

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



CALIBRATION CERTIFICATE

Certificate No. : L202305085-002
Date Issued : 16-May-23

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukhapibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Equipment : Analog Barometer

Manufacturer : Barigo
Model :
Serial No. :
ID No./Tag No. : BM001/41
Date Received : 11-May-23
Date Calibrated : 15-May-23

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-21 base on DKD-R 6-1: Edition 3 2014.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by: 
(Mr. Sarayuth Tochua)



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Certificate No. : L202305085-002
Environment : Ambient Temperature : (25 ± 2)°C
Relative Humidity : (50 ± 15)%RH

STD Reading mbar	UUC Reading (mbar) Before Adjusted	UUC Reading (mbar) After Adjusted	UUC Error mbar	Uncertainty ± mbar
990.00	990.0	-	0.00	0.61
1000.00	1000.0	-	0.00	0.61
1010.00	1010.0	-	0.00	0.61
1020.00	1020.0	-	0.00	0.61
1030.00	1030.0	-	0.00	0.61

STD = Standard

UUC = Unit Under Calibration

Calibrated condition :

Pressure Medium : Air : Density = 1.19 kg/m³ @ 20°C, 1 bar
Mounting Position : Vertical
Reference Level : at center of its dial
Conversion Factor : Multiply by 1.0 E+02 - Pa unit

Description of UUC :

Range : 990 - 1030 mbar Absolute
Calibration Range : 990 - 1030 mbar Absolute
Scale Interval : 1 mbar
Resolution : 0.5 mbar Absolute

Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P220104 for Reference Pressure Monitor Serial No. 1598, Due 11-Nov-23

End of Certificate

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CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15ACX9C Reference Number: 82-401135335-1
Cylinder Number: EB0062815 Cylinder Volume: 144.4 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2015 PSIG
PGVP Number: B52018 Valve Outlet: 660
Gas Code: CO, NO, NO₂, SO₂, BALN Certification Date: Mar 13, 2018
Expiration Date: Mar 13, 2026

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012); document EPA 82-401135335-1. 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 volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	50.55 PPM	G1	+/- 1.4% NIST Traceable	03/06/2018, 03/13/2018
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	+/- 1.4% NIST Traceable	03/06/2018, 03/13/2018
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	+/- 1.0% NIST Traceable	03/06/2018, 03/13/2018
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	+/- 1.0% NIST Traceable	03/06/2018
NITROGEN	Balance				

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTRM	16060607	CC42564	Jun 27, 2020
PRM	12367	APEX1099237	Jun 02, 2017
GMS	0315201604	CC503358	Mar 15, 2019
NTRM	16011025	CC473218	Jun 07, 2022
NTRM	12060735	CC356192	Dec 14, 2026

The SRM, PRM or RGM 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 APW1100391 CO	FTIR	Feb 08, 2018
Nicolet 6700 APW1100391 NO	FTIR	Feb 15, 2018
Nicolet 6700 APW1100391 NO ₂	FTIR	Feb 16, 2018
Nicolet 6700 APW1100391 SO ₂	FTIR	Mar 01, 2018

Triad Data Available Upon Request

NOTES-NET WEIGHT: 10.43lbs
GROSS WEIGHT: 60.93lbs
PO# 5218000763

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate. All samples are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 3082.05

Don Morris
Approved for Release

GAS CHROMATOGRAPH

MODEL : GC-2010 Plus AF

S/N : C12095200986

Operational Qualification Record

Operational Qualification

Performer (signature): *Ch* Date: 15 / 03 / 2022

Reviewer (signature): *[Signature]* Date: 25 / 8 / 22

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Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

☒ Applicable ☐ Not Applicable☒ Single ☐ Dual system, main injector

Component ID		Model Name	AOC-20i	
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 8 0 4		
No.	Item	Criteria	Results	Pass/Fail
1	Display, LED test	Verify the display and LED operation.	All LEDs light, except decimal point.	<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000".	<input checked="" type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	<input checked="" type="checkbox"/>
4	Basic operation test	The version number matches the controlled version number.	Version No. Controlled Ver. No.	<input checked="" type="checkbox"/>
		Verify that the auto injector basic operation is correct.	Sample injected into the GC and GC operation starts.	<input checked="" type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name	AOC-20i	
Serial No. (S/N)				
No.	Item	Criteria	Results	Pass/Fail
1	Display, LED test	Verify the display and LED operation.	All LEDs light, except decimal point.	<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000".	<input type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	<input type="checkbox"/>
4	Basic operation test	The version number matches the controlled version number.	Version No. Controlled Ver. No.	<input type="checkbox"/>
		Verify that the auto injector basic operation is correct.	Sample No.1 transferred to the main injector, sample No. 2 transferred to the sub-injector. Sub-injector injects into the GC simultaneously with the main AOC.	<input type="checkbox"/>

Performer (signature):

Date: 25 / 07 / 2022

Reviewer (signature):

Date: 25 / 8 / 22

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Component ID		Model Name	AOC-20s	
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 9 1 0		
No.	Item	Criteria	Results	Pass/Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.	LED lights green, not red.	<input checked="" type="checkbox"/>
2	Firmware version check	Verify the program version.	Version number is displayed.	<input checked="" type="checkbox"/>
		The version number matches the controlled version number.	Version No. Controlled Ver. No.	<input checked="" type="checkbox"/>

GAS CHROMATOGRAPH

Model. : GC-2010 PLUS AF

Serial No. : C12095200986

1-2 Scope

This Operational Qualification shall apply to the equipment installed at the following site.

(Address): 602 Moo 11 Sukhaphiban 78 Rd Nongkhuaeng Siachua (Kasaburi 20110)
(Company): Eastern Thai Consulting 1992 Co., Ltd.
(Department):
(Installation Site): Instrument Room GC/IC
(Equipment ID No.): Gas Chromatograph LABE 0419
(Product Model Name): GC-2010 Plus /AOC-201 /AOC-204

ZEMC-3379F

Document No.008-TH-6007-0623

SHIMADZU GAS CHROMATOGRAPH SYSTEM
GC-2010Plus Series

Operational Qualification

Operational Qualification Report

System Name
System ID No. Gas Chromatograph LABE 0419
Installation Site Instrument Room GC/IC

The undersigned performer reports that the Operational Qualification Protocol has been successfully completed for the system stated above.

• Performer

Signature Jhu Date 16 / 02 / 2023
Print Thummal Pumpaka
Title Service Engineer
Company Parascientific Co., Ltd.

The undersigned reviewer and manager report that the performer has completed the Operational Qualification Protocol successfully.

• Reviewer

Signature Pongvipar Date 16 / 02 / 2023
Print Pongvipang Bunnayayon
Title Scientist
Company Eastern Thai Consulting 1992 Co., Ltd.

• Manager

Signature Pongvipar Date 16 / 02 / 2023
Print Nuanaphul Bothumtad
Title HS
Company Eastern Thai Consulting 1992 Co., Ltd.

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Performer (signature): Jhu Date: 16 / 02 / 2023
Reviewer (signature): Pongvipar Date: 16 / 02 / 2023

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Operational Qualification

Operational Qualification Record

3. Operational Qualification Record

If the unit is included in the system to be inspected, place a checkmark in the "Applicable" box. If the unit is not included in the system, place a checkmark in the "Not Applicable" box. Enter a diagonal line in the Pass/Fail checkbox for "Not applicable" items.
Here, inspection results are recorded along the procedure of Chapter 4 in Operational Qualification Protocol.

Component ID		Model Name		GC-2010Plus A.E.	
Serial Number (S/N)		LA06 0419		C 1 2 0 9 k 2 0 0 9 3 6	
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	All LEDs light. Screen contrast adjustment is possible.	LED Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Standard self-diagnostic test	"Good" displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Ver. 2.10.40 Build No.: 2.10.40 Version: 2.10.40	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Temperature test	Verify that temperature control is normal. TEMP LED lights green.	Displayed actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$. Temperature controller <input checked="" type="checkbox"/> COOL <input checked="" type="checkbox"/> INJ1 <input checked="" type="checkbox"/> INJ2 <input checked="" type="checkbox"/> DET1 <input checked="" type="checkbox"/> DET2 <input checked="" type="checkbox"/> AUX3 <input checked="" type="checkbox"/> AUX4 <input checked="" type="checkbox"/> AUX5	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure. Inspection pressure gauge reading $\pm 200.0 \pm 20.0\text{kPa}$ Inspection pressure gauge reading $\pm 200.0 \pm 20.0\text{kPa}$ Inspection pressure gauge reading $\pm 500.0 \pm 35.0\text{kPa}$	Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 16 / 03 / 2023

Reviewer (signature):

Date: 18 / 3 / 2023

Operational Qualification

Operational Qualification Record

No.	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Verify that the pressure program operates normally. Monitored pressure 6 minutes after start $250.0 \pm 5.0\text{kPa}$ Inspection pressure gauge reading 8 minutes after start $250.0 \pm 20.0\text{kPa}$	$250.0 \pm 5.0\text{kPa}$ $250.0 \pm 20.0\text{kPa}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Flowrate test	Verify the accuracy of the full-flow and septum purging. Septum purge vent measured flow rate $3.0 \pm 1.0\text{mL/min}$ Total of septum purge and split vent flow rate values $10.0 \pm 3.0\text{mL/min}$ Total of septum purge and split vent flow rate values $200 \pm 20\text{mL/min}$	Septum purge $3.0 \pm 1.0\text{mL/min}$ Split vent $1.0 \pm 0.5\text{mL/min}$ Total $4.0 \pm 1.5\text{mL/min}$ Split vent $1.0 \pm 0.5\text{mL/min}$ Total $200 \pm 20\text{mL/min}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column over test	Verify the accuracy of the column over temperature. Inspection temperature Temp. sensor reading Corrected temp. value Temp. correction value Inspection temperature Temp. sensor reading Corrected temp. value Temp. correction value Inspection temperature Temp. sensor reading Corrected temp. value Temp. correction value	Temp. correction value -1.0°C Temp. sensor reading 51.1°C Corrected temp. value -0.9°C Temp. correction value 1.4°C Temp. sensor reading 50.1°C Corrected temp. value -1.1°C Temp. correction value -1.1°C Temp. sensor reading 52.4°C Corrected temp. value 2.0°C Temp. correction value 2.0°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify that the column temperature program operates normally. Monitored temperature 6 minutes after start $200 \pm 1^{\circ}\text{C}$ Inspection temperature reading 8 minutes after start $200.0 \pm 4.1^{\circ}\text{C}$ Using a temperature sensor with 1°C minimum display increment $200 \pm 3^{\circ}\text{C}$	Monitored temperature 6 minutes after start $200 \pm 1^{\circ}\text{C}$ Inspection temperature reading 8 minutes after start $200.0 \pm 4.1^{\circ}\text{C}$ Using a temperature sensor with 1°C minimum display increment $200 \pm 3^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity. FID (Applicable) Not Applicable Calculated S value Inj. unit (50.1) Make-up gas: N_2 $10.0 \times 10^{-3}\text{C/g min.}$ Make-up gas: He $7.00 \times 10^{-3}\text{C/g min.}$ TCD (Applicable) Not Applicable Calculated S value Inj. unit (4.00) $10^{-3}\text{mV}\cdot\text{mL/mg min.}$	C10AREA value 4.1498 Calculated S value $1.490 \times 10^{-3}\text{C/g}$ C10AREA value Flowrate at vent Calculated S value	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 16 / 03 / 2023

Reviewer (signature):

Date: 18 / 3 / 2023

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

☒ Single ☐ Dual system, main injector☒ Applicable ☐ Not Applicable

<input checked="" type="checkbox"/> Single <input type="checkbox"/> Dual system, main injector		Model Name		AOC-20i	
Component ID					
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 3 0 9			
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test	Verify the display and LED operation.		All LEDs light, except decimal point.	<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.			
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No.	<input checked="" type="checkbox"/>
		The version number matches the controlled version number.		Controlled Ver. No.	
4	Basic operation test	Verify that the auto injector basic operation is correct.		Sample injected into the GC and GC operation starts.	<input checked="" type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)					
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test	Verify the display and LED operation.		Display:	Pass
2	ROM , RAM self diagnosis	Verify that ROM and RAM memory operates normally.			
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No.	Pass
		The version number matches the controlled version number		Controlled Ver.No.	
4	Basic operation test	Verify that the auto injector basic operation is correct.		Sample No.1 transferred to the main injector, sample No. 2 transferred to the sub-injector. Sub-injector injects into the GC simultaneously with the main AOC.	

Performer (signature): *Jim* Date: 16 / 02 / 2023Reviewer (signature): *Timothy W. Jones* Date: 18 / 2 / 2023

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 9 1 0			
No.	Item	Criteria		Results	Pass/Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.		LED lights green, not red.	Pass
2	Firmware version check	Version number is displayed.	Version No. Controlled Ver. No.		
		The version number matches the controlled version number.		3 410	Pass

Performer (signature): *Jim* Date: 16 / 02 / 2023Reviewer (signature): *Timothy W. Jones* Date: 18 / 2 / 2023

Primary Flow Calibrator

Serial No. : 110619 , 207510

Certificate No : 23-AFM-022

Unit Under Calibration Details		
Measurement Item	: Primary Flow Calibrator	Sensor Model : -
Manufacturer	: BIOS	Sensor Serial Number : -
Model	: Defender 510-L	
Serial Number	: 110619	
ID	: ~	

Calibration Environment and Details

Calibration Date : 01/01/2017

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gillibrator 3 Low flow	18501010006	Sensidyne	15 June 2023
Air Flow Meter	Gillibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023

Traceability: *Traceability provides traceability of measurement to recognized national standard, and to the realization of the international System of units, as appropriate.*

Note :

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

Approved By : Mr. Pacit Mathavom
Calibration Engineer Supervisor
Issue Date : 6 February 2023

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

FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-AFM-022

Flow Setting	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty
(L/min)	(L/min)	(L/min)	(L/min)	(L/min)
0.02	0.02018	0.020259	-0.00008	0.00032
0.05	0.05041	0.050541	-0.00013	0.00083
0.1	0.1025	0.10153	0.0010	0.0015
0.25	0.2519	0.25043	0.0015	0.0036
0.5	0.5023	0.50069	0.0016	0.0072

Unit Under Calibration

End of Certificate

Certificate of Calibration

Certificate No : 23-AFM-024

Request No : Req-2023-0196

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11, Sukhapbarn 8 Rd., Nongkharn, Sriracha, Chonburi 20230

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator
Manufacturer : Mesa Labs
Model : Defender 510-M
Serial Number : 207510
ID : -
Sensor Model : -
Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 25 January 2023
Calibration Date : 6 February 2023

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023

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 %.

