25	-
4	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT2 0005289	Sithiporn Associates Co., Ltd.	ACL22082	26 Jan 22	25 Jan 24	-
5	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT2 0005304	Innovative Instrument Co.,Ltd.	22-ACT-249	1 Apr 22	31 Mar 24	-
6	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT2 0005344	Innovative Instrument Co.,Ltd.	22-ACT-248	1 Apr 22	31 Mar 24	-
7	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT2 0005394	Innovative Instrument Co.,Ltd.	22-ACT-034	21 Jan 22	20 Jan 24	-
8	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT2 0005395	Innovative Instrument Co.,Ltd.	22-ACT-247	1 Apr 22	31 Mar 24	-
9	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT2 0005396	Innovative Instrument Co.,Ltd.	22-ACT-105	11 Feb 22	10 Feb 24	-
10	Sound Level Meter	L_{Aeq} 24 hours ¹ L_{Aeq} 1 hour ¹ L_{Amax} L_{A90} L_{Adn}	Larson Davis	LxT2 0005398	Innovative Instrument Co.,Ltd.	22-ACT-035	21 Jan 22	20 Jan 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
11	Sound Level Meter	L_{Aeq} 24 hours, L_{Aeq} 1 hour, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005400	Innovative Instrument Co.,Ltd.	22-ACT-036	21 Jan 22	20 Jan 24	-
12	Sound Level Meter	L_{Aeq} 24 hours, L_{Aeq} 1 hour, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005402	Innovative Instrument Co.,Ltd.	22-ACT-103	11 Feb 22	10 Feb 24	-
13	Sound Level Meter	L_{Aeq} 24 hours, L_{Aeq} 1 hour, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005405	Innovative Instrument Co.,Ltd.	22-ACT-101	11 Feb 22	10 Feb 24	-
14	Sound Level Meter	L_{Aeq} 24 hours, L_{Aeq} 1 hour, L_{Amax} , L_{A90} , L_{Adn}	Larson Davis	LxT2 0005407	Innovative Instrument Co.,Ltd.	22-ACT-037	21 Jan 22	20 Jan 24	-

CERTIFICATE OF CALIBRATION

Certificate No.: CL-009-65

Page 1 of 2 Pages

MEASUREMENT ITEM

Top Load Orifice
Tach Environmental, Inc.
TE-5025A
3380
UAE-EFM-053/2560
Used Item
United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

Calibration procedure:

The Orifice gas flow device was calibrated against
Standard Rotary Displacement Meter (Rods Meter) Model 665/665/W3-4b. The W3-4b-004
was used as a calibration guideline.

Traceability:

This certificate provides a traceability of the
measurement to recognized the national
standards and to recognize of the international
system of units (SI) through the VSL (National
Metrology Institute of Netherlands) via Certificate
number: G2213902

Uncertainty of Measurement:

The reported uncertainty of measurement is based
on the standard uncertainty multiplied by a
coverage factor $k=2$, which for a normal
distribution corresponds to a coverage probability
of approximately 95%. The standard uncertainty
has been determined in accordance with the GUM
(Evaluation of measurement
data - Guide to the expression of uncertainty in
measurement)

RECEIVED DATE: 15 Jul 2022
MEASUREMENT DATE: 25 Jul 2022
ISSUE DATE: 26 Jul 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:

Temperature: 23.0 ± 3.0 °C
Relative Humidity: 55.0 ± 35.0 %RH
Atmospheric Pressure: 1010 ± 10 hPa

CALIBRATION CONDITION:

Preconditioning: 24 hours at ambient conditions.
Measurement Condition: The average values during measurement are 24.8 °C and 55.1 %RH.

TABULATION OF RESULTS:

The table on next page give the measured values.

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Rods Meter). The Humid air was used as a medium in the system. The standard conditions are 25 °C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	Y	Standard Flow [Qs] m ³ /min
1	0.697	754.365	24.640	23.960	55.399	1.699	1.299	0.643
2	1.000	754.236	24.950	24.350	62.172	3.444	1.849	0.913
3	1.118	754.323	24.730	24.210	41.925	4.582	2.133	1.051
4	1.169	754.212	24.640	24.160	31.045	5.150	2.262	1.116
5	1.416	754.175	24.480	24.210	30.117	7.629	2.754	1.355

Slope (a):

Intercept (b):

Correlation coefficient (r):

Uncertainty (k=2):

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	Y	Standard Flow [Qs] m ³ /min
1	0.697	754.265	24.640	23.960	55.399	1.699	0.819	0.647
2	1.000	754.236	24.950	24.350	62.172	3.444	1.167	0.919
3	1.118	754.323	24.730	24.210	41.925	4.582	1.345	1.058
4	1.169	754.212	24.640	24.160	31.045	5.150	1.426	1.129
5	1.416	754.175	24.480	24.210	30.117	7.629	1.735	1.381

Slope (a):

Intercept (b):

Correlation coefficient (r):

Uncertainty (k=2):

End of Certificate of Calibration

Calibrated by:

☐ Mr. Sanyat Thuchad
☒ Miss Jitiporn Lertsomphol



Approved signature:

Mr. Parinya Booncharoen
Calibration Department Manager



THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR
IN WRITING FROM THE LABORATORY

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
524 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9188

Certificate of Calibration

Certificate No.: 23P1401

Page: 1 of 2

Equipment:

U-Tube Manometer

Manufacturer:

Dwyer

Model:

1221-36-WIM

Serial No.:

-

ID No.:

UAE-EFM.022/2560

Condition As-Received:

Used Item

Received Date:

26 April 2023

Calibration Date:

09 May 2023

Reference:

2304-0703WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature:

(23 ± 2) °C

Relative Humidity:

(50 ± 15) %

Atmospheric Pressure:

1010 mbar

81 Soi Udomsuk 41, Sukhumvit Road, Bangkoksk,
Phrakhanong, Bangkok 10260

Procedure used:

The calibration was conducted by direct comparison method against Pressure Measuring Instruments
Standard according to in-house calibration procedure CP-P04, using * OKD-R 6-1; Calibration of Pressure
Gauges, Edition 03/2014 * as a guideline.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0137-22	24 Aug 2023

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

3. Scale and conversion factor is 1 kPa = 4.0146293 inH₂O

4. This instrument was used clean air and oil as pressure media.

5. This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6. This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

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

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

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suwit Aussarnee

Issue Date: 11 May 2023

Approved Signatory:

Attapol R.

| Phatinee Prabpaijai

| Sura Suwanmasri

✓ Attapol Panurach

เอกสารไม่ควบคุม

0314241



Cert.No.: 23P1401

Page: 2 of 2

Result of calibration:- Without adjustment

Function:- Pressure Measurement

Increasing Pressure

Range: 0 inH₂O to 36 inH₂O

Scale Interval: 0.1 inH₂O (The Fifth Estimate)

Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	AP (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98	-0.02
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-2.98	5.98	-0.02
8.00	4.00	-3.98	7.98	-0.02
10.00	5.00	-4.98	9.98	-0.02
12.00	6.00	-6.00	12.00	0.00
14.00	7.00	-7.00	14.00	0.00
16.00	8.00	-8.00	16.00	0.00
18.00	9.00	-9.00	18.00	0.00
20.00	10.00	-10.00	20.00	0.00
22.00	11.00	-11.00	22.00	0.00
24.00	12.02	-12.00	24.02	0.02
26.00	13.02	-13.00	26.02	0.02
28.00	14.02	-14.00	28.02	0.02
30.00	15.04	-15.00	30.04	0.04
32.00	16.04	-16.00	32.04	0.04
34.00	17.02	-17.00	34.02	0.02
36.00	18.00	-17.98	35.98	0.02

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* AP = High-port side - Low-port side

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

-o0o-

Attapol R.

เอกสารไม่ควบคุม

1160340



Certificate of Calibration

Certificate No.: 23P1858
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.124/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKD-R 9-1: Calibration of Pressure Gauges, Edition 03/2014" as a guidelines.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

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

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

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

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

- National Institute of Metrology Thailand (NIMT)

Calibrated by: Suksan Khankaew
Issue Date: 08 June 2023

Approved Signatory: Attapol P.
[] Phalinee Prabpai
[] Sura Suwanasri
[x] Attapol Panurach

เอกสารไม่ควบคุม
B 0316958



Result of calibration:- Without adjustment

Range: 980 hPa to 1030 hPa

Function:- Absolute Pressure Measurement

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	999.93	970.47	961.93	961.32	1002.26	1011.64	1021.14	1032.30
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	0.07	-0.47	-1.93	-1.32	-2.26	-1.64	-1.14	-3.30

Decreasing Pressure

Applied Pressure (hPa)	1032.30	1021.44	1011.67	1002.36	992.35	981.94	970.49	959.94
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-2.30	-1.44	-1.67	-2.36	-2.35	-1.94	-0.49	9.96

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

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เอกสารไม่ควบคุม
B 1165506



Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023

to: 08 June 2023

Reference: 2305-0919WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Procedure used: Calibration was conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360185	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	23305	15 Mar 2024

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

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

- National Institute of Standards and Technology (NIST), The United States of America

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

Calibrated by: Somchai Dumvor
Issue Date: 07 June 2023

Approved Signatory: Attapol P.
[x] Chakrit Waeewanjai
[] Pornthippa Tanmyasul
[] Viporn Tantiyawuti

เอกสารไม่ควบคุม
B 0316274



Result of Calibration:-

Before Adjustment

Function:

Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	7.9	1.6
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:-

After Adjustment

Function:

Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:-

Without Adjustment

Function:

Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

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

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เอกสารไม่ควบคุม
B 1165295

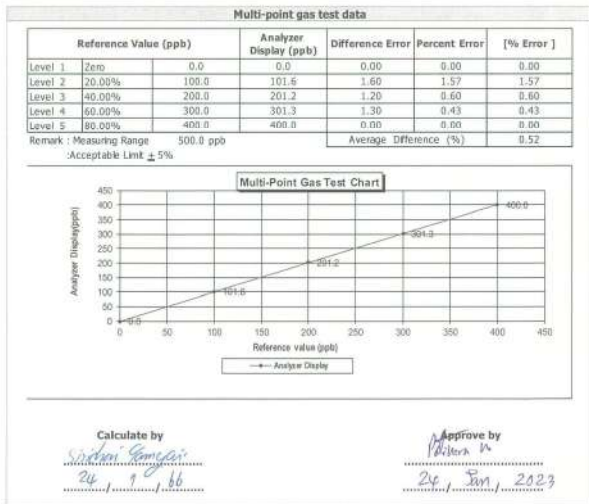
MULTI-POINT GAS TEST REPORT

Test Date : Jan 24, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778106

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071



เอกสารไม่ควบคุม

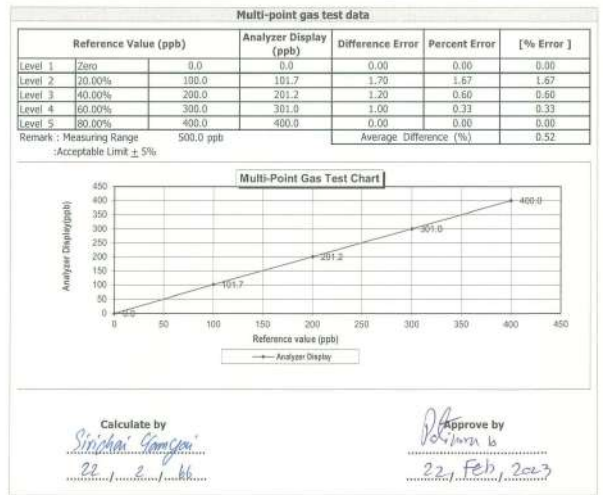
MULTI-POINT GAS TEST REPORT

Test Date : Feb 22, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778107

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071



เอกสารไม่ควบคุม

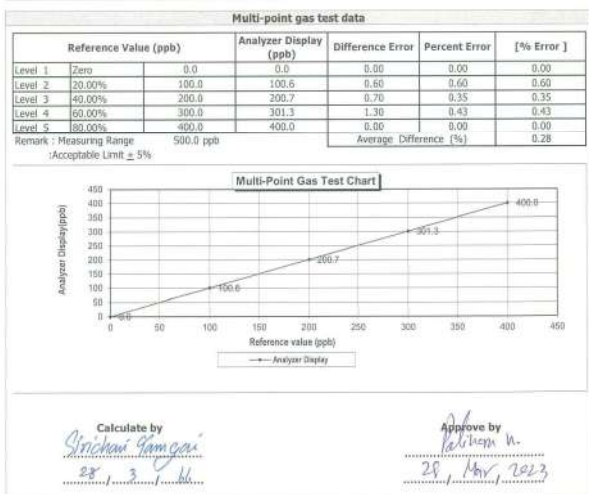
MULTI-POINT GAS TEST REPORT

Test Date : Mar 28, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778108

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071



เอกสารไม่ควบคุม

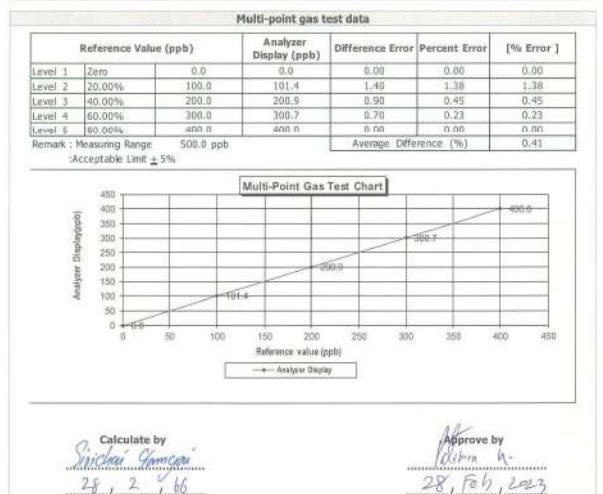
MULTI-POINT GAS TEST REPORT

Test Date : Feb 28, 2023

Equipment : Gas Analyzer (NO₂) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778109

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201778110

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.1	1.10	1.09
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	300.5	0.50	0.17
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb			Average Difference (%)	0.34

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by : Aphinit K.
2, 4, 66

Approve by : Peterson U.
7, Apr, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Mar 28, 2023

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1200636462

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.5	1.50	1.48
Level 3	40.00%	200.0	201.0	1.00	0.50
Level 4	60.00%	300.0	300.9	0.90	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb			Average Difference (%)	0.45

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by : Sirichai Gansai
28, 1, 3, 66

Approve by : Peterson U.
28, Mar, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Jan 24, 2023

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1200636463

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25
Level 4	60.00%	300.0	301.0	1.00	0.33
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb			Average Difference (%)	0.26

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by : Sirichai Gansai
24, 1, 66

Approve by : Peterson U.
24, Jan, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 22, 2023

Equipment : Gas Analyzer (NO_x) Model : 42i
Manufacturer : Thermo Scientific Serial Number : 1201497724

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.0	1.00	0.99
Level 3	40.00%	200.0	200.9	0.90	0.45
Level 4	60.00%	300.0	301.0	1.00	0.33
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb			Average Difference (%)	0.35

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart

Calculate by : Sirichai Gansai
22, 2, 66

Approve by : Peterson U.
22, Feb, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

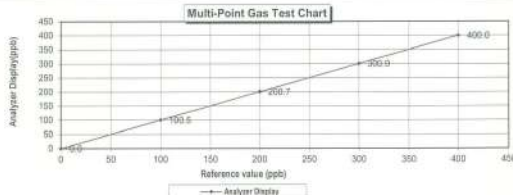
Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201497725

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]	
Level 1	Zero	0.0	0.0	0.00	0.00	0.00	
Level 2	20.00%	100.0	100.5	0.50	0.50	0.50	
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35	
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30	
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00	
Remark : Measuring Range			500.0 ppb			Average Difference (%)	0.23



Calculate by

Aphivat K.
24/4/23

Approve by

Pakorn K.
24/4/23

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

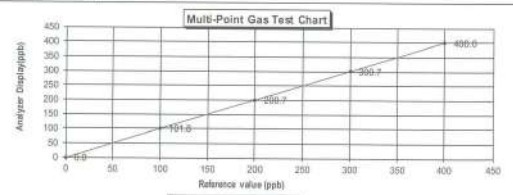
Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201497725

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.8	1.80	1.77	1.77
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.47



Calculate by

Aphivat K.
24/4/23

Approve by

Pakorn K.
24/4/23

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 13, 2023

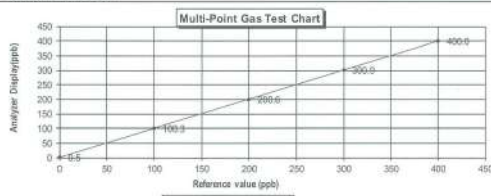
Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201778105

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 1461
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.5	0.50	0.50	0.50
Level 2	20.00%	100.0	100.3	0.30	0.30	0.30
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.28



Calculate by

Aphivat K.
13/02/23

Approve by

Pakorn K.
13/02/23

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 650
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	$\pm 1.0\%$ NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	06/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CCT08068	49.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12385	D689025	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 20, 2020
GMS	401423838102	CC605051	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14600119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.8\%$	Nov 15, 2025

The SRM, PRM or GQM noted above is only in reference to the GMS used in the assay and not part of the analysis.

