ภาคผนวก ง

ใบแสดงการตรวจเทียบเครื่องมือ

ANALYTICAL BALANCE (DU)

Model. : XS205DU

Serial No. : 1126323724

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

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 : 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 Pholthep
Scientist

Approved by (Mr. Somchai Neampunt)
Signed for Director

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

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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

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
☑ No adjustment
☐ Adjustment

Range : 80

	☐ Before adjustment		☐ After adjustment	
Nominal value	40	80	-	-
Standard weight	40.000042	80.000045	-	-
Average reading of indicator	40.00015	80.00019	-	-
Standard deviation	0.000004	0.000007	-	-

Unit : g
☑ No adjustment
☐ Adjustment

Range : 200

	☐ Before adjustment		☐ After adjustment	
Nominal value	100	200	-	-
Standard weight	100.000022	200.000199	-	-
Average reading of indicator	100.0001	200.0004	-	-
Standard deviation	0.00004	0.00008	-	-

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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 : 80		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 Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.00000	0.00000	0.0000090	2.0
0.01	0.0100036	0.01000	0.00000	0.0000093	2.0
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

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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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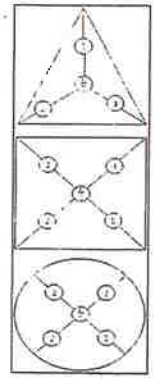
NSC-TISI-TIS1702
CALIBRATION 015

REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

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



Weighing pan ○ Circle ○ Triangular ◉ Rectangular

Test weight : 50 and 100 Unit : g

Range	80	200
Position	Reading of indicator	Reading of indicator
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	0.00008	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 certificate 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	Class	ID.No.	Certificate No.	Due Date
1) STANDARD WEIGHT 1 mg to 1 kg	E2	LB-WE-57	22-060639	27 June 2023

6.

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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- End of Report -

ANALYTICAL BALANCE

Model : MS204TS/00

Serial No. : B904136539

METTLER TOLEDO

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+662 723 0382
MT-TH.ServiceSupport@mt.com

NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company:	EASTERN THAI CONSULTING 1992 CO., LTD.		
Address:	683 Moo 11, Sukhaphiban 8 Rd., Nong Kham		
City:	Sriracha	**Contact:**	Sasiporn Nakin
Zip / Postal:	20230		
State / Province:	Chonburi		
Order Number:	0332630077		

Weighing Device

Manufacturer:	Mettler Toledo	**Instrument Type:**	Weighing Instrument
Model:	MS204TS/00	**Asset Number:**	LABE 05/4
Serial No.:	B904136539	**Terminal Model:**	N/A
Building:	Laboratory	**Terminal Serial No.:**	N/A
Floor:	1	**Terminal Asset No.:**	N/A
Room:	Balance		

Range	Max. Capacity	Readability (d)
1	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CP/W002/20

This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.

The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.

In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
As Found	Start: 25.6 °C	End: 25.2 °C	Start: 50.5 %	End: 44.6 %

As Found Calibration Date: 06-Feb-2023
As Left Calibration Date: N/A
Issue Date: 07-Feb-2023

Calibrator: Thiraphong Salanoi

Approved Signatory: Technical Manager / Head of Calibration Center

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Software Version: 1.23.1.54
Report Version: 2.16.32
Form Number: F103C

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METTLER TOLEDO Service

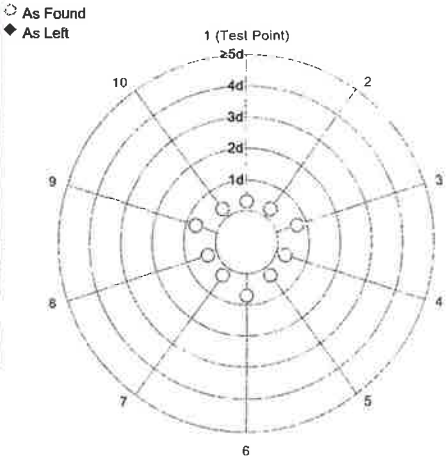
Measurement Results

Repeatability

Test Load: 100 g

	As Found	As Left
1	100.0002 g	N/A
2	100.0002 g	N/A
3	100.0001 g	N/A
4	100.0002 g	N/A
5	100.0002 g	N/A
6	100.0001 g	N/A
7	100.0002 g	N/A
8	100.0002 g	N/A
9	100.0001 g	N/A
10	100.0002 g	N/A

Standard Deviation	**0.00005 g**	**N/A**



The "d" in the graph represents the readability of the range/interval in which the test was performed.