Calibration By :

Mr.

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr.

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date :

6 February 2023

Certificate No : 23-AFM-024

Request No : Req-2023-0196

Result of Calibration :

Calibration Point (cc/min)	STD Flow Reading (cc/min)	UUC Flow Reading (cc/min)	Correction Flow (cc/min)	Uncertainty (±) (cc/min)
500	501.1	506.43	-5.3	7.2
1000	1019	1032.2	-13	15
2000	2003	2017.8	-15	29
3000	3007	3023.8	-17	43
4000	4013	4027.2	-15	57

Note

STD : Standard

UUC : Unit Under Calibration

End of Certificate

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SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34302326

SITHIPIORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com <http://www.sithiporn.com>



Cert. No. : ACC23013
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR

Manufacturer : RION

Model : NC-75

Serial No.: 34302326

ID No.:

Condition As Found : GOOD

Customer :

EASTERN THAI CONSULTING 1992 CO., LTD.
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

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

Received Date : 10 MAY 2023
Calibration Date : 19 MAY 2023
Date of Issue : 24 MAY 2023

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

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.

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SITHIPIORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC23013
Job No. : VC66AC0058
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by based on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/0267	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

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).

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Continuation of Calibration Certificate

Cert. No. : ACC23013
Job No. : VC66AC0058
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	94.03	0.03	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.32	0.10	3.0

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

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SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230994



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0343

MTC No. EEL BP. 156/0266

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd..
Address : 683 Moo 11 Sukhaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : Rion
Model : NL-52A
Serial No. : 00230994
Microphone : Type UC-59 No.22777
Preamplifier : Type NH-25 No.22430

Ambient Environment

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

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
7. Pistonphone Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 27 Feb. 2023

Date of Calibration : 21-23 Mar. 2023

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

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 R

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0243

MTC No. EEL BP. 156/0266

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 21-23 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0343

MTC No. EEL, BP. 156/0266

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.89	114.1	113.9	0.0	0.7	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 123.7 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.5	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	10.5	0.10	N/A
C-Weight	14.8	0.10	N/A
Flat	20.4	0.10	N/A

Date of Calibration : 21-23 Mar. 2023

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FM.BLMTC.002 R

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0343

MTC No. EEL, BP. 156/0266

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.0	0.1	0.0	±1.0	0.45	0.6
1 000	-0.5	-0.5	-0.5	±0.7	0.45	0.6
8 000	0.0	0.0	-0.1	+1.5; -2.5	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-0.1	-0.1	0.0	±1.0	0.20	0.6
125	0.1	0.0	0.0	±1.0	0.20	0.6
250	-0.1	0.0	0.0	±1.0	0.20	0.6
500	0.0	0.0	0.0	±1.0	0.20	0.6
1 000	0.0	0.0	0.0	±0.7	0.20	0.6
2 000	0.0	0.0	0.0	±1.0	0.20	0.6
4 000	0.0	0.0	0.0	±1.0	0.20	0.6
8 000	0.0	0.0	0.0	+1.5; -2.5	0.20	0.7
16 000	-1.3	-1.4	0.0	+2.5; -16.0	0.20	0.7

Date of Calibration : 21-23 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 156/0266

Request No. 21-66/0343

5. Long-term stability

Time	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	94.0	0.0	0.1	0.10	0.1
End	94.0				

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	0.1	0.2	0.20	0.2

6.2 Time weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

Date of Calibration : 21-23 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 156/0266

Request No. 21-66/0343

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137.1	0.1	0.8	0.30	0.3
136	136.1	0.1	0.8	0.30	0.3
135	135.1	0.1	0.8	0.30	0.3
134	134.1	0.1	0.8	0.30	0.3
133	133.1	0.1	0.8	0.30	0.3
132	132.0	0.0	0.8	0.30	0.3
131	131.1	0.1	0.8	0.30	0.3
130	130.1	0.1	0.8	0.30	0.3
129	129.1	0.1	0.8	0.30	0.3
124	124.0	0.0	0.8	0.30	0.3
119	119.0	0.0	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
89	89.0	0.0	0.8	0.30	0.3
84	84.0	0.0	0.8	0.30	0.3
79	79.1	0.1	0.8	0.30	0.3

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

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
74	74.1	0.1	0.8	0.30	0.3
69	69.0	0.0	0.8	0.30	0.3
64	64.0	0.0	0.8	0.30	0.3
59	59.0	0.0	0.8	0.30	0.3
54	53.9	-0.1	0.8	0.30	0.3
49	49.0	0.0	0.8	0.30	0.3
44	44.0	0.0	0.8	0.30	0.3
39	39.0	0.0	0.8	0.30	0.3
34	34.0	0.0	0.8	0.30	0.3
29	29.0	0.0	0.8	0.30	0.3
28	28.0	0.0	0.8	0.30	0.3
27	27.0	0.0	0.8	0.30	0.3
26	25.9	-0.1	0.8	0.30	0.3
25	24.9	-0.1	0.8	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	0.8	0.00	0.3

Date of Calibration : 21-23 Mar. 2023

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8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35	35.0	0.0	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±0.5	0.20	0.3
	2	108.9	-0.1	+1.0; -1.5	0.20	0.3
	0.25	99.9	-0.1	+1.0; -3.0	0.20	0.3
Slow	200	119.6	0.0	±0.5	0.20	0.3
	2	100.0	0.0	+1.0; -3.0	0.20	0.3
	200	120.0	0.0	±0.5	0.20	0.3
SEL	2	100.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	90.8	-0.2	+1.0; -3.0	0.20	0.3

Date of Calibration : 21-23 Mar. 2023

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MTC No. EEL. BP. 156/0266

Request No. 21-66/0343

10. Peak C sound level


Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.4	0.0	2.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	1.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	1.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
136.5	136.5	0.0	1.5	0.20	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	129.0	0.0	0.1	0.10	0.1
End	129.0				

Calibrated by 
(Mr. Pannasit Phasingri)

Approved by : 
(Mr. Prawat Klaiyapa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 21-23 Mar. 2023

Date of Issue : 23 Mar. 2023

Ref. 2011266022700825009

End of Certificate

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SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230987



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 150/0266

Request No. 21-66/0343

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
Address : 683 Moo 11, Sukhaphibarn 8 Rd., Nongkham, Sriracha, Chonburi, 20230
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A. Muang, Samutprakan 10280.

Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : Rion
Model : NL-52A
Serial No. : 00230987
Microphone : UC-59 No.22221
Preamplifier : NH-25 No.22423

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Digital Multimeter Fluke 8520A S/N 4985007.
6. Digital Multimeter Rion NC-72 S/N 00402446.
8. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 27 Feb. 2023

Date of Calibration : 23 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0343

MTC No. EEL. BP. 150/0266

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

Calibration Procedure :

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

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

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

Date of Calibration : 23 Mar. 2023

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.92	114.0	113.9	0.0	0.7	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.8 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
16.4	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	10.7	0.10	N/A
C-Weight	14.9	0.10	N/A
Flat	20.6	0.10	N/A

Date of Calibration : 23 Mar. 2023

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.6	0.6	0.6	+1.0	0.45	0.6
1 000	-0.4	-0.3	-0.3	+0.7	0.45	0.6
8 000	0.7	0.6	0.6	+1.5 ; -2.5	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	-0.1	0.0	0.0	±1.0	0.20	0.6
125	-0.1	0.1	0.0	±1.0	0.20	0.6
250	-0.1	0.1	0.0	±1.0	0.20	0.6
500	0.0	0.1	0.0	±1.0	0.20	0.6
1 000	0.0	0.0	0.0	±0.7	0.20	0.6
2 000	0.0	0.0	0.0	±1.0	0.20	0.6
4 000	0.0	0.0	0.0	±1.0	0.20	0.6
8 000	0.0	0.1	0.0	+1.5 ; -2.5	0.20	0.7
16 000	0.0	0.0	0.0	+2.5 ; -16.0	0.20	1.0

Date of Calibration : 23 Mar. 2023

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E-mail : mtr@tistr.or.th

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E-mail : sumalee@tistr.or.th

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5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

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

6.2 Time weightings at 1 kHz

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

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
135	134.2	-0.8	0.8	0.30	0.3
134	133.3	-0.7	0.8	0.30	0.3
133	132.5	-0.5	0.8	0.30	0.3
132	131.6	-0.4	0.8	0.30	0.3
131	130.6	-0.4	0.8	0.30	0.3
130	129.7	-0.3	0.8	0.30	0.3
129	128.8	-0.2	0.8	0.30	0.3
124	123.9	-0.1	0.8	0.30	0.3
119	119.0	0.0	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
89	89.1	0.1	0.8	0.30	0.3
84	84.0	0.0	0.8	0.30	0.3
79	79.0	0.0	0.8	0.30	0.3
74	74.0	0.0	0.8	0.30	0.3

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FM.BLMTC.002 Rev.1

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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
69	69.0	0.0	0.8	0.30	0.3
64	63.9	-0.1	0.8	0.30	0.3
59	59.0	0.0	0.8	0.30	0.3
54	53.9	-0.1	0.8	0.30	0.3
49	49.0	0.0	0.8	0.30	0.3
44	43.9	-0.1	0.8	0.30	0.3
39	38.9	-0.1	0.8	0.30	0.3
34	33.9	-0.1	0.8	0.30	0.3
29	29.0	0.0	0.8	0.30	0.3
28	28.0	0.0	0.8	0.30	0.3
27	27.0	0.0	0.8	0.30	0.3
26	26.0	0.0	0.8	0.30	0.3
25	25.0	0.0	0.8	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	0.8	0.30	0.3

Date of Calibration : 23 Mar. 2023

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8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	35	35.0	0.0	0.8	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±0.5	0.20	0.3
	2	109.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	99.9	-0.1	+1.0; -3.0	0.20	0.3
Slow	200	119.6	0.0	±0.5	0.20	0.3
	2	100.0	0.0	+1.0; -3.0	0.20	0.3
	200	120.0	0.0	±0.5	0.20	0.3
SEL	2	100.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	91.0	0.0	+1.0; -3.0	0.20	0.3

Date of Calibration : 23 Mar. 2023

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Request No. 21-66/0343

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.4	0.0	2.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	1.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	1.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class I (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
136.5	136.5	0.0	1.5	0.20	0.25

12. High-level stability

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

Calibrated by:

Wittawat Supanich

(Mr. Wittawat Supanich)

Approved by:

Prasit Kiatkanya
(Mr. Prasit Kiatkanya)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 23 Mar. 2023

Date of Issue : 23 Mar. 2023

Ref : 2011266022700825003

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E-mail : sumalee@tistr.or.th

SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322754



Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00322754 / 196477 / 15486
ID No.: -

Condition As Found : GOOD

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

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

Received Date : 02 MAY 2023
Calibration Date : 02-04 MAY 2023
Date of Issue : 05 MAY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thanakul Petchurai)

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Calibration Procedure : CP-AC-01

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	EP-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EP-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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).

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Job No. : VC66AC0047
Pages : 3 of 8

Cert. No. : ACL23143
Job No. : VC66AC0047
Pages : 4 of 8

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	-	-	-	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	16.3
Flat	22.2

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)		
	Flat	C-weight	A-weight
125	0.2	0.2	0.2
1000	0.0	0.0	0.0
8000	0.0	0.1	0.1
			Acceptance Limits
			±1.5
			±1.0
			±5.0

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Cert No. : ACL23143
Job No. : VC66AC0047
Pages : 5 of 8Cert No. : ACL23143
Job No. : VC66AC0047
Pages : 6 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	-0.1	-0.1	±2.0
125	0.0	0.0	±1.5
250	0.0	0.0	±1.5
500	0.0	0.0	±1.5
1000	0.0	0.0	±1.0
2000	0.0	0.0	±2.0
4000	0.0	0.0	±3.0
8000	0.0	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
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	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 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
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

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Cert. No. : ACL23143
Job No. : VC66AC0047
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)
Auto	94.0	94.0	0.0	±1.1

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	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±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	±3.0
One	136.4	136.4	0.0	±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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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Cert. No. : ACL23143
Job No. : VC66AC0047
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.3	89.5	-0.3	±1.5

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

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SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322747

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



NSC-TIS-17025
CALIBRATION 0394

Cert. No. : ACL23167
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00322747 / 196470 / 15479
ID No.:

Condition As Found : GOOD
Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

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

Received Date : 10 MAY 2023
Calibration Date : 17-18 MAY 2023
Date of Issue : 24 MAY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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Cert. No. : ACL23167
Job No. : VC66AC0058
Pages : 2 of 8

Calibration Procedure : CP-AC-01

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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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 :

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

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Pages : 3 of 8Cert. No. : ACL23167
Job No. : VC66AC0058
Pages : 4 of 8Summary 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	-	-	-	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

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.2
Flat	23.1

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)		
	Flat	C-weight	A-weight
125	0.3	0.3	0.3
1000	0.0	0.0	0.0
8000	0.2	0.2	0.2
Acceptance Limits			±1.5 ±1.0 ±5.0

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Continuation of Calibration Certificate

Cert. No. : ACL23167
Job No. : VC66AC0058
Pages : 5 of 8Cert. No. : ACL23167
Job No. : VC66AC0058
Pages : 6 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	-0.1	-0.1	±2.0
125	0.0	0.0	±1.5
250	0.0	0.0	±1.5
500	0.0	0.0	±1.5
1000	0.0	0.0	±1.0
2000	0.0	0.0	±2.0
4000	0.0	0.0	±3.0
8000	0.0	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	±1.1
136.0	136.0	0.0	±1.1
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
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	24.9	-0.1	±1.1

Continuation of Calibration Certificate

Cert. No. : ACL23167
Job No. : VC66AC0058
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)
Auto	94.0	94.0	0.0	±1.1

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	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±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	±3.0
One	136.4	135.9	-0.5	±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	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23167
Job No. : VC66AC0058
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.5	89.5		

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

COPY

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NOISE DOSI METER

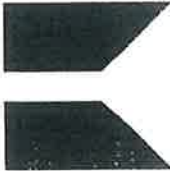
MODEL : CR:110A

SERIAL No. : CB0958

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 12 January 2023 CERTIFICATE NUMBER 185811



Cirrus Research plc
Acoustic House
Bridlington Road
Hummanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory
N. Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes:

Model: CR:110A

Serial number: CB0958

Firmware version: 5.4

Test summary

Date of calibration: 11 January 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTi	TG4001	395851
Attenuator	Cirrus Research	ZE:952	52200
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

Eastern Thai Consulting 1992 Co.,Ltd. 683 Moo.11 , Sukaphibal 8 Rd., Nongkham , Sriracha , Chonburi 20230