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002607
GROSS WT: 28.40kg
NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Electron Corporation Serial Number : 43C-0607415779

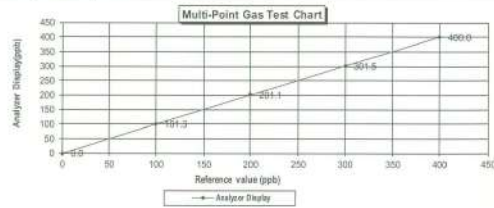
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	101.3	1.30	1.28
Level 3 40.00%	200.0	201.1	1.10	0.55
Level 4 60.00%	300.0	301.5	1.50	0.50
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.47	

Acceptable Limit $\pm 5\%$



Calculate by
Aphiwat K.
3, 5, 66

Approve by
Pichon W.
3, May, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Electron Corporation Serial Number : 43C-0611116459

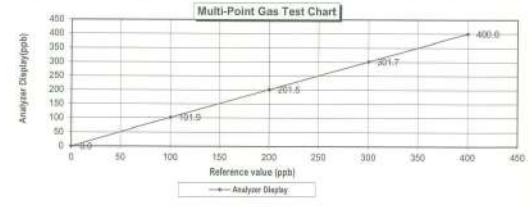
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	101.9	1.90	1.86
Level 3 40.00%	200.0	201.5	1.50	0.74
Level 4 60.00%	300.0	301.7	1.70	0.56
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.63	

Acceptable Limit $\pm 5\%$



Calculate by
Aphiwat K.
2, 4, 66

Approve by
Pichon W.
7, Apr, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : May 3, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Environmental Instruments Serial Number : 43C-62236-334

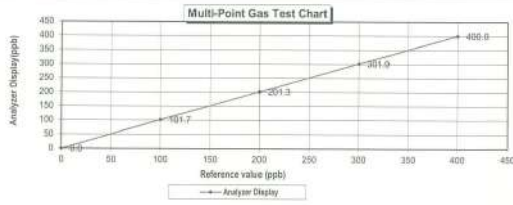
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	101.7	1.70	1.67
Level 3 40.00%	200.0	201.3	1.30	0.65
Level 4 60.00%	300.0	301.9	1.90	0.63
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.59	

Acceptable Limit $\pm 5\%$



Calculate by
Aphiwat K.
3, 5, 66

Approve by
Pichon W.
3, May, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 25, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Environmental Instruments Serial Number : 43C-76465-383

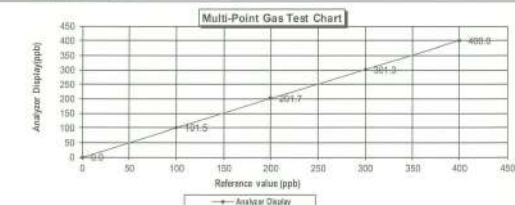
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1 Zero	0.0	0.00	0.00	0.00
Level 2 20.00%	100.0	101.5	1.50	1.48
Level 3 40.00%	200.0	201.7	1.70	0.84
Level 4 60.00%	300.0	301.3	1.30	0.43
Level 5 80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.55	

Acceptable Limit $\pm 5\%$



Calculate by
Aphiwat K.
25, 4, 66

Approve by
Pichon W.
25, Apr, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Environmental Instruments Serial Number : 43C-65007-345

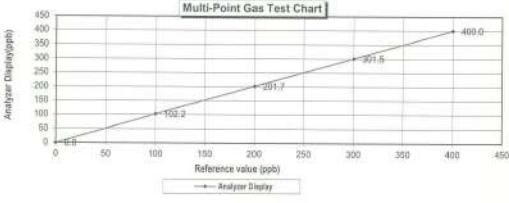
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	102.2	2.20	2.15
Level 3	40.00%	200.0	201.7	1.70	0.84
Level 4	60.00%	300.0	301.5	1.50	0.50
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.70
:Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart



Calculate by Aphiwat K. 7, 4, 2023
Approve by Pichon N. 7, Apr, 2023

MULTI-POINT GAS TEST REPORT

Test Date : Apr 4, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Electron Corporation Serial Number : 0517512002

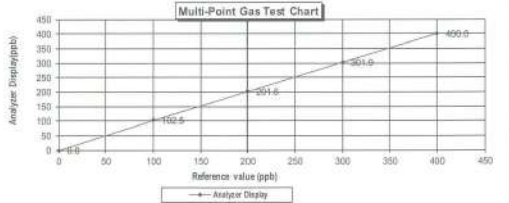
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	102.5	2.50	2.44
Level 3	40.00%	200.0	201.6	1.60	0.79
Level 4	60.00%	300.0	301.9	1.90	0.63
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.77
:Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart



Calculate by Aphiwat K. 4, 4, 2023
Approve by Pichon N. 4, Apr, 2023

MULTI-POINT GAS TEST REPORT

Test Date : Apr 19, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo Electron Corporation Serial Number : 0517512003

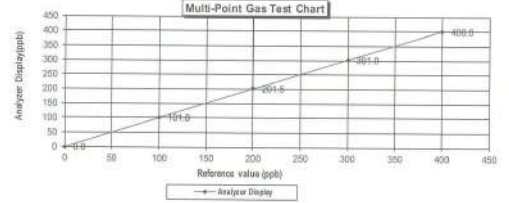
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.6	1.60	1.77
Level 3	40.00%	200.0	201.5	1.50	0.74
Level 4	60.00%	300.0	301.9	1.90	0.63
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.63
:Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart



Calculate by Aphiwat K. 19, 4, 2023
Approve by Pichon N. 19, Apr, 2023

MULTI-POINT GAS TEST REPORT

Test Date : Jan 17, 2023

Equipment : Gas Analyzer (SO₂) Model : 43C
Manufacturer : Thermo SCIENTIFIC Serial Number : CH22387061

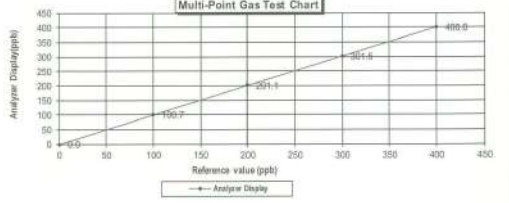
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	109.7	9.70	0.76
Level 3	40.00%	200.0	201.1	1.10	0.55
Level 4	60.00%	300.0	301.5	1.50	0.50
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.35
:Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart



Calculate by Pichon N. 17, 1, 2023
Approve by Pichon N. 17, Jan, 2023

MULTI-POINT GAS TEST REPORT

Test Date : Mar 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387062

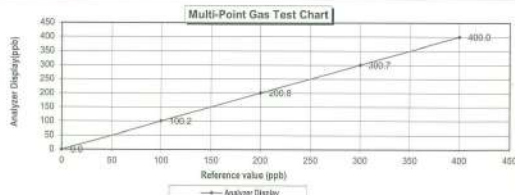
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.2	0.20	0.20
Level 3	40.00%	200.0	200.8	0.40	0.40
Level 4	60.00%	300.0	300.7	0.70	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.17	

Acceptable Limit $\pm 5\%$



Calculate by
Aphivat K.
7, 3, 2023

Approve by
P. N. N.
7, Mar 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387063

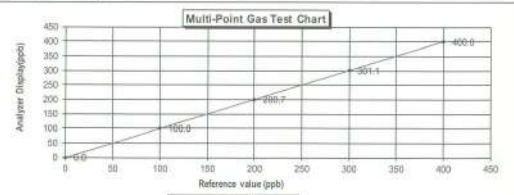
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.8	0.80	0.79
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	301.1	1.10	0.37
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.30	

Acceptable Limit $\pm 5\%$



Calculate by
Aphivat K.
7, 4, 2023

Approve by
P. N. N.
7, Apr 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 14, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387064

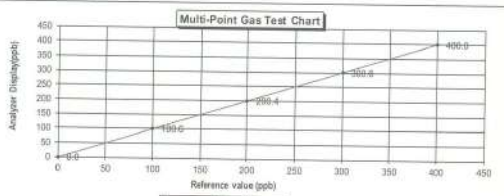
Standard Gas Concentration
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 24, 2024

Dilutor Detail
Manufacturer : Thermo SCIENTIFIC
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.5	0.50	0.60
Level 3	40.00%	200.0	200.4	0.40	0.20
Level 4	60.00%	300.0	300.6	0.60	0.20
Level 5	80.00%	400.0	400.0	0.00	0.00
Remark : Measuring Range	500.0 ppb		Average Difference (%)	0.20	

Acceptable Limit $\pm 5\%$



Calculate by
Srinuan Sangmanee
14, 2, 2023

Approve by
P. N. N.
14, Feb 2023

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 650
Gas Code: CO, NO, NOX, SO₂, BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	$\pm 1.0\%$ NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	06/14/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12388	D689025	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 20, 2020
GMS	40142383102	CC605051	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14600119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.8\%$	Nov 15, 2025

The SRM, PRM or GMS noted above is only in reference to the GMS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO ₂	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002607
GROSS WT: 28.40kg
NET WT: 4.73kg



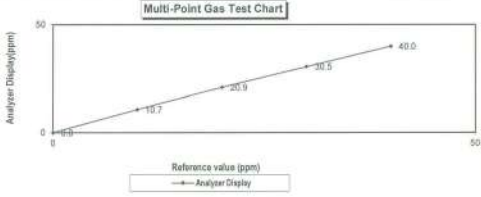
The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Approved for Release



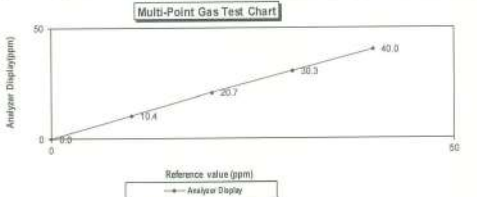
CERT 3082.01

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT					
Test Date : Jan 18, 2023					
Equipment : Gas Analyzer (CO)		Model : 48i			
Manufacturer : Thermo Scientific		Serial Number : CM08140003			
Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	146i	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 20, 2024				
Multi-point gas test data					
Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]	
Level 1 Zero	0.0	0.0	0.0	0.0	
Level 2 20.00%	10.0	10.7	0.7	6.5	
Level 3 40.00%	20.0	20.9	0.9	4.3	
Level 4 60.00%	30.0	30.5	0.5	1.6	
Level 5 80.00%	40.0	40.0	0.0	0.0	
Remark : Measuring Range 50.0 ppm		Average Difference (%)		2.50	
Acceptable Limit $\pm 5\%$					
					
Calculate by Aphivat			Approve by Pichana N.		
18 / 01 / 66			19 Jan, 2023		

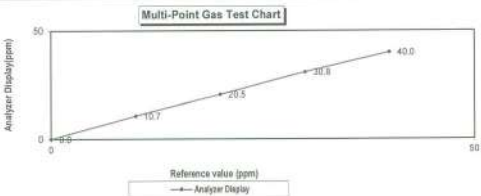
Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT					
Test Date : Feb 21, 2023					
Equipment : Gas Analyzer (CO)		Model : 48i			
Manufacturer : Thermo Scientific		Serial Number : 1180540068			
Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	146i	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 20, 2024				
Multi-point gas test data					
Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]	
Level 1 Zero	0.0	0.0	0.0	0.0	
Level 2 20.00%	10.0	10.4	0.4	3.8	
Level 3 40.00%	20.0	20.7	0.7	3.4	
Level 4 60.00%	30.0	30.3	0.3	1.0	
Level 5 80.00%	40.0	40.0	0.0	0.0	
Remark : Measuring Range 50.0 ppm		Average Difference (%)		1.64	
Acceptable Limit $\pm 5\%$					
					
Calculate by Aphivat			Approve by Pichana N.		
21 / 02 / 66			22 Feb, 2023		

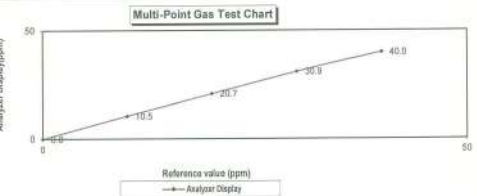
Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT					
Test Date : Mar 14, 2023					
Equipment : Gas Analyzer (CO)		Model : 48i			
Manufacturer : Thermo Scientific		Serial Number : 1180540069			
Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	146i	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 20, 2024				
Multi-point gas test data					
Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]	
Level 1 Zero	0.0	0.0	0.0	0.0	
Level 2 20.00%	10.0	10.7	0.7	6.5	
Level 3 40.00%	20.0	20.5	0.5	2.4	
Level 4 60.00%	30.0	30.8	0.8	2.6	
Level 5 80.00%	40.0	40.0	0.0	0.0	
Remark : Measuring Range 50.0 ppm		Average Difference (%)		2.32	
Acceptable Limit $\pm 5\%$					
					
Calculate by Aphivat			Approve by Pichana N.		
14 / 03 / 66			14 Mar, 2023		

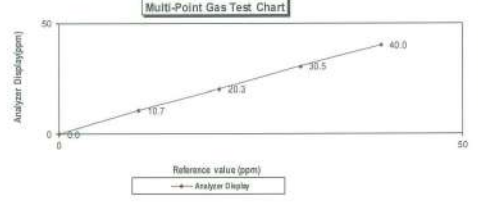
Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT					
Test Date : Mar 14, 2023					
Equipment : Gas Analyzer (CO)		Model : APMA-370			
Manufacturer : HORIBA		Serial Number : YH43AG7T			
Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	146i	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 20, 2024				
Multi-point gas test data					
Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]	
Level 1 Zero	0.0	0.0	0.0	0.0	
Level 2 20.00%	10.0	10.5	0.5	4.8	
Level 3 40.00%	20.0	20.7	0.7	3.4	
Level 4 60.00%	30.0	30.9	0.9	2.9	
Level 5 80.00%	40.0	40.0	0.0	0.0	
Remark : Measuring Range 50.0 ppm		Average Difference (%)		2.21	
Acceptable Limit $\pm 5\%$					
					
Calculate by Aphivat			Approve by Pichana N.		
14 / 03 / 66			14 Mar, 2023		

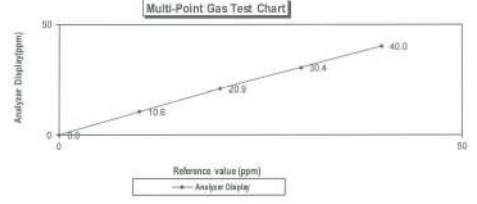
Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT					
Test Date : Feb 8, 2023					
Equipment : Gas Analyzer (CO)		Model : APMA-370			
Manufacturer : HORIBA		Serial Number : YRLHTB7G			
Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	1461	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 20, 2024				
Multi-point gas test data					
Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]	
Level 1 Zero	0.0	0.0	0.0	0.0	
Level 2 20.00%	10.0	10.7	0.7	6.5	
Level 3 40.00%	20.0	20.3	0.3	1.5	
Level 4 60.00%	30.0	30.5	0.5	1.6	
Level 5 80.00%	40.0	40.0	0.0	0.0	
Remark : Measuring Range 50.0 ppm		Average Difference (%)		1.93	
Acceptable Limit $\pm 5\%$					
					
Calculate by Aphiwat			Approve by Patum N		
8, 02, 2023			8, Feb 2023		

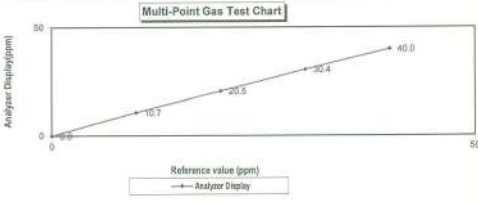
Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT					
Test Date : Feb 8, 2023					
Equipment : Gas Analyzer (CO)		Model : 48C			
Manufacturer : Thermo Environmental Instruments		Serial Number : 48C-65506-348			
Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	1461	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 20, 2024				
Multi-point gas test data					
Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]	
Level 1 Zero	0.0	0.0	0.0	0.0	
Level 2 20.00%	10.0	10.6	0.6	5.7	
Level 3 40.00%	20.0	20.9	0.9	4.3	
Level 4 60.00%	30.0	30.4	0.4	1.3	
Level 5 80.00%	40.0	40.0	0.0	0.0	
Remark : Measuring Range 50.0 ppm		Average Difference (%)		2.26	
Acceptable Limit $\pm 5\%$					
					