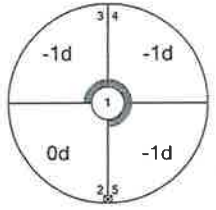
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0002 g	N/A
2	100.0002 g	N/A
3	100.0001 g	N/A
4	100.0001 g	N/A
5	100.0001 g	N/A

Maximum Deviation	**0.0001 g**	**N/A**



As Found

The "d" in the graph represents the readability of the range/interval in which the test was performed.

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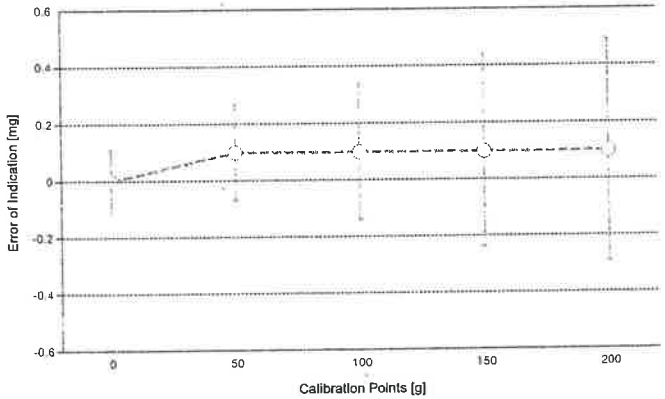
Software Version: 1.23.1.54
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Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.11 mg	2
2	0.0100 g	0.0100 g	0.0000 g	0.13 mg	2
3	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
4	0.1000 g	0.0999 g	-0.0001 g	0.13 mg	2
5	1.0000 g	0.9999 g	-0.0001 g	0.13 mg	2
6	5.0000 g	4.9999 g	-0.0001 g	0.13 mg	2
7	10.0000 g	9.9999 g	-0.0001 g	0.14 mg	2
8	50.0000 g	50.0001 g	0.0001 g	0.17 mg	2
9	100.0001 g	100.0002 g	0.0001 g	0.24 mg	2
10	150.0001 g	150.0002 g	0.0001 g	0.34 mg	2
11	200.0001 g	200.0002 g	0.0001 g	0.39 mg	2



For improved legibility of the graphics only increasing measurement points are shown and measurement points close to zero are not displayed.

The uncertainty stated is the expanded uncertainty at calibration obtained by multiplying the standard combined uncertainty by the coverage factor *k* – which can be larger than 2 according to EURAMET cg-18. The value of the measurand lies within the assigned range of values with a probability of approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.

Test Equipment

All weights used for metrological testing are traceable to national or international standards. The weights were calibrated and certified by an accredited calibration laboratory.

Weight Set 1: OIML E2

Weight Set No.:	WS28	Date of Issue:	01-Apr-2022
Certificate Number:	178498	Calibration Due Date:	17-Sep-2023

Thermo Hygrometer

Equipment No.:	IN306	Date of Issue:	10-Jan-2023
Certificate Number:	23H4	Calibration Due Date:	03-Jan-2024

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Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

The information below and any attachments to this calibration certificate are not part of the accredited calibration.

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Measurement Uncertainty of the Weighing Instrument in Use

Stated is the expanded uncertainty with k=2 in use. The formula shall be used for the estimation of the uncertainty under consideration of the errors of indication. The value R represents the net load indication in the unit of measure of the device.

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-5}$ / K

Temperature range on site for the evaluation of the measurement uncertainty in use: 5 K

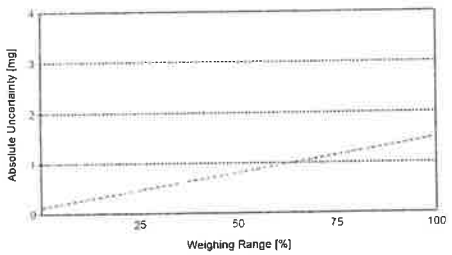
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_I = 0.13\ mg + 0.00625\ mg/g \cdot R$	N/A

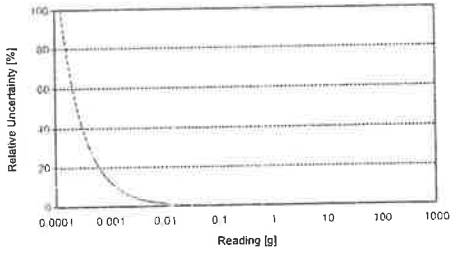
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

Absolute and Relative Measurement Uncertainty in Use for Various Net Indications (Examples)

Net Indication	As Found		As Left	
0.0220 g	0.13 mg	0.59%	N/A	N/A
0.2200 g	0.13 mg	0.060%	N/A	N/A
2.2000 g	0.14 mg	0.0065%	N/A	N/A
22.0000 g	0.27 mg	0.0012%	N/A	N/A
220.0000 g	1.5 mg	0.00068%	N/A	N/A



As Found



As Left

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Report Version: 2.16.32
Form Number: F103C

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GWP® Certificate

As Found ✓

The weighing device meets the given process requirements.