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CERTIFICATE OF CALIBRATION

Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 99.16 kPa Temperature: 22.3 °C Humidity: 44.0 %
After Pressure: 99.15 kPa Temperature: 22.4 °C Humidity: 43.1 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0956

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 12 January 2023 CERTIFICATE NUMBER 185821



Cirrus Research plc
Acoustic House
Bridlington Road
Hummanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2
Approved signatory
N Smith
Electronically signed:

N.D. Smith

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Notes:

Manufacturer: Cirrus Research plc

Model: CR:110A

Serial number: CB0956

Firmware version: 5.4

Test summary

Date of calibration: 11 January 2023

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTI	TG4001	395851
Attenuator	Cirrus Research	ZE:952	52200
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

Eastern Thai Consulting 1992 Co., Ltd. 683 Moo.11 , Sukaphibal 8 Rd., Nongkham , Sriracha , Chonburi 20230

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CERTIFICATE OF CALIBRATION

Certificate Number:
185821

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 99.16 kPa Temperature: 22.3 °C Humidity: 43.9 %
After Pressure: 99.16 kPa Temperature: 22.4 °C Humidity: 43.4 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

COPI

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0954

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 12 January 2023 CERTIFICATE NUMBER 185813



Cirrus Research plc
Acoustic House
Bridlington Road
Hummanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2
Approved signatory
N.Smith
Electronically signed:

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes:
Model: CR:110A
Serial number: CB0954
Firmware version: 5.4

Test summary

Date of calibration: 11 January 2023
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	TTI	TG4001	395851
Attenuator	Cirrus Research	ZE-952	52200
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

Eastern Thai Consulting 1992 Co.,Ltd. 683 Moo.11 , Sukaphibal 8 Rd., Nongkham , Sriracha , Chonburi 20230

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CERTIFICATE OF CALIBRATION

Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 99.13 kPa Temperature: 22.3 °C Humidity: 43.2 %
After Pressure: 99.11 kPa Temperature: 22.3 °C Humidity: 43.4 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0957

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **12 January 2023** **CERTIFICATE NUMBER 185809**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2
Approved signatory
N.Smith
Electronically signed:



Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Notes:

Manufacturer: **Cirrus Research plc**
Model: **CR:110A**
Serial number: **CB0957**
Firmware version: **5.4**

Test summary

Date of calibration: **12 January 2023**

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	92610

Notes

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CERTIFICATE OF CALIBRATION

Environmental conditions

The following conditions were recorded at the time of the test:

Before Pressure: 98.97 kPa Temperature: 21.1 °C Humidity: 37.2 %
After Pressure: 98.96 kPa Temperature: 21.3 °C Humidity: 38.0 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Frequency weighting	Complies

Certificate Number:
185809

Page 2 of 2

COPY

ANALYTICAL BALANCE (DU)

Model. : XS205DU

Serial No. : 1126323724



Certificate No. : 23-006683
Sample Code : 23-02820-006

Page 1 of 4

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Siriracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by : Mr. Thanadol Phoithep
Scientist

Issue date : 25 January 2023

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)



Certificate No. : 23-006683
Sample Code : 23-02820-006

Page 2 of 4

REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE
Manufacturer : METTLER TOLEDO
Model : XS205DU
Capacity : Max 81 g / 220 g
Resolution : 0.01 mg / 0.1 mg
Serial No. : 1126323724
ID No. : LABE 05/1

Result of Calibration

1. Test weight and repeatability of reading

Repeatability is a measure of the ability of a balance to supply the same result in repetitive weighings with one and the same load under the same measurement condition. The measurement of the repeatability must include both the balance specifications and the ambient (vibration, fluctuating air current/temperature/humidity, etc.) Operator handling of the balance is also included in the standard deviation.

Unit : g	Range : 80	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	40	80
<input type="checkbox"/> Adjustment	Standard weight	40.000042	80.000045
	Average reading of indicator	40.000015	80.000018
	Standard deviation	0.0000004	0.0000007
Unit : g	Range : 200	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000189
	Average reading of indicator	100.00001	200.00004
	Standard deviation	0.000004	0.000008

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Certificate No. : 23-006683
Sample Code : 23-02820-006

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g		Range : 200	
Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.99800	0	0.9980
40	0.99800	100	0.9980
80	0.99800	200	0.9980

3. Departure of indication from nominal value, Linearity

Unit : g					
Nominal	Standard	Average Reading	Correction	Expanded	Coverage
Value	Value	of Indicator	Value	Uncertainty	Factor (k)
Unload	0.000000	0.00000	0.00000	0.0000090	2.01
0.01	0.0100036	0.01000	0.00000	0.0000093	2.01
0.1	0.1000062	0.10000	0.00001	0.000012	2.00
1	1.0000036	1.00001	-0.00001	0.000014	2.00
5	5.0000044	5.00003	-0.00003	0.000020	2.00
10	10.000000	10.00007	-0.00007	0.000032	2.00
20	20.000016	20.00011	-0.00009	0.000036	2.00
50	50.000029	50.00013	-0.00010	0.000067	2.00
100	100.000022	100.0001	-0.0001	0.00016	2.00
150	150.000051	150.0001	0.0000	0.00023	2.00
200	200.000199	200.0003	-0.0001	0.00028	2.00

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

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Certificate No. : 23-006683
Sample Code : 23-02820-006

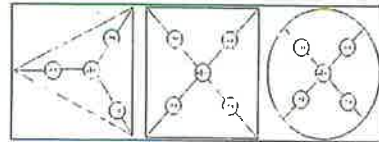
REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

Weighing pan		Test weight : 50 and 100	
Unit : g		Unit : g	
Range	Position	Reading of indicator	Reading of indicator
80	1	50.00014	100.0001
	2	50.00014	99.9998
	3	50.00006	100.0000
	4	50.00010	100.0001
	5	50.00017	100.0001
	6	50.00014	100.0001
Maximum difference		0.00003	0.0003



Condition of Calibration

1. Calibration Method : W/CL-004 base on UKAS LAB 14: 2019

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

3. Condition of Calibration item: Normal

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

- Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

5. Reference standard instrument :

Instrument : 1) STANDARD WEIGHT 1 mg to 1 kg

Class : E2

Certificate No. : 22-060639

Due Date : 27 June 2023

Ambient conditions	Min	Max
Temperature (°C)	21.3	22.4
Relative Humidity (%Rh)	38.2	40.4
Air pressure (hPa)	1008.4	1010.1

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ANALYTICAL BALANCE

Model. : SECURA224-1S

Serial No. : 0036707137



Certificate No. : 23-006682

Sample Code : 23-02820-005

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Analytical Balance Room)

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 20 January 2023

Date of Calibration : 20 January 2023

Calibrated by : Mr. Thanadol Pholthep
Scientist

Issue date : 25 January 2023

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).



Certificate No. : 23-006682

Sample Code : 23-02820-005

REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Capacity : Max 220 g

Resolution : 0.0001 g

Serial No. : 0036707137

ID No. : LABE 05/2

Result of Calibration

1. Test weight and repeatability of reading

Repeatability is a measure of the ability of a balance to supply the same result in repetitive weighings with one and the same load under the same measurement condition. The measurement of the repeatability must include both the balance specifications and the ambient (vibration, fluctuating air current/temperature/humidity, etc.) Operator handling of the balance is also included in the standard deviation.

Unit : g	Range : 220	Before adjustment	After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000022	200.000199
	Average reading of indicator	99.9998	199.9999
	Standard deviation	0.00007	0.00007

Unit : -	Range : -	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	-	-
<input type="checkbox"/> Adjustment	Standard weight	-	-
	Average reading of indicator	-	-
	Standard deviation	-	-

COPY

Certificate No. : 23-006682

Sample Code : 23-02820-005

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g

Range :		Range :	
Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.9980		
100	0.9980		
200	0.9980		

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.0000	0.0000	0.00011	2.04
0.01	0.0100036	0.0100	0.0000	0.00011	2.04
0.1	0.1000062	0.1000	0.0000	0.00011	2.04
1	1.0000036	1.0000	0.0000	0.00011	2.04
2	2.0000128	2.0000	0.0000	0.00011	2.04
5	5.0000044	5.0000	0.0000	0.00011	2.04
10	10.0000000	10.0000	0.0000	0.00011	2.03
20	20.0000016	20.0000	0.0000	0.00012	2.03
50	50.0000029	50.0000	0.0000	0.00013	2.02
100	100.0000022	99.9998	0.0002	0.00017	2.01
200	200.0000199	200.0000	0.0002	0.00028	2.00

The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.



Certificate No. : 23-006682

Sample Code : 23-02820-005

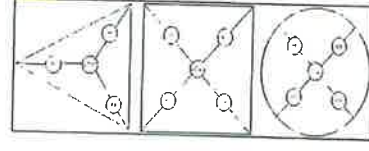
REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

Weighing pan		Test weight : 100	
		Unit : g	
Range	Position	Reading of indicator	Reading of indicator
220			
1		99.9998	
2		100.0001	
3		99.9997	
4		99.9998	
5		99.9998	
6		99.9998	
Maximum difference		0.0003	



Condition of Calibration

1. Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019

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

3. Condition of Calibration item: Normal

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

- Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).

5. Reference standard instrument

Instrument

1) STANDARD WEIGHT 1 mg to 1 kg

Class

E2

ID No.

LB-WE-57

Certificate No.

22-060639

Due Date

27 June 2023

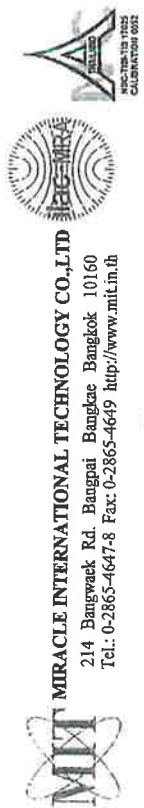
Ambient conditions		Min	Max
Temperature (°C)		21.2	22.5
Relative Humidity (%Rh)		37.1	44.3
Air pressure (hPa)		1072.1	1073.0

- End of Report -

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



MIRACLE INTERNATIONAL TECHNOLOGY CO., LTD
214 Bangwaek Rd. Bangpai Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



CALIBRATION CERTIFICATE

Certificate No. : L202305085-002
Date Issued : 16-May-23

Customer : Eastern Thai Consulting 1992 Co., Ltd.
683 Moo 11 Sukhapibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Equipment : Analog Barometer

Manufacturer : Barigo
Model : -
Serial No. : -
ID No./Tag No. : BM001/41
Date Received : 11-May-23
Date Calibrated : 15-May-23

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-21 base on DKD-R 6-1: Edition 3 2014.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by:



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Certificate No : L202305085-002
Environment Ambient Temperature : (25 ± 2)°C
Relative Humidity : (50 ± 15)%RH

STD Reading	UUC Reading (mbar)	UUC Reading (mbar)	UUC Error	Uncertainty
mbar	Before Adjusted	After Adjusted	mbar	± mbar
990.00	990.0	-	0.00	0.61
1000.00	1000.0	-	0.00	0.61
1010.00	1010.0	-	0.00	0.61
1020.00	1020.0	-	0.00	0.61
1030.00	1030.0	-	0.00	0.61

STD = Standard

UUC = Unit Under Calibration

Calibrated condition : Pressure Medium Air : Density = 1.19 kg/m³ @ 20°C, 1 bar
Mounting Position Vertical
Reference Level at center of its dial
Conversion Factor Multiply by 1.0 E+02 - Pa unit

Description of UUC :

Range 990 - 1030 mbar Absolute
Calibration Range 990 - 1030 mbar Absolute
Scale Interval 1 mbar
Resolution 0.5 mbar Absolute

Condition As-Received : Used Item
The measurement results and statements of conformity with specification only relate to the item calibrated.
Measurement Standards Used & Traceability :

The International System of Units (SI) through
IRPC Certificate No. CL1-P220104 for Reference Pressure Monitor Serial No. 1598, Due 11-Nov-23

End of Certificate

COPY

BOD INCUBATOR

ID No. : LABE 19/2



CERTIFICATE OF CALIBRATION

Certificate No. : 22-136844
Sample Code : 22-51164-006

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhaphan 8 Rd., Nongkham,
Siracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)

Equipment : Temperature controlled enclosures (incubator)
Manufacturer : N/A
Model : N/A
Serial No. : S540040277
ID No. : LABE 19/2
Date of Receipt : 21 December 2022
Date of Calibration : 21 December 2022

Condition of Calibration

1. Environment	1.1 Ambient temperature	±	Maximum	25.1 °C	±	Minimum	24.3 °C
	1.2 Relative humidity	±	Maximum	52.3 %	±	Minimum	48.5 %
	1.3 Line voltage supplied	±	Maximum	223.6 VAC	±	Minimum	221.9 VAC

2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Date Acquisition With Sensor (RTD-P1100)	LB-DA-11 (RTD-148 to RTD-155, RTD-277)	22-040308	24 April 2023

4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Nathanan Phosri

Scientist

Approved by

(Mr. Somchai Neampunt)

Issue date

26 December 2022

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

361 Soi Ladprao 122, Ladprao Road,
Phlabphla, Wang Thonglang, Bangkok 10310
Rev.01

TEL 02-516-2422
FAX 02-516-6949
WWW.AMARC.CO.TH
Effective Date 15/10/21



REPORT OF CALIBRATION

Certificate No. : 22-136844
Sample Code : 22-51164-006

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{ref}		
20	20.0	20.0	19.65	19.56	19.47	19.29	20.96	20.47	20.23	20.58	20.29	0.35	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.13	1.09	1.90

Notes

UUC* = Unit Under Calibration

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Rev.09

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Phlabphla, Wang Thonglang, Bangkok 10310
Rev.01



REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 22-136844

Sample Code : 22-51164-006

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 60 cm ; D = 70 cm ; H = 124 cm
3. Air valve or fresh air level : Off
4. Fan level : open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

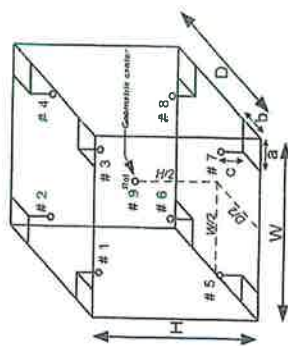


Figure: Example of sensor installation Positions

COPY

BOD INCUBATOR

ID No. : LABE 19/5



CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkhram,
Siracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)

Equipment : Temperature controlled enclosures (Incubator)
Manufacturer : Lovibond
Model : Tc445S
Serial No. : 0520/005227
ID No. : LABE 19/5
Date of Receipt : 21 April 2023
Date of Calibration : 21 April 2023