Calculate by Aphiwat			Approve by Patum N		
8, 02, 2023			8, Feb 2023		

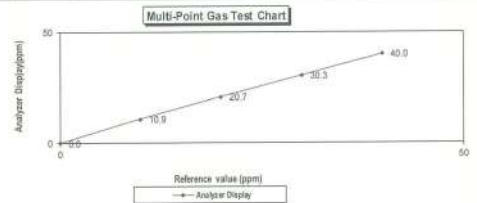
Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT					
Test Date : Feb 8, 2023					
Equipment : Gas Analyzer (CO)		Model : 48i			
Manufacturer : Thermo Scientific		Serial Number : CH08140004			
Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	1461	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 20, 2024				
Multi-point gas test data					
Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]	
Level 1 Zero	0.0	0.0	0.0	0.0	
Level 2 20.00%	10.0	10.7	0.7	6.5	
Level 3 40.00%	20.0	20.5	0.5	2.4	
Level 4 60.00%	30.0	30.4	0.4	1.3	
Level 5 80.00%	40.0	40.0	0.0	0.0	
Remark : Measuring Range 50.0 ppm		Average Difference (%)		2.06	
Acceptable Limit $\pm 5\%$					
					
Calculate by Aphiwat			Approve by Patum N		
8, 02, 2023			8, Feb 2023		

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT					
Test Date : Mar 20, 2023					
Equipment : Gas Analyzer (CO)		Model : 48i			
Manufacturer : Thermo Scientific		Serial Number : 1182920018			
Standard Gas Concentration			Dilutor Detail		
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific	
Nitric Oxide (NO)	45.94	PPM	Model :	1461	
Methane (CH ₄)	-	PPM	Serial Number :	1180540071	
Carbon Monoxide (CO)	984.8	PPM			
Cylinder No. :	EB0143262				
Expiration Date :	Jun 20, 2024				
Multi-point gas test data					
Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]	
Level 1 Zero	0.0	0.0	0.0	0.0	
Level 2 20.00%	10.0	10.9	0.9	8.3	
Level 3 40.00%	20.0	20.7	0.7	3.4	
Level 4 60.00%	30.0	30.3	0.3	1.0	
Level 5 80.00%	40.0	40.0	0.0	0.0	
Remark : Measuring Range 50.0 ppm		Average Difference (%)		2.53	
Acceptable Limit $\pm 5\%$					
					
Calculate by Aphiwat			Approve by Patum N		
20, 03, 2023			20, Mar 2023		

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 3, 2023

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1182920019

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	0.7	6.5
Level 3	40.00%	20.0	20.2	0.2	1.0
Level 4	60.00%	30.0	30.5	0.5	1.6
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range : 50.0 ppm			Average Difference (%) : 1.83		
Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart

Calculate by Aphivat 3 Apr 2023

Approve by Pichan N. 6 Apr 2023

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 21, 2023

Equipment : Gas Analyzer (CO) Model : 48i
Manufacturer : Thermo Scientific Serial Number : 1182920020

Standard Gas Concentration
Sulphur Dioxide (SO₂) : 44.68 PPM
Nitric Oxide (NO) : 45.94 PPM
Methane (CH₄) : - PPM
Carbon Monoxide (CO) : 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.9	0.9	8.3
Level 3	40.00%	20.0	20.5	0.5	2.4
Level 4	60.00%	30.0	30.7	0.7	2.3
Level 5	80.00%	40.0	40.0	0.0	0.0
Remark : Measuring Range : 50.0 ppm			Average Difference (%) : 2.60		
Acceptable Limit $\pm 5\%$					

Multi-Point Gas Test Chart

Calculate by Aphivat 31 Oct 2022

Approve by Pichan N. 22 Feb 2023

Page 1 of 1

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EB0143262
Laboratory: 124 - Durham (SAP) - NC Cylinder Volume: 144.4 CF
PGVP Number: B22021 Valve Outlet: 2015 PSIG
Gas Code: CO,NO,NOX,SO₂,BALN Certification Date: Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	$\pm 1.4\%$ NIST Traceable	09/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	09/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.88 PPM	G1	$\pm 1.0\%$ NIST Traceable	09/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	09/14/2021
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CCT08068	49.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12388	D689025	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 20, 2020
GMS	401423838102	CC605051	4.348 PPM NITROGEN DIOXIDE/NITROGEN	± 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14060119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.8\%$	Nov 15, 2025
The SRM, PRM or RQM noted above is only in reference to the GMS used in the assay and not part of the analysis.					
ANALYTICAL EQUIPMENT					
Instrument/Make/Model	Analytical Principle		Last Multipoint Calibration		
Nicolet 6700 AHR0801333 CO	FTIR		Jun 03, 2021		
Nicolet 6700 AHR0801333 NO	FTIR		Jun 03, 2021		
Nicolet 6700 AHR0801333 NO2	FTIR		Jun 03, 2021		
Nicolet 6700 AHR0801333 SO2	FTIR		Jun 03, 2021		

Triad Data Available Upon Request

NOTES: PO #5221002607
GROSS WT: 28.40kg
NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This includes the test report.

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

Page 1 of 1

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Jan 25, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : VUPVTC21

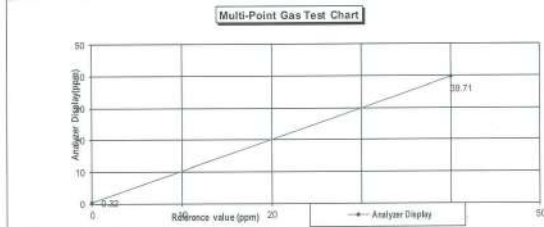
Standard Gas Concentration
Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.32	0.32	0.32	0.32
Level 2	80.00%	40.00	39.71	-0.29	-0.73
Remark	Measuring Range	50.00 ppm	Average Difference (%)	-0.53	0.53

Acceptable Limit $\pm 5\%$



Calculate by
Apawat N.
25, Jan, 2023

Approve by
Pattana N.
26, Jan, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : PDXEGKF7

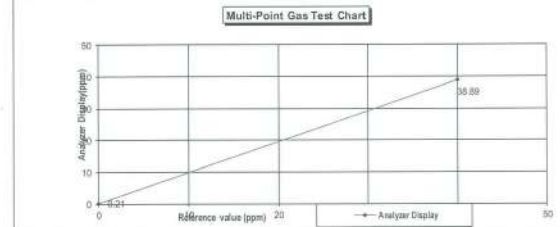
Standard Gas Concentration
Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.21	0.21	0.21	0.21
Level 2	80.00%	40.00	38.89	-1.11	-2.85
Remark	Measuring Range	50.00 ppm	Average Difference (%)	-1.53	1.53

Acceptable Limit $\pm 5\%$



Calculate by
Apawat N.
8, Feb, 2023

Approve by
Pattana N.
8, Feb, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Jan 25, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : SSGEYB3

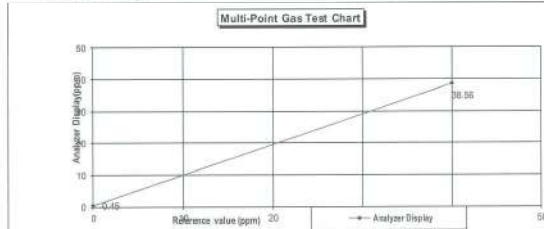
Standard Gas Concentration
Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.45	0.45	0.45	0.45
Level 2	80.00%	40.00	38.56	-1.44	-3.73
Remark	Measuring Range	50.00 ppm	Average Difference (%)	-2.09	2.09

Acceptable Limit $\pm 5\%$



Calculate by
Apawat N.
25, Jan, 2023

Approve by
Pattana N.
26, Jan, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : VV2FY3R3

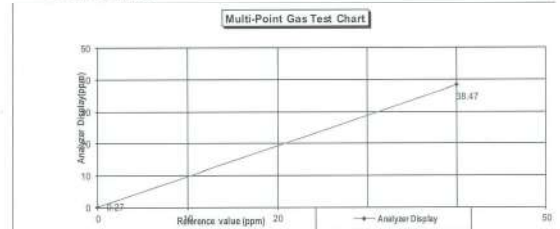
Standard Gas Concentration
Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Level	Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.27	0.27	0.27	0.27
Level 2	80.00%	40.00	38.47	-1.53	-3.98
Remark	Measuring Range	50.00 ppm	Average Difference (%)	-2.12	2.12

Acceptable Limit $\pm 5\%$



Calculate by
Apawat N.
8, Feb, 2023

Approve by
Pattana N.
8, Feb, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 20, 2023

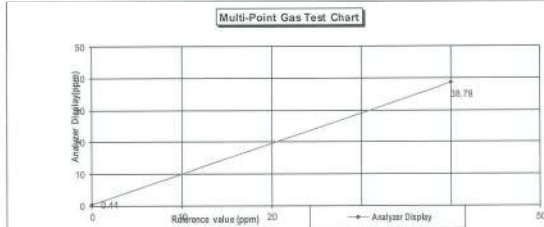
Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : T4FG19AN

Standard Gas Concentration
Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.44	0.44	0.44	0.44
Level 2	80.00%	40.00	38.79	-1.21	-3.12	3.12
Remark : Measuring Range			50.00 ppm	Average Difference (%)		1.78
Acceptable Limit $\pm 5\%$						



Calculate by
Apawat n.
20, 2, 66

Approve by
Pattana n.
20, Feb, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Jan 25, 2023

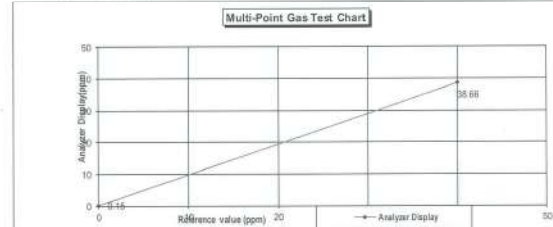
Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : HAMEHUSM

Standard Gas Concentration
Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.15	0.15	0.15	0.15
Level 2	80.00%	40.00	38.66	-1.34	-3.47	3.47
Remark : Measuring Range			50.00 ppm	Average Difference (%)		1.61
Acceptable Limit $\pm 5\%$						



Calculate by
Apawat n.
25, 1, 66

Approve by
Pattana n.
26, Jan, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

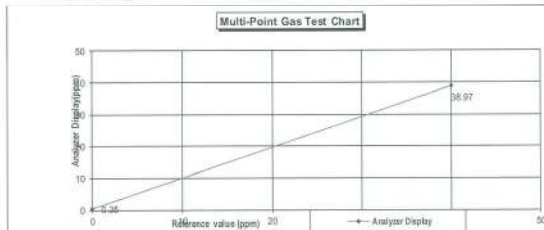
Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : RTHK2PDH

Standard Gas Concentration
Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.35	0.35	0.35	0.35
Level 2	80.00%	40.00	38.97	-1.03	-2.64	2.64
Remark : Measuring Range			50.00 ppm	Average Difference (%)		1.50
Acceptable Limit $\pm 5\%$						



Calculate by
Apawat n.
8, 2, 66

Approve by
Pattana n.
8, Feb, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

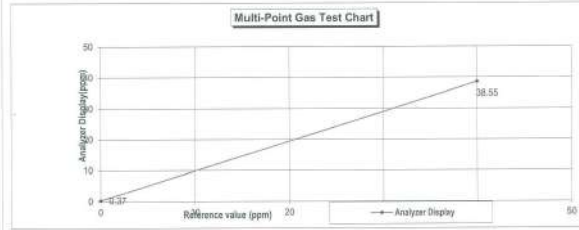
Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : 93JN1MNS

Standard Gas Concentration
Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.37	0.37	0.37	0.37
Level 2	80.00%	40.00	38.55	-1.45	-3.76	3.76
Remark : Measuring Range		50.00 ppm	Average Difference (%)			2.07
:Acceptable Limit ± 5%						



Calculate by
Apawat n.
15, 2, 66

Approve by
Pattana n.
15, Feb, 2023

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Feb 15, 2023

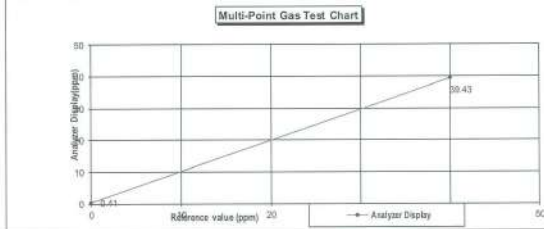
Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : KWWVIR95

Standard Gas Concentration
Sulphur Dioxide (SO₂) : - PPM
Nitric Oxide (NO) : - PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.00	0.41	0.41	0.41	0.41
Level 2	80.00%	40.00	39.43	-0.57	-1.45	1.45
Remark : Measuring Range 50.00 ppm			Average Difference (%)		0.93	
Acceptable Limit $\pm 5\%$						



Calculate by

Apinwat N.
15 Feb 2023

Approve by

Apinwat N.
15 Feb 2023

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

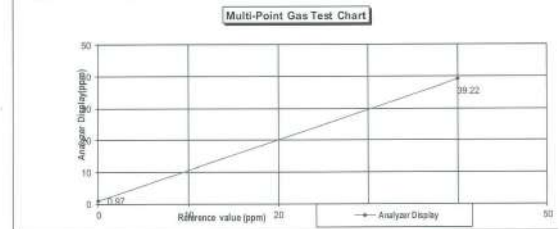
Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : RATFJBXS

Standard Gas Concentration
Sulphur Dioxide (SO₂) : - PPM
Nitric Oxide (NO) : - PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1	Zero	0.00	0.97	0.97	0.97	0.97
Level 2	80.00%	40.00	39.22	-0.78	-1.99	1.99
Remark : Measuring Range 50.00 ppm			Average Difference (%)			1.48
Acceptable Limit $\pm 5\%$						



Calculate by

Apinwat N.
8 Feb 2023

Approve by

Apinwat N.
8 Feb 2023

MULTI-POINT GAS TEST REPORT

Test Date : Feb 20, 2023

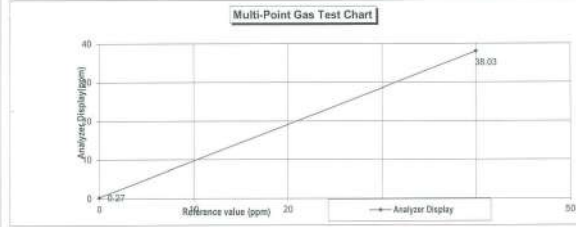
Equipment : Hydrocarbon Analyzer Model : APHA-370
Manufacturer : HORIBA Serial Number : GY21PTED

Standard Gas Concentration
Sulphur Dioxide (SO₂) : - PPM
Nitric Oxide (NO) : - PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : - PPM
Cylinder No. : D824432
Expiration Date : Aug 4, 2028

Dilutor Detail
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.00	0.27	0.27	0.27	0.27
Level 2	80.00%	40.00	38.03	-1.97	-5.18	5.18
Remark : Measuring Range		50.00 ppm	Average Difference (%)			2.73
Acceptable Limit $\pm 5\%$						



Calculate by

Apinwat N.
20 Feb 2023

Approve by

Apinwat N.
20 Feb 2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03A199E15A006C Reference Number: 160-401908379-1
Cylinder Number: CC143232 Cylinder Volume: 144.0 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2016 PSIG
PGVP Number: A12020 Valve Outlet: 590
Gas Code: CH₄, PPN, BALA Certification Date: Oct 16, 2020
Expiration Date: Oct 16, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gasflow Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder Below 100 psig (i.e. 3.7 megapascals).