Condition of Calibration

1. Environment	1.1 Ambient temperature	Maximum	36.1 °C	Minimum	34.5 °C
	1.2 Relative humidity	Maximum	51.8 %	Minimum	49.3 %
	1.3 Line voltage supplied	Maximum	224.7 VAC	Minimum	221.9 VAC

2. Calibration method
TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-P100)	LB-DA-08 (RTD-239 to RTD-247)	22-077888	09 August 2023

4. This certificate is traceable to the international system of unit (SI Unit).
The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by : Mr. Sarawoot Thammo
Scientist

Issue date : 24 April 2023

(Mr. Somchai Neampunt)

Signed for Director

The uncertainties are for a confidence probability of approximately 95%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)

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Rev 01

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WWW.AMARC.CO.TH
Effective Date 15/11/21



REPORT OF CALIBRATION

Certificate No. : 23-040768
Sample Code : 23-16178-002

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{Ref}		
20	20.0	20.0	20.06	19.92	19.96	19.89	19.93	20.08	19.97	19.79	19.86	0.42	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.32	0.37	0.85

Notes

UUC* = Unit Under Calibration

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Phlabphla, Wang Thonglang, Bangkok 10310
FM-CL-018

REPORT OF CALIBRATION

Certificate No. : 23-040788
Sample Code : 23-16178-002
Page 3 of 3
NSC-TSL-TSL7025
CALIBRATION 0152

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 60 cm ; D = 56 cm ; H = 146 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

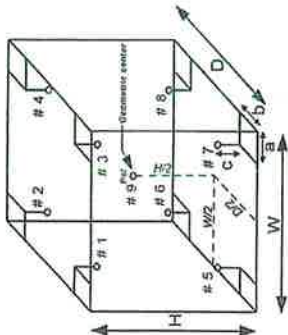


Figure-Example of sensor
installation Positions

The result expanded uncertainty of measurement, U , is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

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BOD INCUBATOR

Model : TC445S

Serial No. : 0223/007275

SK

S K SALES AND SERVICE CO.,LTD.
194/56, 194/57 Thakham Rd. Sornae Dom
Bong Khun Thion Bangkok 10150
Tel : 02-417-2144 Fax : 02-417-2155



Certificate of Calibration

Reference No. : C031902309-025
Customer : Eastern Thai Consulting 1992 Co.,Ltd.
683 Moo 11, Sukthaphiban 8, Tambol Nongkham,
Siracha District, Chonburi 20230, Thailand
Equipment : Incubator
Manufacturer : Lovibond
Model : TC455
Serial No. : 0223/007275
ID No. :
Received Date : 15 September 2023
Calibrated Date : 15 September 2023
Issued Date : 18 September 2023
Environment :

	Minimum Value	Maximum Value
Ambient Temperature (°C)	27.5	28.1
Relative Humidity (% RH)	57	58
AC Line Voltage (VAC)	224	226

Place Of Calibration : Production Line
Calibrated by : Mr. Teerasak Chaiyaporn

Calibration Method

In-house method : SK-WJ-23 base on Thai Laboratory Accreditation Scheme Publication Reference G-20

Condition of this result of calibration

- Reference standard instrument

Instrument	Serial No.	Certificate No.	Due Date
1) Data acquisition/Switch unit	MY4047397	L2305-268	4 November 2023
2) Multiplexer Module	MY41105123	L2305-268	4 November 2023
- This result of calibration was found accurate as shown on date and place of calibration only
- This certificate can be traceable to International System of Unit :

- Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by :

☒ Mr. Suphachai Saksri ☐ Mr. Phayak Toolit ☐ Miss Tanlaporn Pettong

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2.0$,providing a level of confidence level of approximately 95 %

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Certificate No. : S2309-3014

Page 2 of 2

Table1 General Information

Working Area (W*L*H)	60 *56 *145 cm
Fresh Air	OFF

Table2 Chamber Performance

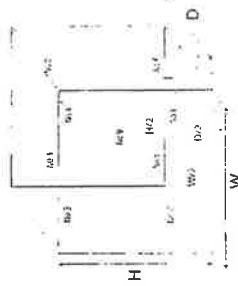
Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (± °C)	Measured Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.37	0.64	0.98

Table3 Temperature Distribution

Setting Temperature (°C)	Average Standard Reading (°C)									Uncertainty (± °C)
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	
20.0	19.52	19.40	19.70	19.43	19.33	19.39	19.45	19.58	19.67	0.55

Resolution : 0.1 °C

* Probe No. 9 is Reference Probe



- Notes :
- The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 - The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time
 - Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 - The reported uncertainty of measurement were excluded Uniformity and Stability

** End of Calibration Report **

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Signature

GAS CHROMATOGRAPH

Model. : GC-2010 PLUS AF

Serial No. : C12095200986

SHIMADZU GAS CHROMATOGRAPH SYSTEM
GC-2010Plus Series

Operational Qualification

System Name	
System ID No Gas Chromatograph LAPP 04/3	
Installation Site Instrument Room GC/IC	
The undersigned performer reports that the Operational Qualification Protocol has been successfully completed for the system stated above.	
• Performer	Signature <u>Ph</u> Date <u>16/02/2023</u>
	Print <u>Thammarat Pongkha</u>
	Title <u>Service Engineer</u>
	Company <u>Parascentific Co., Ltd</u>
The undersigned reviewer and manager report that the performer has completed the Operational Qualification Protocol successfully.	
• Reviewer	Signature <u>Ph</u> Date <u>16/02/2023</u>
	Print <u>Panpong Bunnongro</u>
	Title <u>Scientist</u>
	Company <u>Eastern Thai Consulting 1992 Co., Ltd</u>
• Manager	Signature <u>Ph</u> Date <u>16/02/2023</u>
	Print <u>Nunphol Boekhantod</u>
	Title <u>HS</u>
	Company <u>Eastern Thai Consulting 1992 Co., Ltd</u>

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Operational Qualification Definitions

1-2 Scope

This Operational Qualification shall apply to the equipment installed at the following site.

(Address): 502 Moo 11 Sukhaphiban 3 Rd Nongkhuaeng, Siachue, (November 20110
(Company): Eastern Thai Consulting 1992 Co., Ltd
(Department):
(Installation Site): Instrument Room GC/IC
(Equipment ID No.): Gas Chromatograph LAPP 04/3
(Product Model Name): GC-2010 Plus / AOC-201 / AOC-203

COPY

Performer (signature): Ph Date: 16 / 02 / 2023
Reviewer (signature): Ph Date: 18 / 02 / 2023

Operational Qualification Record

Operational Qualification

Page 21 of 48

☒ Applicable ☐ Not Applicable

Performer (signature):	<i>[Signature]</i>	Date:	16 / 08 / 2023
Reviewer (signature):	<i>[Signature]</i>	Date:	18 / 8 / 2023

Rev. 3.31

Page 21 of 48

Date: 16 / 02 / 2024

Date: 18 / 8 / 2017.

Page 21 of 48

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

☒ Single ☐ Dual system, main injector☒ Applicable ☐ Not Applicable☒ Single ☐ Dual system, main injector

Component ID		Model Name			AOC-20i		
Serial No. (S/N)		C 1 2 1 2 4 1 0 8 0 9					
No.	Item	Criteria			Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation.			All LEDs light, except decimal point.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.			Display shows "000"	Display: 000	<input checked="" type="checkbox"/>
3	Firmware version check	Verify the program version.			Version number is displayed. The version number matches the controlled version number.	9 46 9 46	<input checked="" type="checkbox"/>
4	Basic operation test	Verify that the injector basic operation is correct.			Sample injected into the GC and GC operation starts.		<input checked="" type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name				AOC-20i	
Serial No. (S/N)							
No.	Item	Criteria		Results	Pass	Fail	
1	Display, LED test	Verify the display and LED operation.	All LEDs light, except decimal point.		<input type="checkbox"/>		
2	ROM , RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000".	Display.			
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No			
			The version number matches the controlled version number	Controlled Ver No.			
	Basic operation test	Verify that the auto injector basic operation is correct.	Sample No 1 transferred to the main injector, sample No. 2 transferred to the sub-injector. Sub-injector injects into the GC simultaneously with the main AOC.				
4							

Performer (signature):

Jm

Date: 16 / 07 / 2023

Reviewer (signature):

Fayst

Date: 18 / 8 / 2023

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Model Name AOC-20s					
Component ID					
Serial No. (S/N)		C 1 2 1 3 5 4 6 5 9 1 0			
No.	Item	Criteria		Results	Pass/Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.	LED lights green, not red.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Firmware version check	Verify the program version.	Version number is displayed.	9.5.0	<input checked="" type="checkbox"/>
		The version number matches the controlled version number.		9.5.0	<input checked="" type="checkbox"/>

Performer (signature):

Jm

Date: 16 / 08 / 2023

Reviewer (signature):

Fayst

Date: 18 / 8 / 2023

Hot Air Oven

Model. : UM 400

Serial No. : 900982

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k	
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8			# 9 ^{Rev}
85	85.0	85.0	85.18	85.04	84.62	84.82	85.03	85.04	85.00	84.96	85.08	0.25	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.07	0.49	0.68

Notes

UUC* = Unit Under Calibration

[Signature]

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Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

583 Moo 11, Sukhapiban 8 Rd., Nongkham,

Siracha, Chonburi 20230

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.

(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert Model : UM 400

Serial No. : 900982 ID No. : LABE 17/1

Date of Receipt : 21 February 2023 Date of Calibration : 21 February 2023

Condition of Calibration

1. Environment	1.1 Ambient temperature	: Maximum : 31.2 °C	: Minimum : 28.7 °C
1.2 Relative humidity	: Maximum : 50.2 %	: Minimum : 40.1 %	
1.3 Line voltage supplied	: Maximum : 223.9 VAC	: Minimum : 221.5 VAC	

2. Calibration method

TLAS-G-20: Guidelines for calibration and checks of temperature controlled enclosures.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-PH00)	LB-DA-12	22-040312	02 May 2023

4. This certificate is traceable to the international system of unit (SI Unit).

The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

[Signature]
(Mr. Somchai Neampunt)
Signed for Director

Calibrated by : Mr. Sarawoot Thammo

Approved by : (Mr. Somchai Neampunt)

Scientist

Issue date : 24 February 2023

The uncertainties are for a confidence probability of approximately 95%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)

REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 23-018635

Sample Code : 23-07651-001

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 40 cm ; D = 28 cm ; H = 39 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes " Stability of chamber and loading effect in chamber at 20% of uniformity ".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

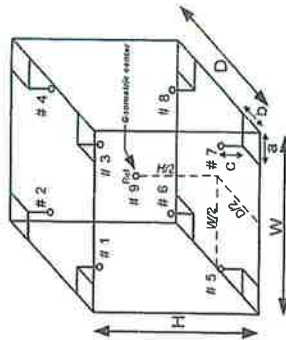


Figure: Example of sensor installation Positions

The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

- End of Report -

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INDUCTIBELY COUPLED PLASMA SPECTROMETER

Model : Prodigy 7

Serial No. : P70177



บริษัท แอปพลิเคชัน ดีฟายน์ จำกัด
Application Defina Company Limited
132/318 ถนนพหลโยธิน แขวงมีนบุรี เขตมีนบุรี กรุงเทพมหานคร 10510
132/318 Haharat Road., Minburi Sub-district Minburi District, Bangkok 10510
Tel: (66)8456-5191 E-mail: support@apdefina.co.th Website : http://www.apdefina.co.th
เลขประจำตัวผู้เสียภาษี 010556032491

CERTIFICATE OF INSTRUMENT PERFORMANCE

INSTRUMENT:

INDUCTIVELY COUPLED PLASMA SPECTROMETER

BRAND: Teladyne Leeman Labs

MODEL: Prodigy 7

SERIAL NO. P70177

CUSTOMER: บริษัท อีทีทีเอ็น โทโฮ คอนสตรัคชั่น 1992 จำกัด

CHECKING:

SPECTROMETER

Wavelength Accuracy check by use emission line of Hg Lamp

Mercury line 253.652 nm.

Plasma View (Dual View)

CMOS Detector check

Align View by Mn line 257.610 nm.

RF GENERATOR

Incident Power 1,200 \pm 10 Watt Reading = 1200 Watt

SAMPLE INTRODUCTION

Plasma Torch, Injector, Spray chamber, Nebulizer

Partialtic pump & Tubing

EXHAUSTING & COOLING SYSTEM

Safety Interlock Switch (Door, Argon pressure, Water pressure)

Cooling System, water flowrate & low pressure switch

Flowrate of Air blower

COMPUTER & SOFTWARE

Plasma Ignition software & Analytical Software

ANALYTICAL TEST

Full Frame Capture & Echellogram check

Calibration Curve & QC Test

DATE : Dec 12, 2022

Mr. Somchai Chumyung
Engineer Sign

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีทีทีเอ็น โทโฮ คอนสตรัคชั่น 1992 จำกัด

Date: Dec 12, 2022

Instrument: ICP-OES Model: Prodigy 7 S/N: P70177

1. Gas Supply /Water Re-circulator/Exhaust Hood Checks

Gas system: ตรวจระบบแก๊สและระบบน้ำ Argon Pressure: 5-15 psi Leak inspected (✓) No leak Nitrogen Pressure: - psi Leak inspected (✓) No leak Oxygen Pressure: - psi Leak inspected (✓) No leak	
() Change camera purge gas Dehydrator (1 times /years) Next time replacement 24.12.22 เปลี่ยนตัวดูดความชื้นที่คัลเดอร่า ทุก 1 ปี	
Water Chiller: RF generator flow rate 4.44 LPM Temperature 2 $^{\circ}$ C ตรวจอุณหภูมิ Leak inspected (✓) No leak ตรวจการรั่วซึม	
Water Chiller : Camera (✓) check water level and refill ตรวจระดับน้ำและเติมน้ำ (✓) change water เปลี่ยนน้ำ Temperature -31 $^{\circ}$ C ตรวจอุณหภูมิ	
Exhaust Hood Flow rate \approx 700 CFM (system request > 150)	



TELEDYNE LEEMAN LABS
Quality Assurance

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีทีพีเอ็น โหนด คอนสตรัคชั่น 1992 จำกัด
Instrument: ICP-OES Model: Prodigy 7
Date: Dec 12, 2022
S/N: P70177