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
METHANE	4000 PPM	4019 PPM	G1	+/- 1.0% NIST Traceable
PROPANE	4000 PPM	4008 PPM	G1	+/- 0.7% NIST Traceable
AIR	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	02010405	K070090	4876 PPM PROPANE/NITROGEN	+/- 0.6%
NTRM	170608	CC180260	0.997 % METHANE/NITROGEN	+/- 0.4%
ANALYTICAL EQUIPMENT				
Instrument/Make/Model	Analytical Principle			Last Multipoint Calibration
MKS FTIR - CH ₄ - 000928781	FTIR			Oct 14, 2020
Nicelot 6700 APW1100391 C3HB	FTIR			Sep 18, 2020

Triad Data Available Upon Request
NOTES: NET WEIGHTS: 4.865kg
GROSS WEIGHTS: 27.365kg
POW: 5220003825



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok,
Prakanong, Bangkok 10260

Certificate No : 23-ACT-114
Request No : Req-2023-1543

Unit Under Calibration Details

Measurement Item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35
Serial Number : 44783
ID : UAE.EFM.019/2559
Class : I
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details


Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 21 July 2023
Calibration Date : 4 August 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	31 May 2024
THD Multimeter	2015	1047765	NIMT	31 January 2024

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

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

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 4 August 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.
เอกสารไม่ควบคุม

Certificate No : 23-ACT-114
Request No : Req-2023-1543

Sound pressure level		Calibration Results : Without Adjustment				
Calibration Range (dB)		Without Adjustment (dB)		Adjustment (dB)		Acceptance limit
		Measured	Error	Measured	Error	
94 dB / 1000 Hz		94.25	0.25	-	-	0.13
114 dB / 1000 Hz		114.19	0.19	-	-	0.25

Frequency of Sound pressure level		Calibration Results : Without Adjustment				
Calibration Range (Hz)		Without Adjustment (%)		Adjustment (%)		Acceptance limit
		Measured (%)	Error (%)	Measured (%)	Error (%)	
94 dB / 1000 Hz		1000.00	0.00	-	-	0.01
114 dB / 1000 Hz		1000.00	0.00	-	-	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)		Calibration Results : Without Adjustment				
Calibration Range (Hz)		Without Adjustment (%)		Adjustment (%)		Acceptance limit
		Measured (%)	Error (%)	Measured (%)	Error (%)	
94 dB / 1000 Hz		0.04	-	-	-	0.40
114 dB / 1000 Hz		0.02	-	-	-	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Laboratory.
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Calibration Certificate

Certificate Number 2023003659

Customer:
United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number : LxT1
Serial Number : 0007302
Test Results : Pass
Initial Condition : As Manufactured
Description : SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number : D0001.8364
Technician : Jacob Cannon
Calibration Date : 29 Mar 2023
Calibration Due :
Temperature : 23.49 °C ± 0.25 °C
Humidity : 49.6 %RH ± 2.0 %RH
Static Pressure : 96.01 kPa ± 0.13 kPa

Evaluation Method : Tested with:
PCB 377802, S/N 344896
Larson Davis PRLxT1, S/N 077637
Larson Davis CAL291, S/N 01108
Larson Davis CAL200, S/N 8079
Data reported in dB re 20 µPa.

Compliance Standards : Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1
IEC 60804:2000 Type 1
IEC 61262:2002
IEC 61260:2001 Class 1
IEC 61671:2011 Class 1
ANSI S1.4-2014 Class 1
ANSI S1.11 (R2009) Type 1
ANSI S1.25 (R2007)
ANSI S1.4-03 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.
Test points marked with a § in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans or comparators. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 0775.01 Rev O Supporting Firmware Version 4.0.5, 2019-05-10

For 1/2" microphones, the Larson Davis ADP024 1/2" to 1/2" adaptor is used with the calibrator and the Larson Davis ADP043 1/2" to 1/2" adaptor is used with the calibrator.

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D0001.8364 Rev G

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Certificate Number 2023003659

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz, Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-29 reference number PTB-1.72-0304218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014 Part 3, for the environmental conditions under which the tests were performed. An evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014 Part 2, to demonstrate that the model or sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014 Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2023-09-09	2023-09-09	001250
Hart Scientific 2426-II Temperature Probe	2021-08-25	2023-08-25	066796
Larson Davis CAL200 Acoustic Calibrator	2023-07-21	2023-07-21	007037
Larson Davis Model 831	2023-02-23	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007183
SR5 DS600 Ultra Low Distortion Generator	2023-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2023-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-50.14	-52.44	-48.33	0.14	Pass

— End of measurement results —

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.24	-0.20	-1.20	0.80	0.23	Pass
1000	0.15	0.00	-0.70	0.70	0.23	Pass
8000	-2.72	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results —

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Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.86

— End of measurement results—

— End of Report—

Signatory: Jacob Cannon

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D3001.8-06 Rev Q

เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003635

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Suk Edonvok 41, Sukkhumvit Road,
Bangkok, Phra Khwang,
Bangkok, 10260, Thailand

Model Number: LxT1

Serial Number: 0007302

Test Results: Pass

Initial Condition: As Manufactured

Description: SoundTrack LxT Class 1

Class 1 Sound Level Meter

Firmware Revision: 2.404

Procedure Number: D0001.8378

Technician: Jacob Cannon

Calibration Date: 23 Mar 2023

Calibration Due: 23.62 °C ± 0.25 °C

Temperature: 50.3 %RH ± 2.0 %RH

Humidity: 86-12 kPa ± 0.13 kPa

Static Pressure: 86-12 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLX1 SN 077637 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60951:2001 Type 1	ANSI S1.4-2014 Class 1
ANSI S1.4:2006 Type 1	ANSI S1.4 (R2006) Type 1
IEC 60804:2000 Type 1	ANSI S1.26 (R2007)
IEC 61252:2002	ANSI S1.43 (R2007) Type 1
IEC 61672:2013 Class 1	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev D Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

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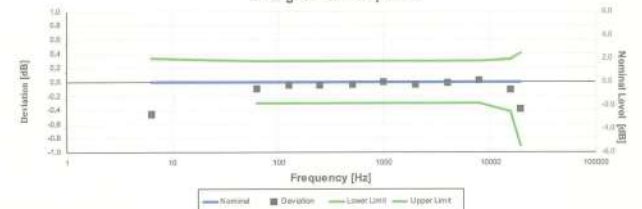


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Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60951:2001 5.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4:1903 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.45	-0.45	-1.11	0.33	0.15	Pass
63.10	-0.09	-0.09	-0.30	0.30	0.15	Pass
125.89	-0.05	-0.05	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.04	-0.04	-0.30	0.30	0.15	Pass
3,981.07	-0.02	-0.02	-0.30	0.30	0.15	Pass
7,943.28	0.02	0.02	-0.30	0.30	0.15	Pass
15,818.99	-0.11	-0.11	-0.42	0.39	0.15	Pass
19,952.62	-0.39	-0.39	-0.91	0.41	0.15	Pass

— End of measurement results—

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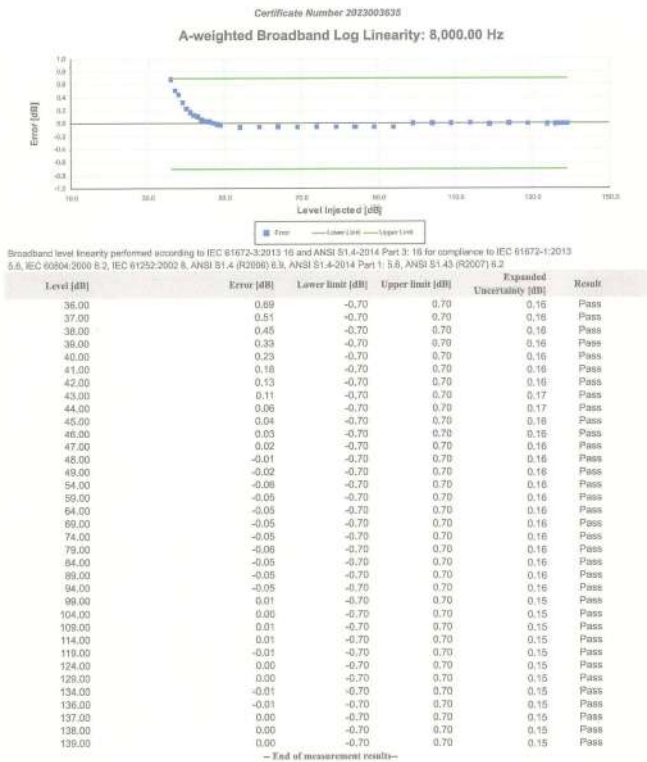
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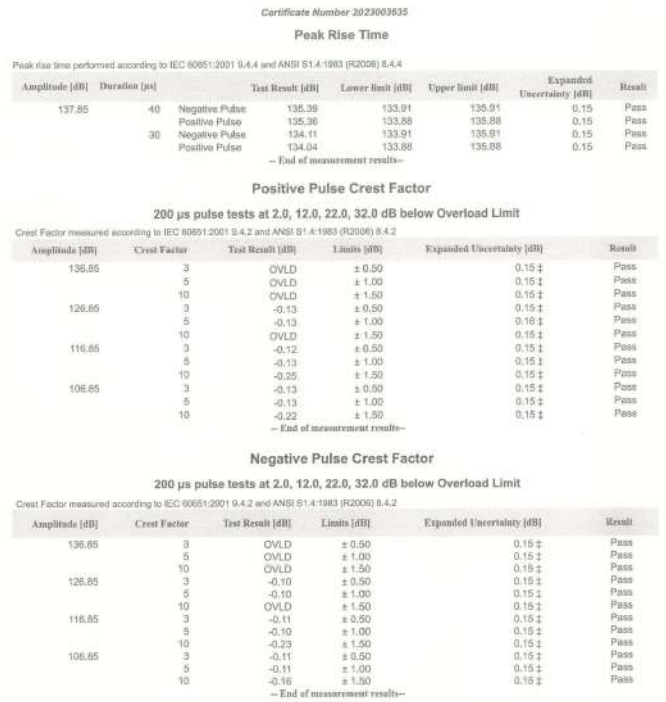
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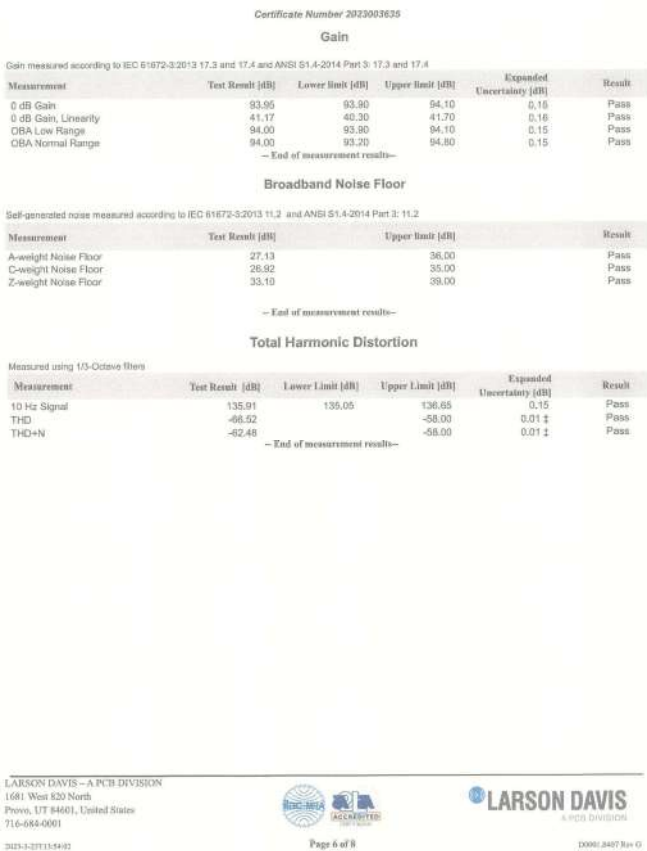
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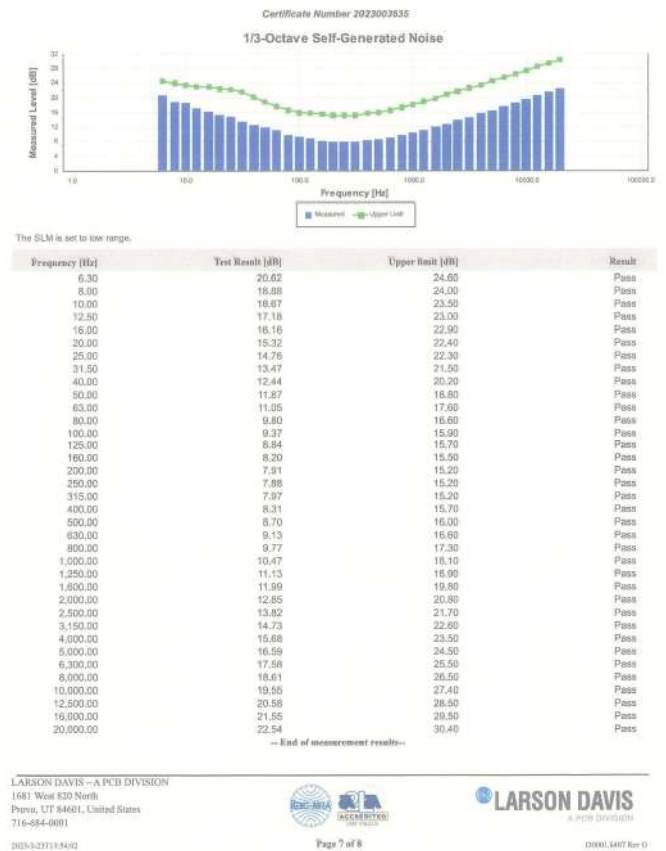
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เอกสารไม่ควบคุม



เอกสารไม่ควบคุม



เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003673

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 11 Sat Udonnuek 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LxT1

Serial Number 0507310

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 1
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number

D0001.8384

Technician Jacob Cannon

Calibration Date 24 Mar 2023

Calibration Due

Temperature 23.47 °C ± 0.25 °C

Humidity 50.9 %RH ± 2.0 %RH

Static Pressure 85.89 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis PPMxLxT1, S/N 077645

PCB 377B02, S/N 345240

Larson Davis CAL200, S/N 9079

Larson Davis CAL291, S/N 0108

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 80651:2001 Type 1

IEC 60904:2000 Type 1

IEC 61252:2002

IEC 61260:2001 Class 1

IEC 61672:2013 Class 1

ANSI S1.4-2014 Class 1

ANSI S1.4 (R2006) Type 1

ANSI S1.11 (R2009) Class 1

ANSI S1.25 (R2007)

ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to comply. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, 1770.01 Rev O Supporting Firmware Version 4.0.5, 2019-02-10

For 1/4" microphones, the Larson Davis ADP624 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP943 1/4" to

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2023-3-24T09:59:13



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— End of Report—

Signature: Jacob Cannon

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2023-3-24T13:54:02



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D0001.8407 Rev G

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Certificate Number 2023003673

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz, Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034219.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, it demonstrates that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001230
Hart Scientific 2626-II Temperature Probe	2021-08-25	2023-05-31	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007827
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB00004703

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-50.12	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.6; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.19	-0.20	-1.20	0.80	0.23	Pass
1000	0.14	0.00	-0.70	0.70	0.23	Pass
8000	-3.64	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

— End of Report—

Signature: Jacob Cannon

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Certificate Number 2023003673

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.34

— End of measurement results—

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Calibration Certificate

Certificate Number 2023003658

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number

LXT1

Serial Number

0007310

Test Results

Pass

Initial Condition

As Manufactured

Description

SoundTrack LxT Class 1

Class 1 Sound Level Meter

Firmware Revision: 2.404

Procedure Number

D0001.8378

Technician

Jacob Cannon

Calibration Date

23 Mar 2023

Calibration Due

23 Mar 2024

Temperature

23.83 °C ± 0.25 °C

Humidity

49.6 %RH ± 2.0 %RH

Static Pressure

86.01 kPa ± 0.13 kPa

Evaluation Method

Tested electrically using Larson Davis PRLxT1 S/N 877645 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60951:2001 Type 1

ANSI S1.4-2014 Class 1

IEC 60804:2000 Type 1

ANSI S1.4 (R2006) Type 1

IEC 61252:2002

ANSI S1.26 (R2007)

IEC 61672:2013 Class 1

ANSI S1.43 (R2007) Type 1

IEC 61260:2001 Class 1

ANSI S1.11 (R2006) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to: the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a † in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the irreducibility of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty of approximately 95% confidence level.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev Q Supporting Firmware Version 4.2.5, 2010-05-10

Calibration Check Frequency: 1000 Hz; Reference: Sound Pressure Level: 114 dB re 20 µPa

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-II Temperature Probe	2021-06-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-09-02	2023-09-02	007167

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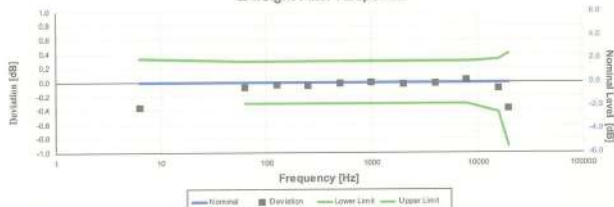