3. Instrument Control

Description	Status
Optical view position: ตรวจสอบตำแหน่งติดตั้งหลอดไฟในตำแหน่ง	
Hg Lamp Delta	
X 2 Y -9	OK
XUV 0	OK
Axial peak positions X 3325 Y 1225	OK
Radial peak positions X 4151 Y 1225	OK
Hg lamp peak positions X 2210 Y 2630	OK
Plasma Control ตรวจสอบการทำงานของพลาสมา	
(✓) Auto Start	OK
(✓) Extinguish	OK
(✓) RF power setting	OK
(✓) Igniter	OK
(✓) Air Knife	OK
Torch Gas ตรวจสอบการทำงานของแก๊สที่ใช้ในพลาสมา	
(✓) Coolant / Plasma Flow control	OK
(✓) Aux Flow	OK
(✓) Nebulizer Flow	OK
(✓) Optimize sample introduction function	OK
(✓) Peristaltic pump control	OK
(✓) Auto sampler Control	OK
(✓) Camera Support Module	OK
(✓) Diagnostic	OK

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2. Computer & Software Check

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีทีพีเอ็น โหนด คอนสตรัคชั่น 1992 จำกัด
Instrument: ICP-OES Model: Prodigy 7
Date: Dec 12, 2022
S/N: P70177

2. Computer & Software Check

Description	Status
Interface Cable USB (✓) No broken	OK
Software Version	OK
(✓) Operation function check :	OK
(✓) Open /Save /Edit method	OK
(✓) Instrument Control	OK
(✓) Sequence	OK
(✓) Full Frame Capture (Echelle Mode)	OK
(✓) Auto alignment /Hg alignment	OK
(✓) Calibration Curve	OK
(✓) Re-Calculation	OK
(✓) Print Report	OK

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีทีบี เทคโนโลยี จำกัด	Date: Dec 12, 2022
Instrument: ICP-OES	Model: Prodigy 7
	S/N: P70177

4. Cleaning & Replacement

Description	Status
(✓) O-Ring Torch replacement	ok
(✓) Pump Tubing replacement	ok
(✓) Glassware cleaning (Torch, Nebulizer, Spray chamber)	ok
(✓) Lube the roll peristaltic pump	ok
(✓) Optical windows cleaning	ok
(✓) Camera Water Re-circulator (water change/refilled)	ok
(✓) RF Generator Water Re-circulator (water change/refilled)	ok
(✓) Cleaning Electronics Board with spray cleaner	ok
(✓) Cleaning dust inside Unit	ok
(✓) Cleaning dust filter	ok

5. Safety Interlock

Description	Status
(✓) Door switch	ok
(✓) RF Water Re-circulator	ok
(✓) Camera Water Re-circulator	ok
(✓) Camera purge gas	ok
(✓) Argon pressure	ok
(✓) Nitrogen pressure	ok

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PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIGY7

Customer: บริษัท อีทีบี เทคโนโลยี จำกัด	Date: Dec 12, 2022
Instrument: ICP-OES	Model: Prodigy 7
	S/N: P70177

6. Hardware Check with SALSA.EXE Diagnostics

Power Supply	Value	Status
-12 VDC (11 - 14.5 VDC)	-13.75%	ok
+12 VDC (11 - 14.5 VDC)	+12.01%	ok
+3.3VDC	3.24%	ok
+5.0 VDC	4.41%	ok
+13.5 VDC	13.48%	ok

Plasma Generator	Value	Status
ICP Current 0.500A = 1kW	0.54%	ok
ICP Ref 5.0Vdc = 1kW	5.46%	ok
ICP Current 0.00 Vdc = 0kW	0	ok
ICP Ref 0.00Vdc = 0kW	0	ok
RF Water (Hz) OFF	0	ok
RF Water (Hz) ON	23	ok
Air Knife Pres. (0.00V) OFF	0	ok
Air Knife Pres. (3.0 - 7.0 V) ON	4.05%	ok
Neb 25 @ setting of 25 PSI	25	ok
Cool 18 @ setting of 18 LPM	1%	ok
Aux 0.6 @ setting of 6 LPM	0.6	ok
Pump Current (0.000 A) OFF	0	ok
Pump Voltage (0.000 V) OFF	0	ok
Pump Current (0.8 to 4.0A) ON	1.0%	ok
Pump Voltage (8 to 13 V) ON	12.52	ok



Set Points	Value	Status
Air In Set Point 32°C	31	ok
Cam Temp Temperature -32°C	-32	ok
Op Purge Low 0.77 LPM	0.7	ok
Op Purge High 15.50 LPM	15.5	ok
Cam Wtr T 28°C	28	ok

PREVENTIVE MAINTENANCE / CALIBRATION REPORT FOR PRODIFY7

Customer: บริษัท อีทีทีไทย คอนสตรัคชั่น 1992 จำกัด	Date: Dec 12, 2022
Instrument: ICP-OES	Model: Prodigy 7
	S/N: P70177

7. Mn Check for performance Test

	Condition for performance Test	Condition Test	Status
Standard	1 ppm, 5 ppm, 10 ppm	10 ppm	ok
Power plasma	1.20 kw	1.2	ok
Plasma gas	16.0 LPM	16	ok
Auxiliary Gas	0.8 LPM	0.8	ok
Nebulizer	1.2 LPM	25 L/min	ok
Pump Speed	25 RPM	25	ok
Integration time	15 s Axial, 5 s Radial	10 s, 5 s	ok
Nebulizer Type	Seaspray, Conical, Meinhard	Seaspray	ok
Intensity first performance	1 ppm ≥ 4,000,000 5 ppm ≥ 15,000,000 10 ppm ≥ 50,000,000	~ 65,000,000	ok

Engineer Sign	12 Dec 2022
 Somchai Chumyung	 TELEDYNE LEEMAN LABS Everywhere you look

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INDUCTIBELY COUPLED PLASMA SPECTROMETER

Model : Prodigy 7

Serial No. : P70177



Preventive Maintenance Report

Instrument Performance Certificate For ICP-OES

PRODUCT ID
Serial Number

Prodigy 7, Teledyne Leeman Labs
P70177

Customer Name
Address

EASTERN THAI CONSULTING 1992 CO., LTD.
999 Moo 11 Tambon Nong Kham, Amphoe Si Racha,
Chonburi 20230

Date of Qualified
Next Due date

Dec 13, 2023
May 13, 2024

This certifies for products which was performed in acceptable criteria specifications

Gas supply /Water chiller/Exhaust hood
Cooling Systems
Spectrometer
RF Generator
Sample Introduction & Autosampler
Software & Computer
Hardware Diagnostics Test
Analytical Test
PASSED
PASSED
PASSED
PASSED
PASSED

Provided by

Scientist Instrument Co.,Ltd.
113 Soi Ekachai 44, Ekachai Road
Khlong Bang Phran, Bangkok
Bangkok 10150 Thailand

Certified by
Thunraphol Sakdayos

Service Engineer

Engineer Sign

Signature
COPY

Signature
COPY

Customer Name: Eastern Thai Consulting 1992 Co.,Ltd
Instrument/Equipment: ICP-OES
Brand: Teledyne Leeman Labs
Date: Dec 13, 2023
Model: Prodigy 7
S/N: P70177

1. Gas Supply / Water Chiller / Exhaust Hood:			Status
Gas systems:			
Argon Pressure (85-95 psi):		90 psi	OK <input checked="" type="checkbox"/>
Nitrogen Pressure (85-95 psi):		— psi	OK <input checked="" type="checkbox"/> use Ar.
No leak inspected			OK <input checked="" type="checkbox"/>
Replace camera purge gas Dehydrator			OK <input type="checkbox"/> waiting spare parts
Water Chiller for RF generator			
Minimum flowrate detected			OK <input checked="" type="checkbox"/>
No leak inspected			OK <input checked="" type="checkbox"/>
Water Chiller for Detector			
Check water level and refill			OK <input checked="" type="checkbox"/>
Change water			OK <input checked="" type="checkbox"/>
Temperature: 25 °C			OK <input checked="" type="checkbox"/>
Exhaust Hood:			
Minimum Air flowrate checked			OK <input checked="" type="checkbox"/>

2.Spectrometer			Status
Optical view position			
Axial peak positions	x 3325	y 4305	OK <input checked="" type="checkbox"/>
Radial peak positions	x 4206	y 4220	OK <input checked="" type="checkbox"/>
Hg lamp peak positions	x 2745	y 3615	OK <input checked="" type="checkbox"/>
Wavelength Calibrate with HG Lamp			OK <input checked="" type="checkbox"/>
Full Frame Image			OK <input checked="" type="checkbox"/>
Temperature controlled 31 °C			OK <input checked="" type="checkbox"/>
Purge gas flow control Low/High			OK <input checked="" type="checkbox"/>
Purge gas flow for Detector			OK <input checked="" type="checkbox"/>
Camera Support Module			OK <input checked="" type="checkbox"/>

3. RF Generator	
Plasma Control	Status
Auto Start	OK ✓
Extinguish	OK ✓
RF power setting	OK ✓
Igniter	OK ✓
Air Knife	OK ✓
Coolant /Plasma Flow control	OK ✓
Aux Flow	OK ✓
Optimize sample introduction function	OK ✓
4. Sample Introduction & Autosampler	
Plasma torch	Status
Plasma Torch	OK ✓
Spray chamber	OK ✓
Injector	OK ✓
Nebulizer: pressure	OK ✓
Peristaltic pump and control	
Speed control	OK ✓
Sample tubing	OK ✓
Drain tubing	OK ✓
Autosampler Control	<input type="checkbox"/> Available <input checked="" type="checkbox"/> Not Available
Position movement	OK □
Drain tubing	OK □
Auto Rinse	OK □
5. Computer & Software Check:	
Interface Cable USB	OK ✓
Software Version 5.2	OK ✓
Operation function check :	OK ✓
Open /Save /Edit method	OK ✓
Instrument Control	OK ✓
Sequence	OK ✓
Full Frame Capture	OK ✓
Auto alignment /Hig alignment	OK ✓
Calibration Curve	OK ✓
Re-Calculatation	OK ✓
Print Report	OK ✓

Engineer Sign

SS Ward

6. Hardware Diagnostics Test		
Power Supply		Status
-12 VDC (+/- 5 %)	-12.9 V	Passed ✓
+12 VDC (+/- 5 %)	+11.91 V	Passed ✓
+3.3 VDC (+/- 5 %)	3.3 V	Passed ✓
+5.0 VDC (+/- 5 %)	4.915 V	Passed ✓
+13.5 VDC (+/- 5 %)	13.41 V	Passed ✓
Plasma Generator		
ICP Current 0.500A = 1kW	0.502 A	Passed ✓
ICP Ref 5.0Vdc = 1kW	5.002 V	Passed ✓
ICP Current 0.00 Vdc = 0kW	0 A	Passed □
ICP Ref 0.00Vdc = 0kW	0 V	Passed □
RF Water (Hz) OFF (1 Hz)	0 Hz	Passed ✓
RF Water (Hz) ON (25-35 Hz)	25 Hz	Passed ✓
Air Knife Pres. (0.00V) OFF	0 V	Passed ✓
Air Knife Pres. (3.0 - 7.0 V) ON	3.46 V	Passed ✓
Heb setting to 25 psi	reading 35 psi	Passed ✓
Cool setting to 16 lpm	reading 16 lpm	Passed ✓
Aux setting to 0.5 lpm	reading 0.5 lpm	Passed ✓
Camera Water pump		
Pump Current (0.000 A) OFF	0 A	Passed ✓
Pump Voltage (0.000 V) OFF	0 V	Passed ✓
Pump Current (0.8 to 4.0A) ON	1.1 A	Passed ✓
Pump Voltage (8 to 13 V) ON	12.43 V	Passed ✓
Set Points		
Cam Tec Temperature (-30 to -38°C)	Set -32 °C Read -31 °C	Passed ✓
Op Purge Low (0-15.5 lpm)	Set 5 lpm Read 5.1 lpm	Passed ✓
Op Purge High (0-15.5 lpm)	Set 40 lpm Read 40.1 lpm	Passed ✓
Cam Wtr T (25-30 °C)	Set 25 °C Read 25 °C	Passed ✓

7.Cleaning & Replacement		Status
O-Ring Torch replacement	OK ✓	
Pump Tubing replacement	OK ✓	
Glassware cleaning	OK ✓	
Lubricate the roll peristaltic pump	OK ✓	
Optical windows cleaning	OK ✓	
Change & refilled Detector water chiller	OK ✓	
Change & refilled RF Generator water Chiller	OK ✓	
Clean All Electronics Board	OK ✓	

Engineer Sign

SS Ward

8. Safety Interlock	Status
Argon pressure	OK ✓
Air Knife	OK ✓
RF power regulator	OK ✓
RF power temp	OK ✓
RF power current	OK ✓
RF water	OK ✓
Oscillator cover	OK ✓
Door switch	OK ✓
Camera purge	OK ✓
Camera TE cooler	OK ✓
Water chiller	OK ✓
Heater Fans	OK ✓

9 Analytical Test	Details	Status
Method name	Mn Setup	
SIRM Standard	Mn	
Calibration curve type	Linear	
Rho	1	
Element	Mn	
QC standard Check		OK

Customer Sign	Engineer Sign
K. D. 0105-506	<u>SEWARD</u> 13/12/2023

Dr. [Signature]

LIQUID IN GLASS THERMOMETER

Model : Total immersion

Serial No. : 43560

Calibration Certificate

Certificate No.: 2300368-001-01
Client name: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhapibarn 8 Rd.,
 Nongkham, Sriracha, Chonburi 20230

Equipment: Liquid-in-Glass Thermometer
Manufacturer: Precision
Model / Type: Total Immersion
Serial No.: 43560
ID No.: LABE 16/1
Order No.: 2300368
Operation No.: 2300368-001
Date of Receipt: 7 November 2022
Date of Calibration: 15 November 2022

Calibrated by Mr. Nattapol Niyomchat
 Specialist
Date of Issue: 18 November 2022
Approved by (Mr. Phraphat Tuanjit)
 Manager, Division of Calibration Laboratory
 Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.



Calibration Report

Certificate No.: 2300368-001-01
Equipment: Liquid-in-Glass Thermometer
Range: -1.9 to 101.1 °C
ID No.: LABE 16/1
Manufacturer: Precision
Date of Calibration: 15 November 2022

Location: Temperature Calibration Laboratory, National Food Institute
Environment Condition:
 Ambient Temperature 23 °C ± 2 °C
 Relative Humidity 55 % ± 15 %

Condition of this results of Calibration:

1. Calibration Method : - In-house method : W-TS-015 based on ASTM E77-07
 - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer
 - The temperature Scale in use at this laboratory is the International Temperature Scale of 1990 (ITS-90)
2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
BLACK STACK THERMOMETER	1560/2560	A39258/A39719	PSL-T 0674/65	7-Jun-23	TISTR
Platinum Resistance Thermometer (PRT)	5615	808926			

Support Equipment : - Ice point Unit, ID No : ana. 614/21
 - Low Temperature Bath (Deep Well Compact Bath), Model: 7381, S/N: B52496.
 - Low Temperature Bath (Deep Well Compact Bath), Model: 7341, S/N: A5A084.
 - High Temperature Bath (Deep Well Compact Bath), Model: 6331, S/N: A5A087.

3. This certificate is traceable to International System of Units (SI Units)
4. This certificate was certified only for the instrument we calibrated
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good
☒ Without adjustment ☐ After adjustment
7. Result of Calibration :

COPY



Calibration Report

Certificate No.:

2300368-001-01

Equipment:

Liquid-in-Glass Thermometer

Type: Total Immersion

Range: -1.9 to 101.1 °C

Resolution: 0.1 °C

ID No.: LABE 16/1

Serial No.: 43560

Manufacturer: Precision

Date of Calibration:

15 November 2022

Page 3 of 3

Calibration point:

3.0, 25.0 and 50.0 °C

Calibration result:

Reporting of ice-point or reference point

UUC* Reading (°C)	Standard Temperature/ice Point (°C)	Correction Value (°C)	Uncertainty ± (°C)
0.0	0.0032	0.0	0.091

Reporting of temperature calibration point

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
25.0	24.9990	0.0	0.088
50.0	49.9943	0.0	0.088

Note

- UUC* : Unit Under Calibration

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

----- End -----



LIQUID IN GLASS THERMOMETER

Model : Total Immersion

Serial No. : 43560



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com



CERTIFICATE No : 23T10864
REFERENCE No : 71117-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : 0 °C TO 100 °C

SERIAL No : 43560
ID No : LABE 16/1
RESOLUTION : 0.1 °C
TYPE : TOTAL IMMERSION

CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : EASTERN THAI CONSULTING 1992 CO., LTD.
683 MOO 11, SUKHAPIBAN 8 ROAD, NONGKHAM,
SRIRACHA, CHONBURI 20230

CALIBRATED BY : CHARUKIT L.
CALIBRATION DATE : 09-Nov-23

APPROVED BY :
PONGSAK J.

ISSUED DATE : 09-Nov-23

RECEIVED DATE : 02-Nov-23

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THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
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www.qcalibration.com

CERTIFICATE No : 23T10864

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : LIQUID IN GLASS THERMOMETER
MANUFACTURER : PRECISION
MODEL : 0 °C TO 100 °C
ID No : LABE 16/1
RESOLUTION : 0.1 °C
RECEIVED DATE : 02-Nov-23
AMBIENT TEMPERATURE : 23 °C ± 3 °C
SERIAL NUMBER : 43560
TYPE : TOTAL IMMERSION
CALIBRATION DATE : 09-Nov-23
RELATIVE HUMIDITY : 50 %RH ± 20 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77:1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.
- REFERENCE STANDARD INSTRUMENTS :-
INSTRUMENT MODEL SERIAL No CERTIFICATE No DUE DATE
1) STANDARD THERMOMETER 77964 23T3927 08-Mar-24
2) SPRT PROBE 5614 636626 23T3927 08-Mar-24
3) PRECISION BATH 7320 A21105 22T13199 14-Dec-23
4) PRECISION BATH CTR-40 A68155 22T13198 09-Dec-23
5) PRECISION BATH 6045 3C023 22T13200 19-Dec-23
- THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	EMERGENT STEM TEMPERATURE (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
0.009	0.0	60	0.0090	N/A	0.26
25.01	25.0	165	0.0050	N/A	0.26
50.00	50.0	275	0.0040	N/A	0.26
99.991	100.0	360	-0.009	29.3	0.26

UUC* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

COPY

MERCURY ANALYZER

Model : RA-4500

Serial No. : 21780504

Eastern Thai Consulting 1992 Co., Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 21780504

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : February 09, 2023

Next due date : August 09, 2023

PM by : 
(P. Siriraj)

Approved by : 
(Pathom S.)



Coax Group Corporation Ltd.

1131/62,64,325-331 Nakornchaisri road,

Kwang ThanonNakornchaisri, Dusit, Bangkok 10300 Thailand

Tel. 02-2435263, 02-6682436 Fax. 02-2437386



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COAX GROUP CORPORATION LTD.

DATE : March 24, 2023

Certificate of Calibration

MERCURY ANALYZER FOR WORKING ENVIRONMENT
THERMOMETER / RA-4500

Customer name : Eastern Thai Consulting 1992 Co.,Ltd.

Certificate No : SRP001-23 Model # RA-4500
Customer P/O : PO.no.PI6602053 Serial No. # 21780504
Sale Order No : -

Results : Quality Reborn Reference Standard Laboratory, NSC-TISI-TIS 17025 Calibration No.0292

Cal. Points	TIME	PRESET TEMP	Ave.	FACTOR ±0.5
Calibration at 3 Point	60 Minutes	95 (°C)	90.73	0.950 - 1.050

This instrument is calibrated at factor 0.955

TEST APPARATUS	
Instrument Type	Serial Number
PONPE 429TP	5845166
PONPE 429TP	5845167
PONPE 429TP	5845168



Date of Calibrate : March 24, 2023

Next due date : March 24, 2024

Calibrate by :  Approve by : 

(Siriraj Pinsiri)

Service Engineer

Environments & Petroleum Division

(Pathom Srivises)

Service Manager

Environments & Petroleum Division

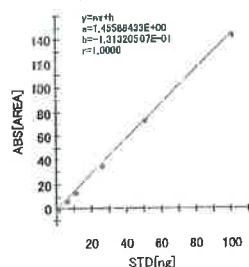
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Title RA-4500 Preventive Maintenance no.2of2 in Warranty
 Date 9/2/2566
 Name Coax Group Corporation Ltd.
 Memo Calibration curve, range 0-100ng

Method

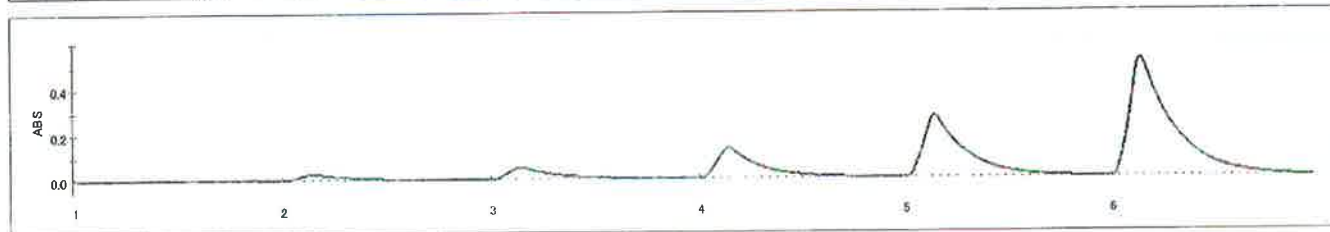
Method (Pretreatment: without)
 (1+1) H₂SO₄ 0.9mL
 10w/v% SnCl₂ 0.5mL
 Measurement Time (sec) : 120sec

Calib



STD

No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Color [1] [2]	Note
1	100.000	0.000	5.000	5.000	0.000	0.0158	0.1011	-	-	
2	100.000	0.050	5.000	5.000	5.000	7.4089	5.1791	3.6	-	
3	100.000	0.100	5.000	5.000	10.000	14.1152	9.7855	2.1	-	
4	100.000	0.250	5.000	5.000	25.000	35.6872	24.6026	1.6	-	
5	100.000	0.500	5.000	5.000	50.000	73.3032	50.4398	0.9	-	
6	100.000	1.000	5.000	5.000	100.000	145.2998	99.8919	0.1	-	



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-1-

NIPON INSTRUMENTS CORPORATION

Inspection result

ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Leak check	0.14 - 2.0L/min	0.17L/min	PASS
1.1.2 Sig/Ref check	Signal 3.00 - 4.00V	Sig:3.97V, Ref:3.89V	PASS
1.3 Drift check	0.0000236 - 0.0000061	0.0000175	PASS
2. Analytical curve inspection (AREA)			
2.1 Calibration curve 0-100ng (Height)	Correlation coefficient	1.0000	PASS
	(r) ≥ 0.9999		
3. Repeatability (AREA)			
3.1 Repeat STD 50ng, n=3		50.60 ng	
		50.94 ng	
		50.71 ng	
	C.V. ≤ 5%	0.34%	PASS
4. Blank	Below 1.0(AREA)	0.0158	PASS

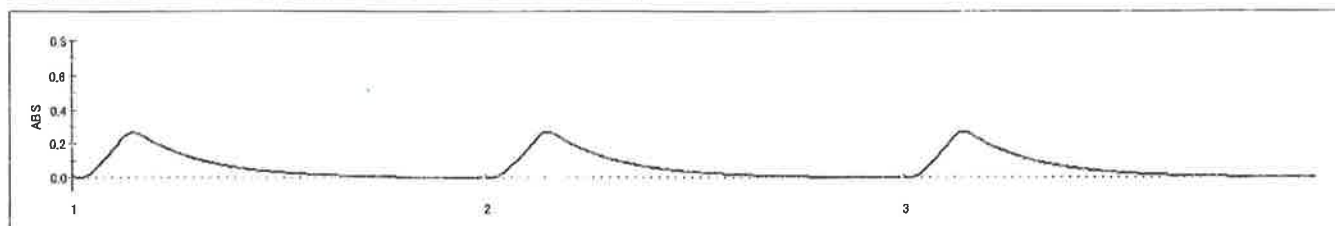
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SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Color		Note
								[1]	[2]	
1	100ppb Hg	0.500	5.000	5.000	73.5373	50.6006	101.2012	-	-	
2	100ppb Hg	0.500	5.000	5.000	74.0347	50.9422	101.8844	-	-	
3	100ppb Hg	0.500	5.000	5.000	73.6938	50.7081	101.4162	-	-	

Statistics

No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	100ppb Hg	3	101.50060	0.3493323	0.34



Self Check

Heat check:PASS!! (27.1degC[05:00] -> 31.2degC[03:03])
 Sensor check:PASS!! (3488- 133=3355)
 Leak check:PASS!! (0.17L/min)
 Sig/Ref check:PASS!! (Sig:3.97V, Ref:3.89V)
 Drift check:PASS!! (0.0000236 - 0.0000061 = 0.0000175)

MERCURY ANALYZER

Model : RA-4500

Serial No. : 21780504

Eastern Thai Consulting 1992 Co., Ltd.

Automatic Mercury Analyzer

Model RA-4500

Preventive Maintenance Report

Serial No. : 21780504

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : August 9, 2023

PM by :  (Pathom S.)

Approved by :  (Phongpan R.)

Coax Group Corporation Ltd.

1131/62,64,325-331 Nakornchaisri road,
Kwang ThanonNakornchaisri, Dusit, Bangkok 10300 Thailand
Tel. 02-2435263, 02-6682436 Fax. 02-2437386



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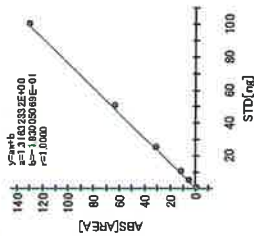
Inspection result

ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Leak check	0.14 - 2.0 L/min.	0.18 L/min	PASS
1.2 Sig/Ref check	3.0 - 4.0 volte	Sig:4.01V, Ref:4.09V.	PASS
1.3 Drift check	0.0000047 - 0.0000014	0.0000038	PASS
2. Analytical curve inspection(AREA)			
2.1 No Pretreatment	Correlation coefficient (r) ≥ 0.9990	1.0000	PASS
3. Repeatability(AREA)			
3.1 No Pretreatment 50ug/L, n=3		1. 50.353 ug/L 2. 51.477 ug/L 3. 51.306 ug/L C.V. ≤ 5% 1.19%	PASS
4. Blank	Below 1.0(AREA)	0.386	OK

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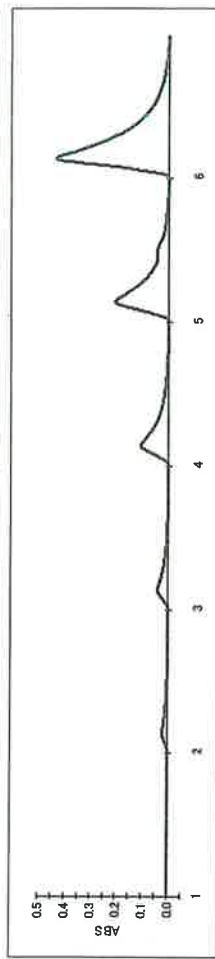
Title : RA-4500 Preventive Maintenance
 Date : 9/8/2566
 Name : Coax Group
 Memo : Calibration curve (No Pretreatment)

Calib



STD

No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	0.000	5.000	5.000	5.000	0.000	0.3869	0.4405	-	
2	50.000	0.100	5.000	5.000	5.000	6.6907	5.2295	4.6	
3	50.000	0.200	5.000	5.000	10.000	12.4017	9.5681	4.3	
4	50.000	0.500	5.000	5.000	25.000	32.5205	24.8522	0.6	
5	50.000	1.000	5.000	5.000	50.000	66.2046	49.6820	0.6	
6	50.000	2.000	5.000	5.000	100.000	131.7390	100.2277	0.2	

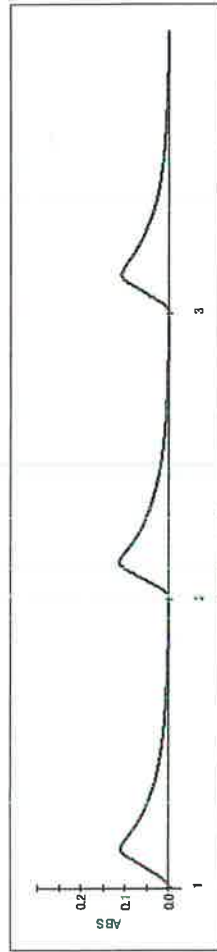


SMP

No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [ug/L]	Note
1	50ug/L	0.500	5.000	5.000	32.9478	25.1768	50.3536	
2	50ug/L	0.500	5.000	5.000	33.6875	25.7387	51.4774	
3	50ug/L	0.500	5.000	5.000	33.5749	25.6532	51.3064	

Statistics

No.	NAME	TRY	AV [ug/L]	SD [ug/L]	Cv [%]
1	50ug/L	3	51.04580	0.6055294	1.19



Self Check

Heat check: PASS!! (25.0degC[05:00] -> 30.0degC[03:06])
 Sensor check: PASS!! (1113- 58=1055)
 Leak check: PASS!! (0.18L/min)
 Sig/Ref check: PASS!! (Sig:4.01V, Ref:4.09V)
 Drift check: PASS!! (0.0000036 - -0.0000002 = 0.0000038).