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Certificate Number 2023003658

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5, IEC 60951:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4-1985 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 6.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.36	-0.36	-1.11	0.33	0.15	Pass
63.10	-0.07	-0.07	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.01	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19,952.82	-0.38	-0.38	-0.91	0.41	0.15	Pass

— End of measurement results —

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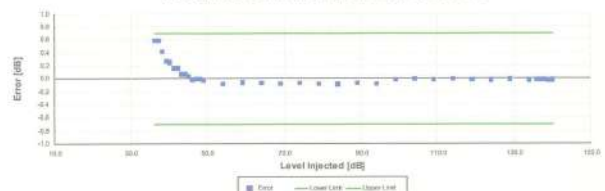


D0001.8407 Rev G

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Certificate Number 2023003658

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.5, IEC 60804:2000 6.2, IEC 61252:2002 8; ANSI S1.4 (R2006) 5.9; ANSI S1.4-2014 Part 1: 5.6; ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.59	-0.70	0.70	0.16	Pass
37.00	0.58	-0.70	0.70	0.16	Pass
38.00	0.41	-0.70	0.70	0.16	Pass
39.00	0.27	-0.70	0.70	0.16	Pass
40.00	0.25	-0.70	0.70	0.16	Pass
41.00	0.16	-0.70	0.70	0.16	Pass
42.00	0.16	-0.70	0.70	0.16	Pass
43.00	0.07	-0.70	0.70	0.17	Pass
44.00	0.07	-0.70	0.70	0.17	Pass
45.00	0.04	-0.70	0.70	0.18	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	0.00	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.03	-0.70	0.70	0.16	Pass
50.00	-0.08	-0.70	0.70	0.16	Pass
51.00	-0.06	-0.70	0.70	0.16	Pass
52.00	-0.07	-0.70	0.70	0.16	Pass
53.00	-0.08	-0.70	0.70	0.16	Pass
54.00	-0.07	-0.70	0.70	0.16	Pass
55.00	-0.08	-0.70	0.70	0.16	Pass
56.00	-0.09	-0.70	0.70	0.16	Pass
57.00	-0.07	-0.70	0.70	0.16	Pass
58.00	-0.08	-0.70	0.70	0.16	Pass
59.00	-0.01	-0.70	0.70	0.15	Pass
60.00	-0.01	-0.70	0.70	0.15	Pass
61.00	-0.02	-0.70	0.70	0.15	Pass
62.00	-0.00	-0.70	0.70	0.15	Pass
63.00	-0.01	-0.70	0.70	0.15	Pass
64.00	-0.02	-0.70	0.70	0.15	Pass
65.00	-0.02	-0.70	0.70	0.15	Pass
66.00	-0.01	-0.70	0.70	0.15	Pass
67.00	-0.01	-0.70	0.70	0.15	Pass
68.00	-0.01	-0.70	0.70	0.15	Pass
69.00	-0.03	-0.70	0.70	0.15	Pass
70.00	-0.02	-0.70	0.70	0.15	Pass

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4-1983 (R2006) 9.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.01	133.55	0.15	Pass
		Positive Pulse	135.00	135.52	0.15	Pass
		Negative Pulse	134.07	133.55	0.15	Pass
130	30	Negative Pulse	134.07	133.52	0.15	Pass
		Positive Pulse	134.07	133.52	0.15	Pass
		Negative Pulse	134.07	133.52	0.15	Pass

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4-1983 (R2006) 9.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15	Pass
	5	OVLD	± 1.00	0.15	Pass
	10	OVLD	± 1.50	0.15	Pass
126.85	3	-0.13	± 0.50	0.15	Pass
	5	-0.14	± 1.00	0.15	Pass
	10	OVLD	± 1.50	0.15	Pass
116.85	3	-0.12	± 0.50	0.15	Pass
	5	-0.14	± 1.00	0.15	Pass
	10	-0.26	± 1.50	0.15	Pass
106.85	3	-0.13	± 0.50	0.15	Pass
	5	-0.11	± 1.00	0.15	Pass
	10	-0.25	± 1.50	0.15	Pass

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4-1983 (R2006) 9.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15	Pass
	5	OVLD	± 1.00	0.15	Pass
	10	OVLD	± 1.50	0.15	Pass
126.85	3	-0.11	± 0.50	0.15	Pass
	5	-0.11	± 1.00	0.15	Pass
	10	OVLD	± 1.50	0.15	Pass
116.85	3	-0.11	± 0.50	0.15	Pass
	5	-0.10	± 1.00	0.15	Pass
	10	-0.23	± 1.50	0.15	Pass
106.85	3	-0.11	± 0.50	0.15	Pass
	5	-0.12	± 1.00	0.15	Pass
	10	-0.24	± 1.50	0.15	Pass



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Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	63.95	63.90	64.10	0.15	Pass
0 dB Gain, Linearity	41.14	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.99	36.00	Pass
C-weight Noise Floor	26.68	35.00	Pass
Z-weight Noise Floor	32.81	39.00	Pass

Total Harmonic Distortion

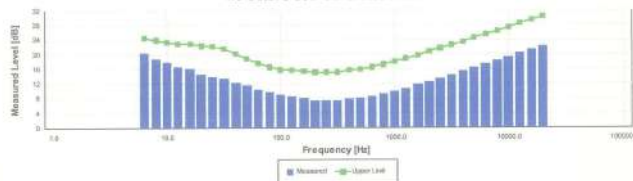
Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.55	135.05	136.65	0.16	Pass
THD	-66.81	-68.00	-65.00	0.01	Pass
THD+N	-62.76	-68.00	-58.00	0.01	Pass



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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
8.30	20.34	24.60	Pass
8.80	18.79	24.00	Pass
10.00	17.87	23.50	Pass
12.50	16.87	23.00	Pass
16.00	16.25	22.90	Pass
20.00	14.64	22.40	Pass
25.00	13.96	22.30	Pass
31.50	13.39	21.90	Pass
40.00	12.35	20.20	Pass
50.00	11.55	18.80	Pass
63.00	10.50	17.50	Pass
80.00	9.71	16.60	Pass
100.00	9.02	15.90	Pass
125.00	8.51	15.70	Pass
160.00	8.14	15.50	Pass
200.00	7.51	15.20	Pass
250.00	7.42	15.20	Pass
315.00	7.44	15.20	Pass
400.00	7.80	15.70	Pass
500.00	8.14	16.00	Pass
630.00	8.66	16.50	Pass
800.00	9.34	17.30	Pass
1,000.00	10.07	18.10	Pass
1,250.00	10.79	18.90	Pass
1,600.00	11.74	19.80	Pass
2,000.00	12.59	20.80	Pass
2,500.00	13.50	21.70	Pass
3,150.00	14.46	22.60	Pass
4,000.00	15.43	23.50	Pass
5,000.00	16.41	24.50	Pass
6,300.00	17.40	25.50	Pass
8,000.00	18.39	26.50	Pass
10,000.00	19.37	27.40	Pass
12,500.00	20.41	28.50	Pass
16,000.00	21.38	29.50	Pass
20,000.00	22.35	30.40	Pass

~ End of measurement results ~



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Signature: Jacet Cannon

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Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : LARSON DAVIS
Model : LxT2/ Microphone 375B02 / Preamplifier PRML x T2B
Serial No.: 0005289 / 011732 / 056076
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 18 JANUARY 2022
Calibration Date : 26 JANUARY 2022
Date of Issue : 28 JANUARY 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurui
(Thanakul Petchurui)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Calibration Procedure : CP-AC-02

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

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T. Petchurui

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	✓	-	0.3	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

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T. Petchurui

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
29.6

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

Frequency Weighting	Measured value (dB)
A - weight	29.4
C - weight	29.1
Flat	34.8

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	-0.1	0.2	0.2	± 1.5
1000	-0.2	-0.2	-0.2	± 1.0
8000	2.6	2.6	2.6	±5.0

QF-TS12-04-04-020664

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T. Petchurui

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	-0.1	0.0	±3.0
8000	0.0	0.1	0.0	±5.0
16000	-0.1	0.1	0.1	±5.0 (-∞)

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

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T. Retch.

Cert. No. : ACL22082
Job No. : VC65AC0044
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Cert. No. : ACL22082
Job No. : VC65AC0044
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
140	94.0	94.0	0.0	±0.5

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.8	-0.2	1.5 ; -5.0
	2	8	117.0	116.7	-0.3	1.0 ; -2.5
	200	800	134.0	133.9	-0.1	±1.0
Slow	2	8	108.0	107.8	-0.2	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	N/A	N/A	N/A	1.5 ; 5.0
SEL	2	8	N/A	N/A	N/A	1.0 ; -2.5
	200	800	N/A	N/A	N/A	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.4	0.0	±2.0
Negative half cycle	135.4	135.4	0.0	±2.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Cert. No. : ACL22082
Job No. : VC65AC0044
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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.2	±1.5
89.2	89.4		

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Retch.

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-049
Address : R1 Soi Udomsak 40, Sukhumvit Road, Bangkok, Prakanong, Bangkok. Request No : Req-2022-0629
10260

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : Lx12 Microphone S/N : 329356
Serial Number : 0005394 Preamplifier Model : PKMLA12B
ID : UAEJEM11132562 Preamplifier S/N : 036099
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 March 2022
Calibrated Date : 1 April 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3:2013 Electromagnetics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Scansel	Scansel01	131	10 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadol Luangrat
Calibration Officer

Approved By : 
Mr. Paiton Mathayon
Calibration Engineer Supervisor

Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body. **เอกสารไม่ควบคุม**

Certificate No : 22-ACT-049

Request No : Req-2022-0629

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		Level (dB)	UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)	
FAST / A / 37-139							
Calibrator Setting							
1000 Hz 114.00 dB	113.85	113.8	-0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SYANTEK, Model SY 35A, SN:58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting		
A	24.7	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting		
A	24.1	0.10
C	23.3	0.10
Z	27.8	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST / 37-139					
STD Setting					
125 Hz	0.1	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.4	0.3	0.3	0.60	3.0
8000 Hz	-0.2	-0.3	-0.1	0.70	5.0

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Certificate No : 22-ACT-049

Request No : Req-2022-0629

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST / 37-139					
STD Setting					
63 Hz	-0.1	-0.1	-0.1	0.2	2.0
125 Hz	-0.1	0.0	0.0	0.2	1.5
250 Hz	0.0	0.0	0.0	0.2	1.5
500 Hz	0.0	0.0	0.0	0.2	1.5
1000 Hz	0.0	0.0	0.0	0.2	1.0
2000 Hz	0.0	0.0	0.0	0.2	2.0
4000 Hz	0.0	0.0	0.0	0.2	3.0
8000 Hz	-0.1	-0.1	0.0	0.2	5.0
16000 Hz	-0.1	-0.1	-0.1	0.2	+5, -INF

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	UUC	ERR		
FAST / 37-139						
UUC Weighting						
A	114.00	114.0	0.0	0.2	0.2	0.2
C	114.00	114.1	0.1	0.2	0.2	0.2
Z	114.00	114.1	0.1	0.2	0.2	0.2

UUC Setting	STD	Measured			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	UUC	ERR		
37-139 / A						
UUC Time Response						
Fast	114.00	114.0	0.0	0.1	0.1	0.1
Slow	114.00	114.0	0.0	0.1	0.1	0.1
Log	114.00	114.0	0.0	0.1	0.1	0.1

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Certificate No : 22-ACT-049

Request No : Req-2022-0629

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit
FAST / A / 37-139			
STD Setting			
Initial	114.0		
Final	114.0		
Deviation	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation			UNCERTAINTY	Acceptance Limit
		REF	UUC	ERR		
FAST / A / 37-139		(dB)	(dB)	(dB)	(± dB)	(± dB)
STD dB						
130.00	130	129.0	129.0	0.0	B3	1.1
134.00	134	134.0	134.0	0.0		1.1
139.00	139	139.0	139.0	0.0		1.1
144.00	144	144.0	144.0	0.0		1.1
149.00	149	149.0	149.0	0.0		1.1
154.00	154	154.0	154.0	0.0		1.1
159.00	159	159.0	159.0	0.0		1.1
164.00	164	164.0	164.0	0.0		1.1
169.00	169	169.0	169.0	-0.1		1.1
174.00	174	174.0	174.0	0.0		1.1
179.00	179	179.0	179.0	0.0		1.1
184.00	184	184.0	184.0	0.0		1.1
189.00	189	189.0	189.0	0.0		1.1
194.00	194	194.0	194.0	0.0		1.1
199.00	199	199.0	199.0	0.0		1.1
204.00	204	204.0	204.0	0.0		1.1
209.00	209	209.0	209.0	0.0		1.1
214.00	214	214.0	214.0	0.0		1.1
219.00	219	219.0	219.0	0.0		1.1
224.00	224	224.0	224.0	0.0		1.1
229.00	229	229.0	229.0	0.0	1.1	
234.00	234	234.0	234.0	0.0	1.1	
239.00	239	239.0	239.0	0.0	1.1	
244.00	244	244.0	244.0	0.1	1.1	
249.00	249	249.0	249.0	0.0	1.1	
254.00	254	254.0	254.0	0.0	1.1	
259.00	259	259.0	259.0	0.0	1.1	
264.00	264	264.0	264.0	0.0	1.1	
269.00	269	269.0	269.0	0.0	1.1	
274.00	274	274.0	274.0	0.0	1.1	
279.00	279	279.0	279.0	0.0	1.1	
284.00	284	284.0	284.0	0.0	1.1	
289.00	289	289.0	289.0	0.0	1.1	
294.00	294	294.0	294.0	0.0	1.1	
299.00	299	299.0	299.0	0.0	1.1	
304.00	304	304.0	304.0	0.0	1.1	
309.00	309	309.0	309.0	0.0	1.1	
314.00	314	314.0	314.0	0.0	1.1	
319.00	319	319.0	319.0	0.0	1.1	
324.00	324	324.0	324.0	0.0	1.1	
329.00	329	329.0	329.0	0.0	1.1	
334.00	334	334.0	334.0	0.0	1.1	
339.00	339	339.0	339.0	0.0	1.1	
344.00	344	344.0	344.0	0.0	1.1	
349.00	349	349.0	349.0	0.0	1.1	
354.00	354	354.0	354.0	0.0	1.1	
359.00	359	359.0	359.0	0.0	1.1	
364.00	364	364.0	364.0	0.0	1.1	
369.00	369	369.0	369.0	0.0	1.1	
374.00	374	374.0	374.0	0.0	1.1	
379.00	379	379.0	379.0	0.0	1.1	
384.00	384	384.0	384.0	0.0	1.1	
389.00	389	389.0	389.0	0.0	1.1	
394.00	394	394.0	394.0	0.0	1.1	
399.00	399	399.0	399.0	0.0	1.1	
404.00	404	404.0	404.0	0.0	1.1	
409.00	409	409.0	409.0	0.0	1.1	
414.00	414	414.0	414.0	0.0	1.1	
419.00	419	419.0	419.0	0.0	1.1	
424.00	424	424.0	424.0	0.0	1.1	
429.00	429	429.0	429.0	0.0	1.1	
434.00	434	434.0	434.0	0.0	1.1	
439.00	439	439.0	439.0	0.0	1.1	
444.00	444	444.0	444.0	0.0	1.1	
449.00	449	449.0	449.0	0.0	1.1	
454.00	454	454.0	454.0	0.0	1.1	
459.00	459	459.0	459.0	0.0	1.1	
464.00	464	464.0	464.0	0.0	1.1	
469.00	469	469.0	469.0	0.0	1.1	
474.00	474	474.0	474.0	0.0	1.1	
479.00	479	479.0	479.0	0.0	1.1	
484.00	484	484.0	484.0	0.0	1.1	
489.00	489	489.0	489.0	0.0	1.1	
494.00	494	494.0	494.0	0.0	1.1	
499.00	499	499.0	499.0	0.0	1.1	
504.00	504	504.0	504.0	0.0	1.1	
509.00	509	509.0	509.0	0.0	1.1	
514.00	514	514.0	514.0	0.0	1.1	
519.00	519	519.0	519.0	0.0	1.1	
524.00	524	524.0	524.0	0.0	1.1	
529.00	529	529.0	529.0	0.0	1.1	
534.00	534	534.0	534.0	0.0	1.1	
539.00	539	539.0	539.0	0.0	1.1	
544.00	544	544.0	544.0	0.0	1.1	
549.00	549	549.0	549.0	0.0	1.1	
554.00	554	554.0	554.0	0.0	1.1	
559.00	559	559.0	559.0	0.0	1.1	
564.00	564	564.0	564.0	0.0	1.1	
569.00	569	569.0	569.0	0.0	1.1	
574.00	574	574.0	574.0	0.0	1.1	
579.00	579	579.0	579.0	0.0	1.1	
584.00	584	584.0	584.0	0.0	1.1	
589.00	589	589.0	589.0	0.0	1.1	
594.00	594	594.0	594.0	0.0	1.1	
599.00	599	599.0	599.0	0.0	1.1	
604.00	604	604.0	604.0	0.0	1.1	
609.00	609	609.0	609.0	0.0	1.1	
614.00	614	614.0	614.0	0.0	1.1	
619.00	619	619.0	619.0	0.0	1.1	
624.00	624	624.0	624.0	0.0	1.1	
629.00	629	629.0	629.0	0.0	1.1	
634.00	634	634.0	634.0	0.0	1.1	
639.00	639	639.0	639.0	0.0	1.1	
644.00	644	644.0	644.0	0.0	1.1	
649.00	649	649.0	649.0	0.0	1.1	
654.00	654	654.0	654.0	0.0	1.1	
659.00	659	659.0	659.0	0.0	1.1	
664.00	664	664.0	664.0	0.0	1.1	
669.00	669	669.0	669.0	0.0	1.1	
674.00	674	674.0	674.0	0.0	1.1	
679.00	679	679.0	679.0	0.0	1.1	
684.00	684	684.0	684.0	0.0	1.1	
689.00	689	689.0	689.0	0.0	1.1	
694.00	694	694.0	694.0	0.0	1.1	
699.00	699	699.0	699.0	0.0	1.1	
704.00	704	704.0	704.0	0.0	1.1	
709.00	709	709.0	709.0	0.0	1.1	
714.00	714	714.0	714.0	0.0	1.1	
719.00	719	719.0	719.0	0.0	1.1	
724.00	724	724.0	724.0	0.0	1.1	
729.00	729	729.0	729.0	0.0	1.1	
734.00	734	734.0	734.0	0.0	1.1	
739.00	739	739.0	739.0	0.0	1.1	
744.00	744	744.0	744.0	0.0	1.1	
749.00	749	749.0	749.0	0.0	1.1	
754.00	754	754.0	754.0	0.0	1.1	
759.00	759	759.0	759.0	0.0	1.1	
764.00	764	764.0	764.0	0.0	1.1	
769.00	769	769.0	769.0	0.0	1.1	
774.00	774	774.0	774.0	0.0	1.1	
779.00	779	779.0	779.0	0.0	1.1	
784.00	784	784.0	784.0	0.0	1.1	
789.00	789	789.0	789.0	0.0	1.1	
794.00	794	794.0	794.0	0.0	1.1	
799.00	799	799.0	799.0	0.0	1.1	
804.00	804	804.0	804.0	0.0	1.1	
809.00	809	809.0	809.0	0.0	1.1	
814.00	814	814.0	814.0	0.0	1.1	
819.00	819	819.0	819.0	0.0	1.1	
824.00	824	824.0	824.0	0.0	1.1	
829.00	829	829.0	829.0	0.0	1.1	
834.00	834	834.0	834.0	0.0	1.1	
839.00	839	839.0	839.0	0.0	1.1	
844.00	844	844.0	844.0	0.0	1.1	
849.00	849	849.0	849.0	0.0	1.1	
854.00	854	854.0	854.0	0.0	1.1	
859.00	859	859.0	859.0	0.0	1.1	
864.00	864	864.0	864.0	0.0	1.1	
869.00	869	869.0	869.0	0.0	1.1	
874.00	874	874.0	874.0	0.0	1.1	
879.00	879	879.0	879.0	0.0	1.1	
884.00	884	884.0	884.0	0.0	1.1	
889.00	889	889.0	889.0	0.0	1.1	
894.00	894	894.0	894.0	0.0	1.1	
899.00	899	899.0	899.0	0.0	1.1	
904.00	904	904.0	904.0	0.0	1.1	
909.00	909	909.0	909.0	0.0	1.1	
914.00	914	914.0	914.0	0.0	1.1	
919.00	919	919.0	919.0	0.0	1.1	
924.00	924	924.0	924.0	0.0	1.1	
929.00	929	929.0	929.0	0.0	1.1	
934.00	934	934.0	934.0	0.0	1.1	
939.00	939	939.0	939.0	0.0	1.1	
944.00	944	944.0	944.0	0.0	1.1	
949.00	949	949.0	949.0	0.0	1.1	
954.00	954	954.0	954.0	0.0	1.1	
959.00	959	959.0	959.0	0.0	1.1	
964.00	964	964.0	964.0	0.0	1.1	
969.00	969	969.0	969.0	0.0	1.1	
974.00	974	974.0	974.0	0.0	1.1	
979.00	979	979.0	979.0	0.0	1.1	
984.00	984	984.0	984.0	0.0	1.1	
989.00	989	989.0	989.0	0.0	1.1	
994.00	994	994.0	994.0	0.0	1.1	
999.00	999	999.0	999.0	0.0	1.1	

Certificate No : 22-ACT-049
Request No : Req-2022-0629

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)
37-139	43.9	44.1	0.2	1.1
	114	114.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance
A / 37-139	Touchburst	Ref	UUC	ERR	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)
Fast	200	135.0	135.0	0.0	1.0
	2	118.0	117.9	-0.2	+1.0, -2.5
	0.25	109.0	108.8	-0.2	+1.5, -5.0
Slow	200	128.6	128.5	-0.1	1.0
	2	109.0	108.9	-0.1	+1.0, -5.0
	200	129.0	129.0	0.0	1.0
SEL	2	109.0	108.9	-0.1	+1.0, -2.5
	0.25	100.0	99.9	-0.1	+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance
FAST / C / 65-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.9	-0.50	3.0
Positive half cycle	136.4	136.2	-0.20	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

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Certificate No : 22-ACT-049
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12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	Limit	Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.9		
Negative one-half cycle	142.7		
Deviated	0.2	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	Limit	Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Body. Page: 4/8

เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udonnuk 41, Sukhumvit Road, Bangchak, Phrakong, Bangkok 10260
Certificate No : 22-ACT-048
Request No : Req-2022-0628

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0085344
ID : UAE.EFM.04/2563
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329362
Preamplifier Model : PPMx12C
Preamplifier S/N : 071494
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 23 March 2022
Calibrated Date : 1 April 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-val	EFA000234	14 June 2022	TISI
Audio Generator	Swank	Swan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :
Mr. Nopphon Luangart
Calibration Officer

Approved By :
Mr. Pavit Matharons
Calibration Engineer Supervisor
Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Body. Page: 1/6

เอกสารไม่ควบคุม

Certificate No : 22-ACT-048
Request No : Req-2022-0628

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	Adjust	UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)
1000 Hz 114.00 dB	113.85	113.7	-0.15	113.9	0.05
				0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SYNTEK, Model SV 35A, SN 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	29.1	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	28.6	0.10
C	28.4	0.10
Z	32.6	0.10

4. Acoustic signal test of frequency weightings

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance
FAST / 37-139	Weighting Response curve	Limit	Limit
STD Setting	(dB)	(dB)	(± dB)
125 Hz	0.0	0.1	0.30
1000 Hz	0.0	0.0	0.60
4000 Hz	0.2	0.2	0.60
8000 Hz	0.0	0.0	0.70

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Issuing Body. Page: 2/6

เอกสารไม่ควบคุม

Certificate No : 22-ACT-248
Request No : Req-2022-0628

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A (dB)	C (dB)	Z (dB)	(\pm dB)	(\pm dB)
STD Setting	-0.2	-0.1	-0.1	0.2	2.0
63 Hz	-0.1	0.0	0.0		1.5
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.0
1000 Hz	0.0	0.0	0.0		2.0
2000 Hz	0.0	0.0	0.0		3.0
4000 Hz	-0.1	-0.1	0.0		5.0
8000 Hz	-0.1	-0.1	0.0		+5, -INF
16000 Hz	-0.1	-0.1	-0.1		

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	(\pm dB)	Limit
UUC Weighting	(dB)	(dB)	(dB)	0.2	0.2
A	114.00	114.0	0.0		0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	(\pm dB)	Limit
UUC Time Response	(dB)	(dB)	(dB)	0.2	0.1
Fast	114.00	114.0	0.0		0.1
Slow	114.00	114.0	0.0		0.1
Leq	114.00	114.0	0.0		0.1

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing body. เอกสารไม่ควบคุม

Certificate No : 22-ACT-248
Request No : Req-2022-0628

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(\pm dB)	Limit
STD Setting	(dB)		(\pm dB)
Initial	114.0		
Final	114.0		
Deviasi	0.0		0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	(\pm dB)	Limit
STD dB	(dB)	(dB)	(dB)	0.3	(\pm dB)
139.00	139	139.0	0.0		3.1
134.00	134	134.0	0.0		3.1
129.00	129	129.0	0.0		3.1
124.00	124	124.0	0.0		3.1
119.00	119	119.0	0.0		3.1
114.00	114	114.0	0.0		3.1
109.00	109	109.0	0.0		3.1
104.00	104	104.0	0.0		3.1
99.00	99	98.9	-0.1		3.1
94.00	94	94.0	0.0		3.1
89.00	89	89.0	0.0		3.1
84.00	84	84.0	0.0		3.1
79.00	79	79.0	0.0		3.1
74.00	74	74.0	0.0		3.1
69.00	69	69.0	0.0		3.1
64.00	64	64.0	0.0		3.1
59.00	59	59.0	0.0		3.1
54.00	54	54.0	0.0		3.1
49.00	49	49.0	0.0		3.1
44.00	44	44.1	0.1		3.1
39.00	39	39.4	0.4		3.1
34.00	34	34.3	0.3		3.1

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Certificate No : 22-ACT-248
Request No : Req-2022-0628

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	(\pm dB)	Limit
UUC Range	(dB)	(dB)	(dB)	0.3	(\pm dB)
37-139	44.2	44.4	0.2		1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Touchstart	Ref	UUC	ERR	(\pm dB)	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	0.3	(\pm dB)
Fast	200	135.0	135.0	0.0		1.0
	2	118.0	117.7	-0.3		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.1	+0.1		1.0
SEL	2	109.0	109.1	+0.1		+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	(\pm dB)	Limit
STD Setting	(dB)	(dB)	(dB)	0.2	(\pm dB)
Complete cycle	137.4	136.7	-0.70		3.0
Positive half cycle	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing body. เอกสารไม่ควบคุม

Certificate No : 22-ACT-248
Request No : Req-2022-0628

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(\pm dB)	Limit
STD Setting	(dB)		(\pm dB)
Positive one-half cycle	143.2		
Negative one-half cycle	143.1		
Deviasi	0.1		1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(\pm dB)	Limit
STD Setting	(dB)		(\pm dB)
Initial	138.0		
Final	138.0		
Deviasi	0.0		0.3

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing body. เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-034
Address : 81 Soi Udomak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok Request No : Req-2022-0092
10560

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : J75A04
Model : LaT2 Microphone S/N : J20361
Serial Number : 0005394 Pre-amplifier Model : PRMLA2C
ID : UAEJFM.031/2564 Pre-amplifier S/N : 073810
Resolution : 0.1 dB Instrument Status : Used
Calibration Environment and Details
Temperature : 23 °C ± 1 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Scamk	Svan401	131	18 October 2022	WK Electric

Note

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

Calibrated By :

Mr. Noppadol Luangart
Calibration Officer

Approved By :

Mr. Paich Mahaveon
Calibration Engineer Supervisor
Issue Date : 21 January 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-034

Request No : Req-2022-0092

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Level	UUC	ERR	UUC	ERR		
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)
1000 Hz / 114.00 dB	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	27.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	27.5	0.10
C	27.0	0.10
Z	31.8	0.10

4. Acoustic signal test of frequency weightings

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
STD Setting	0.0	0.3	0.0	0.50	2.0
125 Hz	0.0	0.0	0.0	0.60	1.0
1000 Hz	0.2	0.3	0.2	0.60	3.0
8000 Hz	-0.3	-0.3	-0.3	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-034

Request No : Req-2022-0092

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
STD Setting	-0.2	-0.1	0.0	0.2	2.0
83 Hz	-0.3	0.0	0.0	1.3	1.3
125 Hz	-0.1	0.0	0.0	1.3	1.3
250 Hz	-0.1	0.0	0.0	1.3	1.3
500 Hz	-0.1	0.0	0.0	1.3	1.3
1000 Hz	0.0	0.0	0.0	1.3	1.3
2000 Hz	0.0	0.0	0.0	1.3	1.3
4000 Hz	0.0	0.0	0.0	1.3	1.3
8000 Hz	-0.1	-0.1	0.0	1.3	1.3
16000 Hz	-0.1	-0.1	-0.1	1.3	1.3

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
FAST / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0	0.2	0.2

UUC Setting	STD	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
37-139 / A	(dB)	(dB)	(dB)	(± dB)	(± dB)
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.1	0.1
Slow	114.00	114.0	0.0	0.1	0.1
Eq	114.00	114.0	0.0	0.1	0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-034

Request No : Req-2022-0092

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit (± dB)
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated REF	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC	ERR		
FAST / A / 37-139	(dB)	(dB)	(dB)	(± dB)	(± dB)
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
139.00	139	139.0	0.0	0.3	0.3
134.00	134	134.0	0.0	0.3	0.3
129.00	129	129.0	0.0	0.3	0.3
124.00	124	124.0	0.0	0.3	0.3
119.00	119	119.0	0.0	0.3	0.3
114.00	114	114.0	0.0	0.3	0.3
109.00	109	109.0	0.0	0.3	0.3
104.00	104	104.0	0.0	0.3	0.3
99.00	99	99.0	0.0	0.3	0.3
94.00	94	93.9	-0.1	0.3	0.3
89.00	89	88.9	-0.1	0.3	0.3
84.00	84	83.9	-0.1	0.3	0.3
79.00	79	78.9	-0.1	0.3	0.3
74.00	74	73.9	-0.1	0.3	0.3
69.00	69	69.0	0.0	0.3	0.3
64.00	64	63.9	-0.1	0.3	0.3
59.00	59	59.0	0.0	0.3	0.3
54.00	54	54.0	0.0	0.3	0.3
49.00	49	49.0	0.0	0.3	0.3
44.00	44	44.1	0.1	0.3	0.3
39.00	39	39.3	0.3	0.3	0.3
34.00	34	34.3	0.3	0.3	0.3
29.00	29	29.5	0.5	0.3	0.3

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-034
Request No : Req-2022-0092

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)
37-139	-42.8	43.0	0.2	1.1
	114	114.0	0.0	1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance
A / 37-139	Touchburst	Ref	UUC	ERR	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)
Fast	200	135.0	135.0	0.0	1
	2	118.0	117.7	-0.3	+1.0, -2.5
	0.25	109.0	108.8	-0.2	+1.5, -5.0
Slow	200	128.6	128.5	-0.1	1
	2	109.0	108.9	-0.1	+1.0, -5.0
	200	129.0	129.0	0.0	1
SEL	2	109.0	109.1	+0.1	+1.0, -2.5
	0.25	108.0	108.0	0.0	+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.1	-0.30	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovate Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-034
Request No : Req-2022-0092

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	Limit	Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	Limit	Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovate Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 22-ACT-247
Request No : Req-2022-0627

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005395
ID : UAEJFM022564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329335
Preamplifier Model : PRMLxT3C
Preamplifier S/N : 073797
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 30 %RH ± 20 %RH
Barometric Pressure : 1013.3 kPa ± 10.0 kPa
Received Date : 23 March 2022
Calibrated Date : 1 April 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TISI
Audio Generator	Scantek	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :
Mr. Noppidon Laungert
Calibration Officer

Approved By :
Mr. Pachi Matharoen
Calibration Engineer Supervisor
Issue Date : 1 April 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovate Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-247
Request No : Req-2022-0627

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	Adjust	UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)
1000 Hz 114.00 dB	113.85	113.8	-0.05	113.9	0.05
				0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN:58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	28.4	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	28.1	0.10
C	27.7	0.10
Z	32.0	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency	UNCERTAINTY	Acceptance
FAST / 37-139	Weighting Response curve	Limit	Limit
STD Setting	(dB)	(dB)	(± dB)
125 Hz	0.0	0.1	0.30
1000 Hz	0.0	0.0	0.60
4000 Hz	0.4	0.3	0.60
8000 Hz	0.2	0.1	0.70

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovate Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-047
Request No : Req-2022-0627