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pH Meter

Model. : SevenCompact S220

Serial No. : B448305208



CERTIFICATE OF CALIBRATION

Page 1 of 3
Certificate No. : 23-011524
Sample Code : 23-04833-001

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : pH Meter

Manufacturer : METTLER TOLEDO Model : SevenCompact S220

Serial No. : B448305208 ID No. : LABE 11/4

Date of Receipt : 01 February 2023 Date of Calibration : 01 February 2023

Condition of Calibration

1. Environment
- 1.1 Ambient temperature : 25.0 ± 2.5 °C 1.2 Relative humidity : 55.0 % ± 15.0 %
2. Calibration method
- In house method WI-CL-019; based on direct measurement by using standard voltage calibrator and using certified reference material (CRM).

3. Reference standard / Certified reference material

Instrument	ID No.	Certificate No.	Due Date
3.1 Voltage Calibrator	LB-AMC-01	22E3240	03 October 2023
3.2 Digital Thermometer	LB-TH-33	22-107027	02 October 2023
Certified Reference Material			
3.3 Buffer Solution pH 4.008	838357	PH216.L5	15 September 2024
3.4 Buffer Solution pH 6.985	838358	PH107.L5	15 September 2023
3.5 Buffer Solution pH 10.008	838359	PH220.L5	15 September 2023

4. This certificate is traceable to the international system of unit (SI Unit).

- 4.1 Instrument No. 3.1 through Technology Promotion Association (Thailand-Japan).
- 4.2 Instrument No. 3.2 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.
- 4.3 Buffer Solution No. 3.3 and No. 3.5 traceable to CPA chem (through primary measurement method-Harned cell using calibrated thermometer, barometer, and nanovoltmeter. Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).
- 4.4 Buffer Solution No. 3.4 traceable to CPA chem (BIM RefN HI-27 LotN 04.06.2021 ; BIM RefN HI-28 LotN 28.05.2021 ; BIM RefN HI-27 LotN 04.06.2021 ; BIM RefN HI-28 LotN 28.05.2021 Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).

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

6. Condition of calibration item : Normal

Calibrated by Mr.Anupong Lakawin Approved by (Ms. Pawana Pan-on)

Scientist

03 February 2023

Issue date

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).



REPORT OF CALIBRATION

Page 2 of 3
Certificate No. : 23-011524
Sample Code : 23-04833-001

Equipment : pH Meter Resolution : 0.01 pH ; 0.1 mV ; 0.1°C

Manufacturer : METTLER TOLEDO Model : SevenCompact S220

Serial No. : B448305208 ID No. : LABE 11/4

Range : -2.000 pH to 20.000 pH ; ± 2000.0 mV ; -5.0°C to 130.0°C

Results of Calibration

Part 1. DC Voltage measurement

pH Meter Serial No. : B448305208

Nominal Value	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor k
		mV	pH		
0	414.113	414.0	0.00	± 0.083	2.00
4	177.477	177.5	4.00	± 0.083	2.00
7	0.000	0.1	7.00	± 0.083	2.00
10	-177.477	-178.3	10.00	± 0.083	2.00
14	-414.113	-413.8	14.00	± 0.083	2.00

Part 2. Performance of Electrode system

Electrode Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM

Electrode Serial No. : 2365921

Three-Point Calibration at pH4 and pH7 Percent Slope : 98.6 ; at pH7 and pH10 Percent Slope : 98.4

Standard Buffer Solution pH (@ 25 °C)	Average indicator reading		Error Value	Uncertainty pH	Coverage factor k
	pH	mV			
4.008	4.01	184.2	0.002	± 0.011	2.00
6.985	6.99	8.9	0.005	± 0.010	2.00
10.008	10.01	-166.8	0.002	± 0.010	2.00

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which in a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003.

DR

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NSC-TISI-TSI7025
CALIBRATION 0152
Page 3 of 3

REPORT OF CALIBRATION

Certificate No. : 23-011524
Sample Code : 23-04833-001

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO

Serial No. : B448305208

Resolution : 0.1 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO

Serial No. : 2365921

Model : SevenCompact S220

ID No. : LABE 11/4

Range : -5.0 °C to 130.0 °C

Model : InLab Expert Pro-ISM

ID No. : N/A

Condition of Calibration

1. Environment
 - 1.1 Ambient temperature : 23.0 °C ± 3.0 °C
 - 1.2 Relative humidity : 55.0 % ± 15.0 %

2. Calibration method

- 2.1 The calibration use in house method WI-CL-021 : by comparison with standard thermometer
- 2.2 The calibration by comparison unit under calibration (UUC) to the standard thermometer in a calibration bath at the controlled temperature.
- 2.3 The temperature scale in use of this laboratory is the international temperature scale of 1990 (ITS-90).

3. Reference standard instrument

Instrument	Model	ID. No.	Certificate No.	Due date
3.1 Platinum Resistance Thermometer	PT-100	RTD-90	22-107027	02 October 2023
3.2 Thermometer Readout	GT-11	LB-TM-33	22-107027	02 October 2023

4. This certificate is traceable to the international system of unit (SI Unit).

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Accreditation Under TLAS Laboratory Calibration No.0152)

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

6. Condition of Calibration item : Normal

Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration			Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C	Correction value °C		
25	25.002	120	25.0	+ 0.002	± 0.13	2.00

Notes

- Calibration results without adjustment

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

- End of report -

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STANDARD WEIGHT 50 g



Certificate No. : 22-052238
Sample Code : 22-19150-003

Page 1 of 3

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 31 May 2022

Approved by

(Mr. Somchai Neampunt)

Signed for Director

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).

361 Soi Ladprao 122, Ladprao Road,
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FM-CL-007

TEL 02-516-2422
FAX 02-516-6949
Rev.05

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21



Certificate No. : 22-052238
Sample Code : 22-19150-003

Page 2 of 3

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Result of Calibration :

☒ Without adjustment

☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_0) of 1.2 kg.m⁻³

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	± (mg)	
50 g	-0.324	49.999676 g	0.10	0.30	LABE 10/1

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2.0, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

[Signature]

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TEL 02-516-2422
FAX 02-516-6949
Rev.03

CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH
Effective Date: 15/10/21



Certificate No. : 22-052238
Sample Code : 22-19150-003

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.20 kg/m³
2. Calibration Method : Direct comparison weighing according to OIML R111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

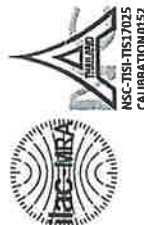
6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

COPY

STANDARD WEIGHT 100 g



Certificate No. : 22-052239
Sample Code : 22-19150-004

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist
Issue date : 31 May 2022

(Mr. Somchai Neampunt)
Signed for Director

The uncertainties are for a confidence probability of approximately 95%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).



Certificate No. : 22-052239
Sample Code : 22-19150-004

REPORT OF CALIBRATION

Equipment : Standard Weight 100 g
Manufacturer : N/A
Class : N/A
Serial No. : N/A
ID No. : LABE 10/2

Result of Calibration : ☒ Without adjustment ☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_a) of 1.2 kg.m⁻³

Description	Deviation	Conventional Mass	Expanded Uncertainty	Maximum Permissible Error	ID No.
100 g	(mg)	99.999829 g	(mg)	± (mg)	LABE 10/2
	-0.171		0.16	0.50	

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2.0, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003





Certificate No. : 22-052239

Sample Code : 22-19150-004

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature $20 \pm 1.5^\circ\text{C}$, Relative humidity $50\% \pm 10\%$ and air density 1.18 kg/m^3
2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 100 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

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STANDARD WEIGHT 50 g



Certificate No. : 22-052237
Sample Code : 22-19150-002

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapiban 8 Rd., Nongkham,
Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration Laboratory)

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist
Issue date : 31 May 2022

The uncertainties are for a confidence probability of approximately 95%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC).



Certificate No. : 22-052237
Sample Code : 22-19150-002

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g
Manufacturer : N/A
Class : N/A
Serial No. : N/A
ID No. : LABE 10/4

Result of Calibration :

☒ Without adjustment

☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature (t_{ref}) of 20°C, the conventional mass is the mass of a reference weight of a density (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_0) of 1.2 kg.m⁻³

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(mg)		(mg)	\pm (mg)	
50 g	-0.111	49.999889 g	0.10	0.30	LABE 10/4

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

[Signature]

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Certificate No. : 22-052237

Sample Code : 22-19150-002

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$, Relative humidity $50\% \pm 10\%$ and air density 1.18 kg/m^3

2. Calibration Method : WI-CL-007 base on OIML R 111-1 : 2004(E)

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

Type and Nominal Value :	Standard Weight 50 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

Signature

COPY

SPECTROPHOTOMETER

Model : PROVE 100

Serial No. : 1613110857

CERTIFICATE OF CALIBRATION

Instrument : SPECTROPHOTOMETER
Model : PROVE 100
Date of Calibration : February 13, 2023
Customer Name : Eastern Thai Consulting 1992 Co., Ltd.

Procedure used

The wavelength accuracy and the linearity of the absorbance measurement of photometers are checked using Check solutions according to Merck calibration laboratory work instruction.

Measurements results

Function : Absorbance measurement.
 All data shown below as received values of blank solution before adjustment.

Check Solution (Abs.)	Wavelength (nm)	Desired Absorbance (Abs.)	Measured Absorbance (Abs.)	Error (Abs)
0.000	445	0.000 ± 0.005	0.000	0.000
0.000	525	0.000 ± 0.005	0.000	0.000
0.000	690	0.000 ± 0.005	0.000	0.000

Function : Absorbance measurement.
 All data shown below were final value of standard solution after adjustment.

Check Solution* (Abs.)	Desired Absorbance (Abs.)	Allowed tolerance (Abs.)	Actual Absorbce (Abs.)	Assessment Yes/No
445-1	0.198	± 0.020	0.196	Yes
445-2	0.496	± 0.030	0.493	Yes
445-3	0.994	± 0.040	0.985	Yes
445-4	1.492	± 0.050	1.475	Yes
525-1	0.197	± 0.020	0.195	Yes
525-2	0.494	± 0.030	0.491	Yes
525-3	0.986	± 0.040	0.984	Yes
525-4	1.482	± 0.050	1.480	Yes
690-1	0.197	± 0.020	0.197	Yes
690-2	0.498	± 0.030	0.497	Yes
690-3	0.985	± 0.040	0.978	Yes
690-4	1.485	± 0.050	1.482	Yes

* Spectroquant Photocheck (Check Solution) Lot : HC35941

- Check solution for this certification is traceable to : Reference Photometer Agilent Cary 4000 checked and calibrated using NIST-glass filter SRM 1930 and Holmiumoxide Solution NIST SRM 2034
 - Desired absorbance round cell has been calculated from the absorbance of the 1 cm cell using the path length of the round cell and is entered as the desired



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CERTIFICATE OF CALIBRATION

Software version: 1.5.1

Wavelength Accuracy*					Result
Equipment	Nominal value	Tolerance limit**	Actual value		
Holmium Oxide Liquid Filter Hellma 567-UV5	361.25 nm	380.1 - 382.5 nm	360.8 nm	P	
	536.55 nm	535.4 - 539.3 nm	536.9 nm	P	
	640.55 nm	639.4 - 642.8 nm	640.9 nm	P	
Photometric Accuracy*					
Equipment	Wavelength	Nominal value	Tolerance limit**	Actual value	Result
Neutral Density 1.00 Abs. Hellma 566-F4	440 nm	1.079 A	1.067 - 1.091 A	1.083 A	P
	546 nm	1.012 A	1.004 - 1.020 A	1.015 A	P
	635 nm	1.050 A	1.042 - 1.058 A	1.051 A	P
Stray Light*					
Equipment	Wavelength	Nominal value	Actual value	Result	
UV-VIS Standard 2 Sodium Nitrite Solution	340 nm	≤0.10 %T	0.05 %T	P	
Self-test Hardware					
No visual flaws, no burrs, no loose parts and fastenings					P



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CERTIFICATE OF CALIBRATION

INSTRUMENT : SPECTROPHOTOMETER

MANUFACTURER : Merck KGaA, Darmstadt, Germany

MODEL : PROVE 100

SERIAL No. : 1613110857

CLIENT : Eastern Thai Consulting 1992 Co., Ltd.

DATE OF ISSUE : February 13, 2023

APPROVED SIGNATORY

NAME : Mr. Rawat Rattanacheththakul
(SERVICE ENGINEER)

SIGNATURE :

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



CERTIFICATE OF CALIBRATION

Page 1 of 2

Certificate No. : 23-055203

Sample Code : 23-21440-001

Customer

EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 8 Rd., Nongkham,

Sriracha, Chonburi 20230

Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Calibration laboratory)

Equipment : Digital thermo-hygrometer

Manufacturer : testo Model : 608-H1

Serial No. : 45106737 ID No. : LABE 09/7

Date of Receipt : 25 May 2023 Date of Calibration : 29 May 2023

Condition of Calibration

1. Environment 1.1 Ambient temperature : 23.0 °C ± 3.0 °C

1.2 Relative humidity : 55.0 % ± 15.0 %

2. Calibration method

2.1 In-house method: WI-CL-045 By comparison with thermometer standard / chilled mirror hygrometer in controlled chamber.

2.2 The calibration by comparison unit under calibration (UUC) to the thermometer standard / chilled mirror hygrometer in

a chamber at the controlled temperature / relative humidity.

3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due Date
3.1 Chilled Mirror	Optidew Vision	LB-DP-02 & LB-DP-02 (DP)	TH-0157-22	05 December 2023
3.2 Digital Thermometer	Optidew Vision	LB-DP-02 & LB-DP-02 (Temp.)	23-014916	12 February 2024
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	22-095535	06 September 2023

4. This certificate is traceable to the international system of unit (SI Unit).

4.1 Instrument No. 3.1 through National Institute of Metrology (Thailand).

4.2 Instrument No. 3.2 and 3.3 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by

Miss Pornsuda Lohabai

Approved by

(Mr. Somchai Neampunt)

Scientist

Signed for Director

Issue date 31 May 2023

The uncertainties are for a confidence probability of approximately 95%.