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A (dB)	C (dB)	Z (dB)	(\pm dB)	Limit
STD Setting	-9.2	-9.1	-9.1		2.0
63 Hz	-9.1	0.0	0.0		1.5
125 Hz	-9.1	0.0	0.0		1.5
250 Hz	-9.1	0.0	0.0		1.5
500 Hz	-9.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0	0.2	1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-9.1	-9.1	0.0		5.0
16000 Hz	-9.1	-9.1	-9.1		+5, -INF

6. Frequency and time weightings at 10Hz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	(\pm dB)	Limit
UUC Weighting	(dB)	(dB)	(dB)		
A	114.00	114.0	-0.0	0.2	0.2
C	114.00	114.0	-0.0		0.2
Z	114.00	114.0	-0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	(\pm dB)	Limit
UUC Time Response	(dB)	(dB)	(dB)		
Fast	114.00	114.0	-0.0	0.2	0.1
Slow	114.00	114.0	-0.0		0.1
Log	114.00	114.0	-0.0		0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-047
Request No : Req-2022-0627

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(\pm dB)	(\pm dB)
Initial	114.0		
Final	114.0		
Deviant	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	(\pm dB)	Limit
STD dB	(dB)	(dB)	(dB)		
139.00	139	139.0	0.0		1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	94.0	0.0		1.1
89.00	89	89.0	0.0		1.1
84.00	84	84.0	0.0		1.1
79.00	79	79.0	0.0		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.0	0.0		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.4	0.4		1.1

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เอกสารไม่ควบคุม

Certificate No : 22-ACT-047
Request No : Req-2022-0627

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	(\pm dB)	Limit
UUC Range	(dB)	(dB)	(dB)		
37-139	43.4	43.5	0.1	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	(\pm dB)	Limit
UUC Time Response	(dB)	(dB)	(dB)	(dB)		
Fast	200	133.0	134.9	-0.1		1.0
	2	118.0	117.8	-0.2		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.0	128.4	-0.2		1.0
	2	109.0	108.8	-0.2		+1.0, -5.0
	0.25	109.0	109.1	+0.1		+1.0, -2.5
SEL	200	129.0	129.0	0.0		1.0
	2	109.0	109.1	+0.1		+1.0, -2.5
	0.25	109.0	99.9	-9.1		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	(\pm dB)	Limit
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.8	-0.60	0.2	2.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-047
Request No : Req-2022-0627

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(\pm dB)	(\pm dB)
Positive one-half cycle	142.2		
Negative one-half cycle	142.2		
Deviant	0.0	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC		Limit
STD Setting	(dB)	(\pm dB)	(\pm dB)
Initial	138.0		
Final	138.0		
Deviant	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 91 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok
10260

Certificate No : 22-ACT-105
Request No : Req-2022-0229

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005396
ID : UAEFPM0332564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329350
Preamplifier Model : PRMLX72C
Preamplifier S/N : 075812
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 31 January 2022
Calibrated Date : 11 February 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-5 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svante	Svan401	131	18 October 2022	WK Electric

Note

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

Calibrated By : 
Mr. Noppradon Luangrat
Calibration Officer

Approved By : 
Mr. Pachi Matheworn
Calibration Engineer Supervisor
Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FSM-700-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139 Calibrator Setting 1000 Hz 114.00 dB	Nominal Level (dB)	Before Adjust UUC (dB) ERR (dB)		Adjust UUC (dB) ERR (dB)		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.58079

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting A	27.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting A	27.8	0.10
C	27.3	0.10
Z	33.1	0.10

4. Acoustic signal test of frequency weightings: (Without Windscreen)

UUC Setting FAST / 37-139 STD Setting 125 Hz 1000 Hz 4000 Hz 8000 Hz	Deviation from various Frequency Weighting Response curve A C Z (dB) (dB) (dB)			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	0.1	0.1	0.2	0.50	2.0
	0.0	0.0	0.0	0.60	1.0
	0.6	0.5	0.6	0.60	3.0
	0.1	0.0	0.2	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FSM-700-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

UUC Setting FAST / 37-139 STD Setting 63 Hz 125 Hz 250 Hz 500 Hz 1000 Hz 2000 Hz 4000 Hz 8000 Hz 16000 Hz	Deviation from various Frequency Weighting Response curve A (dB) C (dB) Z (dB)			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	-0.2	0.0	0.0	0.2	2.0
	-0.1	0.0	0.0		1.5
	-0.1	0.0	0.0		1.5
	-0.1	0.0	0.0		1.5
	0.0	0.0	0.0		1.0
	0.0	0.1	0.0		2.0
	0.0	0.0	0.0		3.0
	0.0	0.0	0.0		5.0
	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139 UUC Weighting A C Z	STD REF (dB)	Measured UUC (dB) ERR (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	114.00	114.0	0.0	0.2
	114.00	114.0	0.0	0.2
	114.00	114.0	0.0	0.2

UUC Setting 37-139 / A UUC Time Response Fast Slow Leq	STD REF (dB)	Measured UUC (dB) ERR (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	114.00	114.0	0.0	0.1
	114.00	114.0	0.0	0.1
	114.00	114.0	0.0	0.1

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FSM-700-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-105
Request No : Req-2022-0229

7. Long Term Stability

UUC Setting FAST / A / 37-139 STD Setting Initial Final Deviated	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	114.0		
	114.0		
	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139 STD dB	Anticipated REF (dB)	Deviation UUC (dB) ERR (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
129.00	139	139.0	0.0	1.1
134.00	134	134.0	0.0	1.1
129.00	129	129.0	0.0	1.1
124.00	124	124.0	0.0	1.1
119.00	119	119.0	0.0	1.1
114.00	114	114.0	0.0	1.1
109.00	109	109.0	0.0	1.1
104.00	104	104.0	0.0	1.1
99.00	99	99.0	0.0	1.1
94.00	94	93.9	-0.1	1.1
89.00	89	88.9	-0.1	1.1
84.00	84	83.9	-0.1	1.1
79.00	79	78.9	-0.1	1.1
74.00	74	73.9	-0.1	1.1
69.00	69	68.9	-0.1	1.1
64.00	64	63.9	-0.1	1.1
59.00	59	58.9	-0.1	1.1
54.00	54	53.9	-0.1	1.1
49.00	49	48.9	-0.1	1.1
44.00	44	44.0	0.0	1.1
39.00	39	39.2	0.2	1.1
34.00	34	34.3	0.3	1.1

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FSM-700-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-185
Request No : Req-2022-8229

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	(± dB)	Limit
UUC Range	(dB)	(dB)	(dB)		
37-139	43.2	42.8	-0.4	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	(± dB)	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	134.9	-0.1	0.3	1.0
	2	118.0	117.6	-0.4		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	108.9	-0.1	0.0	+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.7	-0.70	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

ISM-T08-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-185
Request No : Req-2022-8229

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)		
Positive one-half cycle	141.7		
Negative one-half cycle	141.8		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

ISM-T08-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udonruek 41, Sukhumvit Road, Bangtrak, Prakanong, Bangkok 10260

Certificate No : 22-ACT-035
Request No : Req-2022-0094

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 000298
ID : UAE.FPM.035/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : J26675
Preamplifier Model : PRMLAT2C
Preamplifier S/N : 073793
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 1 °C
Humidity : 30 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic test
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	(8927)	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA1000234	14 June 2022	TISI
Audio Generator	Swanick	Swan401	(3)	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Nopadol Luangart
Calibration Officer

Approved By : 
Mr. Pait Mathavorn
Calibration Engineer/Supervisor
Issue Date : 21 January 2022

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เอกสารไม่ควบคุม

ISM-T08-SLM-01 Rev.0 Issue date 01/07/19

Certificate No : 22-ACT-035
Request No : Req-2022-0094

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	114.6	+0.15	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.38079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		(± dB)
UUC Weighting	(dB)	
A	28.1	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		(± dB)
UUC Weighting	(dB)	
A	27.9	0.10
C	27.3	0.10
Z	31.9	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A	C	Z	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)		
125 Hz	0.0	0.0	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.4	0.3	0.3	0.60	3.0
8000 Hz	-0.1	-0.2	-0.1	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

ISM-T08-SLM-01 Rev.0 Issue date 01/07/19

Certificate No : 22-ACT-035
Request No : Req-2022-0094

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	(± dB)	Limit
STD Setting	A (dB)	C (dB)	Z (dB)	(± dB)	(± dB)
63 Hz	-0.2	-0.1	-0.1	0.2	2.0
125 Hz	-0.1	0.0	-0.1		1.5
250 Hz	-0.1	0.0	-0.1		1.5
500 Hz	-0.1	0.0	-0.1		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	-0.1	-0.1	0.0		5
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / 37-139	REF	UUC	ERR	(± dB)	Limit
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR	(± dB)	Limit
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Loq	114.00	114.0	0.0		0.1

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เอกสารไม่ควบคุม

Certificate No : 22-ACT-035
Request No : Req-2022-0094

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
FAST / A / 37-139	REF	UUC	ERR	(± dB)	Limit
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
139.00	139	139.0	0.0	0.3	1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	93.9	-0.1		1.1
89.00	89	88.9	-0.1		1.1
84.00	84	83.9	-0.1	0.3	1.1
79.00	79	78.9	-0.1		1.1
74.00	74	73.9	-0.1		1.1
69.00	69	69.0	0.0		1.1
64.00	64	63.8	-0.1		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		0.8
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.3	0.3		1.1
37.00	37	37.3	0.3		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-035
Request No : Req-2022-0094

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	(± dB)	Limit
UUC Range	(dB)	(dB)	(dB)	(± dB)	(± dB)
37-139	-0.2	-0.4	0.2	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	(± dB)	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	200	135.0	135.0	0.0	0.3	1
	2	118.0	117.9	-0.1		+1.0, -2.5
	0.25	109.0	108.7	-0.3		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1
	2	109.0	108.9	-0.1		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	109.1	+0.1		+1.0, -2.5
	0.25	100.0	99.9	-0.1		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
Complete cycle	137.4	136.8	-0.60	0.2	3.0
Positive half cycle	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	136.1	-0.30		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-035
Request No : Req-2022-0094

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)	(± dB)	(± dB)
Positive one-half cycle	142.3		
Negative one-half cycle	142.0		
Deviated	0.3	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)	(± dB)	(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-036
Address : R1 Soi Udonnak 41, Sukhumvit Road, Bangchak, Prakanong Bangkok Request No : Req-2022-0095
10200

Unit Under Calibration Details


Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : LA12 Microphone S/N : 328676
Serial Number : 0005400 Pre-amplifier Model : PRMLA12C
ID : UAEFM.037/2564 Pre-amplifier S/N : 073803
Resolution : 0.1 dB Instrument Status : Used
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	183273	15 September 2022	GRAS
Multi-frequency Calibrator	Quate	Quate-cal	EFA000234	14 June 2022	TNI
Audio Generator	Scanak	Scan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadol Lamsert
Calibration Officer

Approved By : 
Mr. Paitt Mathavorn
Calibration Engineer Supervisor
Issue Date : 21 January 2022

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. **เอกสารไม่ควบคุม**

Certificate No : 22-ACT-036
Request No : Req-2022-0095

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	Level	UUC	ERR	UUC	ERR		
FAST / A / 37-139							
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)
1000 Hz 114.00 dB	113.35	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	29.0	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	28.8	0.10
C	28.2	0.10
Z	32.9	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A	C	Z		
FAST / 37-139					
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
125 Hz	-0.1	0.1	0.0	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	3.0
4000 Hz	0.5	0.5	0.6	0.60	3.0
8000 Hz	0.4	0.4	0.5	0.70	5.0

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. **เอกสารไม่ควบคุม**

Certificate No : 22-ACT-036
Request No : Req-2022-0095

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curves			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
FAST / 37-139					
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)
63 Hz	-0.2	-0.1	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0	0.2	1.5
250 Hz	-0.1	0.0	0.0	0.2	1.5
500 Hz	-0.1	0.0	0.0	0.2	1.5
1000 Hz	0.0	0.0	0.0	0.2	1.0
2000 Hz	0.0	0.0	0.0	0.2	2.0
4000 Hz	0.0	0.0	0.0	0.2	3.0
8000 Hz	-0.1	0.0	0.0	0.2	5
16000 Hz	-0.1	-0.1	0.0	0.2	+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC	ERR		
FAST / 37-139					
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0	0.2	0.2
Z	114.00	114.0	0.0	0.2	0.2

UUC Setting	STD 37-139 / A	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		REF	ERR		
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0	0.2	0.1
Log	114.00	114.0	0.0	0.2	0.1

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. **เอกสารไม่ควบคุม**

Certificate No : 22-ACT-036
Request No : Req-2022-0095

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139			
UUC	(dB)	(± dB)	Limit (± dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated REF	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC	ERR		
FAST / A / 37-139					
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
139.00	139	139.0	0.0	0.3	1.1
134.00	134	134.0	0.0	0.3	1.1
129.00	129	129.0	0.0	0.3	1.1
124.00	124	124.0	0.0	0.3	1.1
119.00	119	119.0	0.0	0.3	1.1
114.00	114	114.0	0.0	0.3	1.1
109.00	109	109.0	0.0	0.3	1.1
104.00	104	104.0	0.0	0.3	1.1
99.00	99	99.0	0.0	0.3	1.1
94.00	94	93.9	-0.1	0.3	1.1
89.00	89	88.9	-0.1	0.3	1.1
84.00	84	83.9	-0.1	0.3	1.1
79.00	79	78.9	-0.1	0.3	1.1
74.00	74	73.9	-0.1	0.3	1.1
69.00	69	68.9	-0.1	0.3	1.1
64.00	64	63.9	-0.1	0.3	1.1
59.00	59	59.0	0.0	0.3	1.1
54.00	54	54.0	0.0	0.3	1.1
49.00	49	49.0	0.0	0.3	1.1
44.00	44	44.1	0.1	0.3	1.1
39.00	39	39.3	0.3	0.3	1.1
34.00	34	34.3	0.3	0.3	1.1
29.00	29	29.5	0.5	0.3	1.1

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory. **เอกสารไม่ควบคุม**

Certificate No : 22-ACT-036
Request No : Req-2022-0095

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A	REF	UUC	ERR		
UUC Range	(dB)	(dB)	(dB)		
37-139	-42.9	43.2	0.3	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
A : 37-139	Timeburst		UUC	ERR		
UUC Time Response	(ms)	(dB)	(dB)	(dB)		
Fast	200	135.0	135.0	0.0	0.3	1
	2	138.0	137.8	-0.2		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1
	2	109.0	108.8	-0.2		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	109.0	0.0		+1.0, -2.5
	0.25	100.0	99.9	-0.1		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / C / 95-142		UUC	ERR		
STD Setting	(dB)	(dB)	(dB)		
Complete cycle	137.4	136.9	-0.30	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-036
Request No : Req-2022-0095

12. Overload indication

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A : 37-139	UUC		
STD Setting	(dB)		
Positive one-half cycle	142.1		
Negative one-half cycle	141.9		
Deviated	0.2	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A : 27-139	UUC		
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate of Calibration

Customer
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 22-ACT-103
Request No : Req-2022-0230

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0003402
ID : UAEFEM.038/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 328668
Preamplifier Model : PRMLxT2C
Preamplifier S/N : 071540
Instrument Status : Used

Calibration Environment and Details

Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Humidity : $50\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 31 January 2022
Calibrated Date : 11 February 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svante	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :
Mr. Noppadol Luangrat
Calibration Officer

Approved By :
Mr. Pasi Mathavorn
Calibration Engineer Supervisor
Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A : 37-139	Level	UUC	ERR	UUC	ERR		
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		
1000 Hz 114.00 dB	113.85	114.0	+0.15	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.59079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(\pm dB)
A	28.1	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(\pm dB)
A	28.1	0.10
C	27.9	0.10
Z	34.4	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / 37-139	A	C	Z		
STD Setting	(dB)	(dB)	(dB)		
125 Hz	0.6	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.9	0.9	1.0	0.60	3.0
8000 Hz	0.7	0.7	0.8	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance
FAST / 37-139	Weighting Response curve				
STD Setting	A (dB)	C (dB)	Z (dB)	(± dB)	Limit (± dB)
63 Hz	-0.2	0.0	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.1	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	0.0	0.0	0.0		5.0
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting	STD REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / 37-139					
UUC Weighting	(dB)	(dB)	(dB)		
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
37-139 / A	REF	UUC	ERR		
UUC Time Response	(dB)	(dB)	(dB)	(\pm dB)	Limit (\pm dB)
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Leq	114.00	114.0	0.0		0.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-709-8234-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

7. Long Term Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139			
STD Setting	(dB)	(\pm dB)	(\pm dB)
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range

UUC Setting	Anticipated REF (dB)	Deviation		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / A / 37-139					
STD dB	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)
139.00	139	139.0	0.0	0.3	1.1
134.00	134	134.0	0.0		1.1
129.00	129	129.0	0.0		1.1
124.00	124	124.0	0.0		1.1
119.00	119	119.0	0.0		1.1
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	94.0	0.0		1.1
89.00	89	89.0	0.0		1.1
84.00	84	84.0	0.0		1.1
79.00	79	79.0	0.0		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.0	0.0		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		1.1
44.00	44	44.0	0.0		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.3	0.3		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-709-8234-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

9. Level linearity including the level range control

UUC Setting	STD REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / A					
UUC Range	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)
37-139	43.2	42.9	-0.3	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
			UUC (dB)	ERR (dB)		
A / 37-139						
UUC Time Response	(ms)					
Fast	200	135.0	135.0	0.0	0.3	1.0
	2	118.0	117.7	-0.3		+1.0,-2.5
	0.25	109.0	108.7	-0.3		+1.5,-5.0
Slow	200	128.6	128.5	-0.1		1.0
	2	109.0	108.9	-0.1		+1.0,-5.0
	200	129.0	129.0	0.0		1.0
SEL	2	109.0	109.0	0.0		+1.0,-2.5
	0.25	100.0	99.9	-0.1		+1.5,-5.0

11. Peak C Sound level

UUC Setting	Anticipated REF	Measured		UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
		UUC (dB)	ERR (dB)		
FAST / C / 95-142					
STD Setting	(dB)	(dB)	(dB)	(\pm dB)	(\pm dB)
Complete cycle	137.4	136.7	-0.70	0.2	3.0
Positive half cycle	136.4	136.1	-0.30		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-709-8234-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate No : 22-ACT-103
Request No : Req-2022-0230

12. Overload indication

UUC Setting	Measured UUC (dB)	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139			
STD Setting	(dB)	(\pm dB)	(\pm dB)
Positive one-half cycle	142.2		
Negative one-half cycle	142.3		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured UUC (dB)	UNCERTAINTY (\pm dB)	Acceptance Limit (\pm dB)
FAST / A / 37-139			
STD Setting	(dB)	(\pm dB)	(\pm dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-709-8234-01 Rev.0 Issue date 01/07/11

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 22-ACT-101
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok Request No : Req-2022-0231
10268

Unit Under Calibration Details

Measurement item : Sound Level Meter Microphone Class : 2
Manufacturer : LARSON DAVIS Microphone Model : 375A04
Model : LX72 Microphone SN : 329360
Serial Number : 0005405 Preamplifier Model : PRMLA72C
ID : UAEFPM.041/2564 Preamplifier SN : 075800
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 31 January 2022
Calibrated Date : 11 February 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	15 September 2022	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	14 June 2022	TSI
Audio Generator	Svante	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Laungart
Calibration Officer

Approved By : 
Mr. Pait Mahavorn
Calibration Engineer Supervisor
Issue Date : 11 February 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FSM-T08-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-101

Request No : Req-2022-0231

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139 Calibrator Setting	Nominal Level (dB)	Before Adjust			Adjust		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		UUC (dB)	ERR (dB)		
1000 Hz 114.00 dB	113.85	113.9	+0.05		113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN.S9079

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting		
A	27.3	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY (± dB)
UUC Weighting		
A	27.6	0.10
C	27.3	0.10
Z	33.2	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting FAST / 37-139 STD Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.2	0.2	0.2	0.60	3.0
8000 Hz	-0.1	-0.1	0.0	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FSM-T08-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-101

Request No : Req-2022-0231

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting FAST / 37-139 STD Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)
	A (dB)	C (dB)	Z (dB)		
63 Hz	-0.2	0.0	0.0	0.2	2.0
125 Hz	-0.1	0.0	0.0		1.5
250 Hz	-0.1	0.0	0.0		1.5
500 Hz	-0.1	0.0	0.0		1.5
1000 Hz	0.0	0.0	0.0		1.0
2000 Hz	0.0	0.0	0.0		2.0
4000 Hz	0.0	0.0	0.0		3.0
8000 Hz	0.0	0.0	0.0		5
16000 Hz	-0.1	-0.1	-0.1		+5, -INF.

6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139 UUC Weighting	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
A	114.00	114.0	0.0	0.2	0.2
C	114.00	114.0	0.0		0.2
Z	114.00	114.0	0.0		0.2

UUC Setting 37-139 / A UUC Time Response	STD REF (dB)	Measured		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
Fast	114.00	114.0	0.0	0.2	0.1
Slow	114.00	114.0	0.0		0.1
Leq	114.00	114.0	0.0		0.1

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FSM-T08-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-101

Request No : Req-2022-0231

7. Long Term Stability

UUC Setting FAST / A / 37-139 STD Setting	Measured UUC (dB)	UNCERTAINTY (± dB)	Acceptance Limit (± dB)
Initial	114.0		0.3
Final	114.0		
Deviated	0.0		

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139 STD dB	Anticipated REF (dB)	Deviation		UNCERTAINTY (± dB)	Acceptance Limit (± dB)
		UUC (dB)	ERR (dB)		
139.00	139	139.0	0.0	0.3	1.3
134.00	134	134.0	0.0		1.3
129.00	129	129.0	0.0		1.3
124.00	124	124.0	0.0		1.3
119.00	119	119.0	0.0		1.3
114.00	114	114.0	0.0		1.1
109.00	109	109.0	0.0		1.1
104.00	104	104.0	0.0		1.1
99.00	99	99.0	0.0		1.1
94.00	94	93.9	-0.1		1.1
89.00	89	88.9	-0.1		1.1
84.00	84	83.9	-0.1		1.1
79.00	79	78.9	-0.1		1.1
74.00	74	74.0	0.0		1.1
69.00	69	69.0	0.0		1.1
64.00	64	64.1	0.1		1.1
59.00	59	59.0	0.0		1.1
54.00	54	54.0	0.0		1.1
49.00	49	49.0	0.0		1.1
44.00	44	44.1	0.1		1.1
39.00	39	39.3	0.3		1.1
34.00	34	34.4	0.4		1.1

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FSM-T08-SLM-01 Rev.0 Issue date 01/07/21

เอกสารไม่ควบคุม

Certificate No : 22-ACT-101
Request No : Req-2022-0231

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance
FAST / A	REF	UUC	ERR	(± dB)	Limit
UUC Range	(dB)	(dB)	(dB)		(± dB)
37-139	43.9	43.6	-0.3	0.3	1.1
	114	114.0	0.0		1.1

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance
A / 37-139	Toneburst	Ref	UUC	ERR	(± dB)	Limit
UUC Time Response	(ms)	(dB)	(dB)	(dB)		(± dB)
Fast	200	135.0	134.9	-0.1	0.3	1
	2	118.0	117.6	-0.4		+1.0, -2.5
	0.25	109.0	108.8	-0.2		+1.5, -5.0
Slow	200	128.6	128.5	-0.1		1
	2	109.0	108.8	-0.2		+1.0, -5.0
	200	129.0	129.0	0.0		1
SEL	2	109.0	109.0	0.0	0.3	+1.0, -2.5
	0.25	100.0	100.0	0.0		+1.5, -5.0

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance
FAST / C / 95-142	REF	UUC	ERR	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)		(± dB)
Complete cycle	137.4	136.7	-0.70	0.2	3.0
Positive half cycle	136.4	136.2	-0.20		2.0
Negative half cycle	136.4	136.2	-0.20		2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate No : 22-ACT-101
Request No : Req-2022-0231

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)		(± dB)
Positive one-half cycle	141.8		
Negative one-half cycle	141.9		
Deviated	-0.1	0.2	1.5

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(± dB)	Limit
STD Setting	(dB)		(± dB)
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-SLM-01 Rev.0 Issue date 01/07/19

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 22-ACT-037
Request No : Req-2022-0096

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Manufacturer : LARSON DAVIS
Model : LxT2
Serial Number : 0005407
ID : UAEFPM04/2564
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 329358
Preamplifier Model : PRMLA12C
Preamplifier S/N : 073M02
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 14 January 2022
Calibrated Date : 21 January 2022
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	18373	15 September 2022	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA080234	14 June 2022	TST
Audio Generator	Svanok	Svan401	131	18 October 2022	WK Electric

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :
Mr. Noppadol Luangrat
Calibration Officer

Approved By :
Mr. Paet Mathavon
Calibration Engineer Supervisor
Issue Date : 21 January 2022

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-037
Request No : Req-2022-0096

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		Adjust		UNCERTAINTY	Acceptance
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	(± dB)	Limit
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)		(± dB)
1000 Hz (14.00 dB)	113.85	113.9	+0.05	113.9	0.05	0.20	0.3

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN 58079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	29.0	0.0

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting		
A	28.8	0.10
C	28.1	0.10
Z	32.8	0.10

4. Acoustic signal test of frequency weightings

(Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance
FAST / 37-139	A	C	Z	(± dB)	Limit
STD Setting	(dB)	(dB)	(dB)		(± dB)
125 Hz	0.0	0.1	0.1	0.50	2.0
1000 Hz	0.0	0.0	0.0	0.60	1.0
4000 Hz	0.0	0.1	0.1	0.60	3.0
8000 Hz	-0.5	-0.5	-0.4	0.70	5.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate No : 22-ACT-037
Request No : Req-2022-0096

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz				
UUC Setting	Deviation from various Frequency Weighting Response curve			Acceptance Limit (\pm dB)
	FAST / 37-139	STD Setting	Measured	
FAST / 37-139	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(\pm dB)
63 Hz	-0.2	-0.1	0.0	2.0
125 Hz	-0.1	0.0	0.0	1.5
250 Hz	-0.1	0.0	0.0	1.5
500 Hz	-0.1	0.0	0.0	1.5
1000 Hz	0.0	0.0	0.0	1.0
2000 Hz	0.0	0.0	0.0	2.0
4000 Hz	0.0	0.0	0.0	3.0
8000 Hz	-0.1	-0.1	0.0	5
16000 Hz	-0.1	-0.1	-0.1	+5, -INF.

6. Frequency and time weightings at 1kHz				
UUC Setting	STD	Measured		Acceptance Limit (\pm dB)
		UUC	ERR	
FAST / 37-139	REF	UUC	ERR	Limit
UUC Weighting	(dB)	(dB)	(dB)	(\pm dB)
A	114.00	114.0	0.0	0.2
C	114.00	114.0	0.0	0.2
Z	114.00	114.0	0.0	0.2

UUC Setting	STD	Measured		Acceptance Limit (\pm dB)
		UUC	ERR	
37-139 / A	REF	UUC	ERR	Limit
UUC Time Response	(dB)	(dB)	(dB)	(\pm dB)
Fast	114.00	114.0	0.0	0.1
Slow	114.00	114.0	0.0	0.1
Log	114.00	114.0	0.0	0.1

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เอกสารไม่ควบคุม

Certificate No : 22-ACT-037
Request No : Req-2022-0096

7. Long Term Stability			
UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(\pm dB)	Limit (\pm dB)
STD Setting	(dB)		
Initial	114.0		
Final	114.0		
Deviated	0.0	0.1	0.3

8. Level linearity on the reference level range					
UUC Setting	Anticipated	Deviation		UNCERTAINTY	Acceptance
		UUC	ERR		
FAST / A / 37-139	REF	(dB)	(dB)	(\pm dB)	Limit (\pm dB)
STD dB	(dB)	(dB)	(dB)		
139.00	139	139.0	0.0		1.3
134.00	134	134.0	0.0		1.3
129.00	129	129.0	0.0		1.3
124.00	124	124.0	0.0		1.3
119.00	119	119.0	0.0		1.3
114.00	114	114.0	0.0		1.3
109.00	109	109.0	0.0		1.3
104.00	104	104.0	0.0		1.3
99.00	99	99.0	0.0		1.3
94.00	94	93.9	-0.1		1.3
89.00	89	88.9	-0.1		1.3
84.00	84	83.9	-0.1		1.3
79.00	79	78.9	-0.1		1.3
74.00	74	73.9	-0.1		1.3
69.00	69	69.0	0.0		1.3
64.00	64	64.0	0.0		1.3
59.00	59	59.0	0.0		1.3
54.00	54	54.0	0.0		1.3
49.00	49	48.5	-0.5		0.8
44.00	44	44.1	0.1		1.3
39.00	39	39.4	0.4		1.3
34.00	34	33.5	-0.5		1.3
29.00	29	27.6	-1.4		1.3

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written consent of the calibration laboratory.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-037
Request No : Req-2022-0096

9. Level linearity including the level range control				
UUC Setting	STD	Measured		Acceptance Limit (\pm dB)
		UUC	ERR	
FAST / A	REF	UUC	ERR	Limit
UUC Range	(dB)	(dB)	(dB)	(\pm dB)
37-139	44.1	44.2	0.1	1.3
	114	114.0	0.0	1.1

10. Tone burst response					
UUC Setting	STD	Anticipated	Measured		Acceptance Limit (\pm dB)
			UUC	ERR	
A / 37-139	Touchstart	Ref	(dB)	(dB)	(\pm dB)
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(\pm dB)
Fast	200	135.0	135.0	0.0	1
	2	118.0	117.7	-0.3	+1.0, -2.5
	0.25	109.0	108.8	-0.2	+1.5, -5.0
Slow	200	128.6	128.3	-0.1	1
	2	109.0	108.9	-0.1	+1.0, +5.0
	200	129.0	129.1	+0.1	1
SEL	2	109.0	108.9	-0.1	+1.0, -2.5
	0.25	100.0	100.0	0.0	+1.5, -5.0

11. Peak C Sound level				
UUC Setting	Anticipated	Measured		Acceptance Limit (\pm dB)
		UUC	ERR	
FAST / C / 95-142	REF	UUC	ERR	Limit
STD Setting	(dB)	(dB)	(dB)	(\pm dB)
Complete cycle	137.4	136.8	-0.60	3.0
Positive half cycle	136.4	136.1	-0.30	2.0
Negative half cycle	136.4	136.2	-0.20	2.0

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written consent of the calibration laboratory.
เอกสารไม่ควบคุม

Certificate No : 22-ACT-037
Request No : Req-2022-0096

12. Overload indication			
UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(\pm dB)	Limit (\pm dB)
STD Setting	(dB)		
Positive one-half cycle	142.9		
Negative one-half cycle	142.9		
Deviated	0.0	0.2	1.5

13. High Level Stability			
UUC Setting	Measured	UNCERTAINTY	Acceptance
FAST / A / 37-139	UUC	(\pm dB)	Limit (\pm dB)
STD Setting	(dB)		
Initial	138.0		
Final	138.0		
Deviated	0.0	0.1	0.3

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written consent of the calibration laboratory.
เอกสารไม่ควบคุม

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Horiba	LAQUA-PH210 HA0A0007	Technology Promotion Association (Thailand-Japan)	23CH419	30 Mar 23	29 Mar 24	-



Cert.No.: 23CH419
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HAQA0007
ID No. : UAE.EFM.002/2563(EFM.PH.02/63)
Condition As-Received: Used Item
Received Date : 28 March 2023
Calibration Date : 29-30 March 2023
Reference : 2303-1001WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house - method :
- CP-CH5 by direct measurement with standard
voltage calibrator and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagtrakul

Approved by :
Approved Signatory

(/) Malee Butkrusa
() Saithip Meangmai
() Warakorn Lemgagtrakul

Issue Date : 31 March 2023

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 23CH419
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	22E2769	24 Aug 2023
2) Ref. Standard Thermometer	4982054	110RC044	22I1306	27 Oct 2023

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

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	863832	28 Dec 2024
pH 6.987	CPA chem	826589	09 July 2023
pH 10.010	CPA chem	863835	28 Dec 2023

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

Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement	Coverage factor
	pH	mV	mV	pH	(±mV)	k
pH Meter S/N.: HAQA0007	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.2	6.98	0.058	2.00
	7.00	0.00	0.2	6.98	0.058	2.00
	10.00	-177.48	-177.3	10.01	0.058	2.00

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Cert.No.: 23CH419
Page: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: Q92M0159	4.008	4.01	184.7	0.0085	2.05
	6.987	7.00	10.1	0.011	2.00
	6.987	7.00	9.6	0.011	2.00
	10.010	10.00	-165.7	0.0095	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D

- Serial No. : Q92M0159

Dimension of probe;

- Length : 107 mm

- Diameter : 16 mm

- Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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