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognised national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)

361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

PM-CL-14

TEL 02-516-2422

FAX 02-516-6949

Rev 01

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date 15/10/21



REPORT OF CALIBRATION

Page 2 of 2

Certificate No. : 23-055203

Sample Code : 23-21440-001

Results of Calibration

Temperature measurement

Resolution : 0.1 °C

Range : 0 °C to 50 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.00	20.0	0.00	± 0.39
25	50	25.02	25.1	- 0.08	± 0.39
30	50	30.00	30.0	0.00	± 0.39

Humidity measurement

Resolution : 0.1 %RH

Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.00	45.18	53.5	- 8.32	± 1.3
60	25.00	60.03	68.3	- 8.27	± 1.5
75	25.00	75.20	83.2	- 8.00	± 1.7

Notes

Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with GUM 2000.

- End of Report -

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WWW.AMARC.CO.TH

Effective Date 15/10/21

UV/VIS SPECTROPHOTOMETER

Model : UV - 1800

Serial No. : A11635101643 CD



Bara Scientific Co., Ltd.
988 U Chu Liang Building Floor7 Rama4 Road
Sicom Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No.

Equipment

Model

Manufacturer

Serial No.

ID No.

Date of receipt

Date of calibration

Date of issue

Customer name

Address

BSCC-UV-152/23

UV/Vis Spectrophotometer

UV-1800

Shimadzu

A11635101643 CD

N/A

25 April 2023

25 April 2023

27 April 2023

Eastern Thai Consulting 1992 Co.,Ltd

883 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Temperature

Humidity

Equipment condition

Calibration Location

Calibration Procedure

Traceability

Calibrated by

(22.4-23.1) °C (On site)
(44.5-45.2) %RH (On site)

Good Operation

Analysis Department

In-house method WI-UV-702-01 based on ASTM E275-01

Wavelength Accuracy is traceable to certificate No. 94780 and 94775

Photometric Accuracy is traceable to certificate No. 94808 and 100147

Stray Light is traceable to certificate No. 94791

The above certificate are traceable to SI unit through Starna Scientific Ltd

(UKAS accredited calibration laboratory NO. 0659)

Mr.Pannaphong Phannmekakul

Approved by

Mr.Kanchit Choothep
Technical Manager

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www.barascientific.com



Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-152/23

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.65	-0.06	0.18
445.82	445.80	-0.02	0.18
536.52	536.35	-0.17	0.18
741.02	740.99	-0.03	0.18
879.41	879.27	-0.14	0.18

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0075
	0.7311	0.7313	0.0002	0.0075
257	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6306	0.6314	0.0008	0.0075

*CNR = Customer not request

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Certificate of Calibration

Certificate No. **BSCC-UV-152/23**

Number of Page(s) **3 of 3**

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5488	0.5508	0.0020	0.0042
	0.7527	0.7535	0.0008	0.0042
	1.0756	1.0758	0.0002	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5391	0.5406	0.0015	0.0042
	0.7355	0.7360	0.0005	0.0042
	1.0509	1.0501	-0.0008	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5045	0.5044	-0.0001	0.0042
	0.6884	0.6885	0.0001	0.0042
	0.9816	0.9808	-0.0008	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5183	0.5178	-0.0005	0.0042
	0.6864	0.6868	0.0004	0.0042
	0.9747	0.9739	-0.0008	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.75±0.11nm	200.72	2.0164

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A.
*Stray Light not NSC-ONSC Accredited.

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

End of Certificate

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Bara Scientific Co., Ltd.

O2 Analyzer Calibration Data

Source identification : B-910
Test personnel : KItupong T.
Date : September 01, 2023
Analyzer calibration data for sampling O2 AMI Model 70-Zirconium S/N 111117-2
Span(%) 7.94
Time : 09:40-10:40

	Cylinder value (%)	Analyzers calibration response (%)	Absolute difference (%)	Difference (percent of span)
Zero gas	0.00	0.00	0.00	0.00
Mid-level gas	7.94	7.94	0.00	0.00
High level gas	20.90	20.80	0.10	1.26

NOx Analyzer Calibration Data

Source identification : B-910
Test personnel : KItupong T.
Date : September 01, 2023
Analyzer calibration data for sampling NOx API Model 200AH S/N 441
Span(ppm) 79.5
Time : 09:40-10:40

	Cylinder value (ppm)	Analyzers calibration response (ppm)	Absolute difference (ppm)	Difference (percent of span)
Zero gas	0.00	0.00	0.00	0.00
Mid-level gas	19.60	19.51	0.09	0.11
High level gas	79.50	79.50	0.00	0.00

System Calibration Bias and Drift Data

Source identification B-910
Date : September 1, 2023
Test personnel : KItupong T.
Cylinder Cone : 7.94 %
Time : 10:40-10:55 12:25-12:40
Span : 7.94 %

	Initial values		Final values		Drift (percent of span)
	System Calibration response	System cal bias (percent of span)	System Calibration response	System cal bias (percent of span)	
Zero gas	0.00	0.83	0.05	0.63	-0.25
Upscale gas	7.94	-0.25	7.94	0.00	0.25

System Calibration Bias and Drift Data:

Source identification B-910
Date : September 1, 2023
Test personnel : KItupong T.
Cylinder Cone : 19.6 ppm
Time : 10:40-10:55 12:25-12:40
Span : 79.5 ppm

	Initial values		Final values		Drift (percent of span)
	Nox Analyzer Calibration response	System Calibration response	System Calibration response	System cal bias (percent of span)	
Zero gas	0.00	0.03	0.01	0.01	-0.03
Upscale gas	19.51	19.51	19.57	0.08	0.08

System Calibration Bias and Drift Data

Source identification B-910
Date : September 1, 2023
Test personnel : Kitipong I.
Cylinder Conc : 7.94 %
Time : 12:25-12:40, 14:10-14:25
Span : 7.94 %

	O2 Analyzer Calibration response	Initial values		Final values		Drift (percent of span)
		System Calibration response	System cal bias (percent of span)	System Calibration response	System cal bias (percent of span)	
Zero gas.....	0.00	0.05	0.63	0.05	0.63	0.00
Upscale gas.....	7.94	7.94	0.00	7.94	0.00	0.00

System Calibration Bias and Drift Data

Source identification B-910
Date : September 1, 2023
Test personnel : Kitipong I.
Cylinder Conc : 19.6 ppm
Time : 12:25-12:40, 14:10-14:25
Span : 79.5 ppm

	Nox Analyzer Calibration response	Initial values		Final values		Drift (percent of span)
		System Calibration response	System cal bias (percent of span)	System Calibration response	System cal bias (percent of span)	
Zero gas.....	0.00	0.01	0.01	0.00	0.00	-0.01
Upscale gas.....	19.51	19.57	0.08	19.88	0.47	0.39

System Calibration Bias and Drift Data

Source identification B-910
Date : September 1, 2023
Test personnel : Kitipong I.
Cylinder Conc : 7.94 %
Time : 14:10-14:25, 15:55-16:20
Span : 7.94 %

	O2 Analyzer Calibration response	Initial values		Final values		Drift (percent of span)
		System Calibration response	System cal bias (percent of span)	System Calibration response	System cal bias (percent of span)	
Zero gas.....	0.00	0.05	0.63	0.06	0.76	0.13
Upscale gas.....	7.94	7.94	0.00	7.92	-0.25	-0.25

System Calibration Bias and Drift Data

Source identification B-910
Date : September 1, 2023
Test personnel : Kitipong I.
Cylinder Conc : 19.6 ppm
Time : 14:10-14:25, 15:55-16:20
Span : 79.5 ppm

	Nox Analyzer Calibration response	Initial values		Final values		Drift (percent of span)
		System Calibration response	System cal bias (percent of span)	System Calibration response	System cal bias (percent of span)	
Zero gas.....	0.00	0.00	0.00	0.08	0.10	0.10
Upscale gas.....	19.51	19.88	0.47	19.67	0.20	-0.26



Certificate of Analysis Special Gases Mixture

Customer Details		Customer Tag No.
Name:	Address:	
Secor Co., Ltd.	239, Rimkongsriprada Rd., Bangsue, Bangkok 10800	

Certificate Details		Expiry date:
Number:	0529/23	7-Mar-2025
Material Details		
Production Order:	90176407	A008195K
Gas content:	5.23 M ¹	CGA 650 SS
Cylinder Owner:	LINDE	Cylinder Size: 40L

Laboratory Report		Assay Date
Analytical Result		27-Feb-23
Component	Analysis Result ¹ Uncertainty ² Method of Analysis ³	
Nitric Oxide	79 ± ppm ± 1% relative (6) I-PB-352	
Other NOx impurity	Less than 3.9 ppm ± 1% relative (6) I-PB-352	
Carbon Monoxide	80.0 ppm	27-Feb-2023
In Nitrogen		

Reference Standard used in Assay		Expiry date:
Cylinder Number	Concentration	31-Dec-2024
25C0735G	50.89 ± 0.41 ppm	4-May-2024
ND-H-023	50.20 ± 0.26 ppm	

Analytical Instruments used in Assay		Last Multi-point Calibration
Instrument/Make/Model	Analytical Principle	27-Jan-6 1-Mar-23
FTIR Spectrometers Nicolet 550	FTIR-NO	22-Feb-2023
FTIR Spectrometers Nicolet 550	FTIR-CO	

Recommend usage condition	
Minimum utilization:	5% of actual content or before expiry date whichever comes first.
Storage condition:	Keep in well ventilation and secure place.

Comments	
When recording, please quote the material number.	

Note:

- All results expressed in this report are obtained using standard methods. The accuracy of this analysis has been performed in accordance with the ISO 9001:2015 standard. The results are subject to the accuracy of the standard gases used.
- The reported impurity is based on a standard uncertainty of ± 1% relative to the nominal value. The actual impurity may vary slightly due to the manufacturing process.
- The impurity level is based on the standard method of analysis. The results are subject to the accuracy of the standard gases used.
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Sukanya Panyasophon		Signature
Sukanya Panyasophon		
Signature for and on behalf of Linde (Thailand) Co., Ltd.		
Linde (Thailand) Public Company Limited		HS-007/1026
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Bangkok, Thailand 10710		Bangkok, Thailand 10710
Wangchow Puri 105 Mts 5, Bangkok, Thailand 10710		Wangchow Puri 105 Mts 5, Bangkok, Thailand 10710
Thailand, Tel: (66) 3857-47993		Thailand, Tel: (66) 3857-47993
Fax: (66) 3857-47993		Fax: (66) 3857-47993



Agilent CrossLab Start Up Services

Agilent 7890 Gas Chromatograph

Preventive Maintenance Checklist



Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the longevity of your investment.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.



Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/services/repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- **7890B Manuals** are also available on Agilent.com:
 - **Safety** https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - **Installation and First Startup** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - **Operation Manual** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Operation.pdf
 - **Maintaining Your GC** https://www.agilent.com/cs/library/usermanuals/public/G3430-900529207890B_Maintaining%20Guide.pdf

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓"
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

System Information

- ☒ Check this box if an instrument configuration report is attached instead of completing the table below.

Instrument System Name and ID

GC7890B

CN15343147

Instrument System Site and Location

Seet Co., Ltd.

Instrument room

List System Component Product Numbers

List the Serial Numbers of each Component

1. GC7890B

CN15343147

2. GC519A

CN1910080

3. GC514A

CN19080006

4.

5.

6.

7.

8.

9.

10.

Preparation

- ☒ Discuss any specific issues with the customer before starting
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual – "Maintaining Your GC" - for the inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.

ALS Maintenance

- ☐ Section NOT applicable
 - ☒ Check all cabling and configuration settings between GC, tray, and injectors.
 - ☒ Vacuum or remove any dust, especially around fans.
 - ☒ Check operation of all fans.
 - ☒ Check syringe for smooth plunger operation.
 - ☒ Check for smooth operation of the needle support – clean if necessary
- ### Restore Instrument
- ☒ Restore the normal operating conditions or customer method using the Data System.
 - ☒ Purge the system with carrier flow for 15 minutes
 - ☒ Bake out the system, then restore the normal operating conditions
 - ☒ After equilibration, check and record the post-PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
 - ☐ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page Service Review

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output <i>1000</i>	<i>N/A</i>	<i>126.2</i>
Back detector output <i>FID</i>	<i>N/A</i>	<i>22.6</i>
AUX detector output	<i>N/A</i>	<i>N/A</i>
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	<i>Pass</i>
Back inlet pressure decay test	Pass	<i>Pass</i>

7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or models where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	<i>N/A</i>
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	<i>2</i>
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	<i>N/A</i>
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	<i>N/A</i>
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	<i>N/A</i>
PD Inlet PM kit	5188-6498	7890A/B	<i>N/A</i>
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	<i>N/A</i>
MMI Cleaning Kit	GS510-60820	7890A/B	<i>N/A</i>
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	<i>N/A</i>
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	<i>N/A</i>
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	<i>1</i>
FID Collector Rebuild/Cleaning Kit	GT531-67000	7890A/B	<i>N/A</i>
Standard .011-inch FID Jet for capillary FID base	GT531-80560	7890A/B	<i>1</i>
High Temperature .018-inch FID Jet for capillary FID base	GT531-80620	7890A/B	<i>N/A</i>
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	<i>N/A</i>
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	<i>N/A</i>
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	<i>N/A</i>
NPD Jet, universal fit, .011-inch ID	GT534-80580	7890A/B	<i>N/A</i>
NPD Jet, universal fit, .011-inch ID Extended tip	GT534-80590	7890A/B	<i>N/A</i>
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	<i>N/A</i>
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	<i>N/A</i>
**FID Collector Replacement Kit, if needed	GT531-67001	7890A/B	<i>N/A</i>

Certificate of Completion

Learner Name: Saenguthai Saeng Tarak

Title Of Course: AN-ASP/CE/CSE-GC-I-001-M: 7890/7820 GC and OL GC Standalone Chemstation I&F/ Service

Completion Date: November 23, 2014

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's: Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Service Engineer Comments

If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

Service Completion

Service request number 600041153 Date service completed 29 May 2023

Agilent signature [Signature] Customer signature [Signature]

Total number of pages in this document 9 pages

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name:	Saenguthai Tarak
Title Of Course:	ANCE-GCMS-2-041-D-5977 ELCHIES MSD GC-MS OPER. HW SW Intro, Repair and Troubleshooting
Completion Date:	March 18, 2016
Certified By Company:	Learning at Agilent

All Service and Support training certificates have the following specific limitations.

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Date: September 6, 2016 6:11:18 PM
System ID: SGH545TXVW

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Certificate of Completion

Learner Name:	Saenguthai Saeng Tarak
Title Of Course:	AN-CE-GC-II-022-A: Advanced GC Detectors Application and Troubleshooting Labs
Completion Date:	November 25, 2014
Certified By Company:	Learning at Agilent

All Service and Support training certificates have the following specific limitations.

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent-authorized service provider, through which the service employee has ongoing access to Agilent's: Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.