As Left ✓

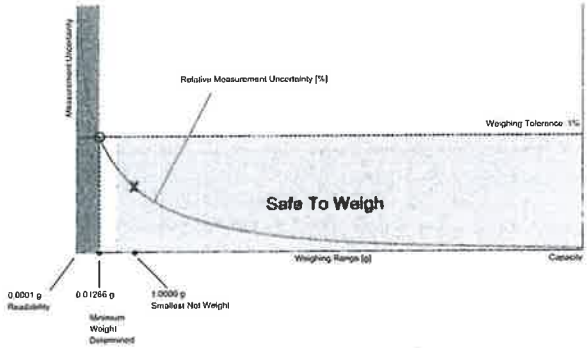
The weighing device meets the given process requirements.

Tests Performed: ☑ As Found ☐ As Left ☑ No adjustments/modifications made. As Left results correspond to As Found.

Process Requirements

Weighing Tolerance: **1%** | Smallest Net Weight: **1.0000 g** | Safety Factor: **2**

Safe Weighing Range



While the values in this graph reflect the actual calibration results, the measurement uncertainty curves are simply a visual representation. This graph reflects As Left testing, unless only As Found was performed.

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Software Version: 1.23.1.54
Report Version: 2.16.32
Form Number: F103C

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Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
	Safety Factor				
Tolerance	1	2	3	5	10
0.1%	0.12729 g	0.25618 g	0.38672 g	0.65284 g	1.34917 g
0.2%	0.06344 g	0.12729 g	0.19153 g	0.32124 g	0.65284 g
0.5%	0.02533 g	0.05072 g	0.07618 g	0.12729 g	0.25618 g
1%	0.01266 g	0.02533 g	0.03802 g	0.06344 g	0.12729 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03167 g	0.06344 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02533 g

✓ Pass: The determined minimum weight meets the requirement for the smallest net weight.

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
	Safety Factor				
Tolerance	1	2	3	5	10
0.1%	0.12729 g	0.25618 g	0.38672 g	0.65284 g	1.34917 g
0.2%	0.06344 g	0.12729 g	0.19153 g	0.32124 g	0.65284 g
0.5%	0.02533 g	0.05072 g	0.07618 g	0.12729 g	0.25618 g
1%	0.01266 g	0.02533 g	0.03802 g	0.06344 g	0.12729 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03167 g	0.06344 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02533 g

✓ Pass: The determined minimum weight meets the requirement for the smallest net weight.

At these net minimum weight values, the measurement uncertainty of the weighing device is equal to or less than 1/1 (no safety factor), 1/2, 1/3, 1/5, or 1/10 of the required tolerance. The values are calculated with k = 2 and based on the linear formula of the measurement uncertainty of the weighing device in use.

The safety factor for As Found is always 1. This implies no safety factor. As Found testing looks at the behavior of the instrument from the past until test occurred. For the past, it is necessary to know that the tolerance was met, but not the safety factor. The safety factor is a proactive measure to apply for future measurements.

Notes on minimum weight values in above table:

1. If "N/A" is shown above, no appropriate value could be calculated.
2. METTLER TOLEDO is not responsible for the definition of the process requirements.

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Measurement Results

Results Summary

	Repeatability	Eccentricity	Error of Indication
As Found	✓	✓	✓
As Left	✓	✓	✓

✓ = Passed
✗ = Failed
⚠ = Safety Factor not met

Repeatability

Test Load: 100 g

		As Found		As Left	
Tolerance	Control Limit	Std. Deviation	Result	Std. Deviation	Result
0.1%	0.00050 g	0.00005 g	✓	0.00005 g	✓
0.2%	0.00100 g		✓		✓
0.5%	0.00250 g		✓		✓
1%	0.00500 g		✓		✓
2%	0.01000 g		✓		✓
5%	0.02500 g		✓		✓

The weighing tolerance is met if the standard deviation is less than or equal to the corresponding control limit.

Eccentricity

Test Load: 100 g

		As Found		As Left	
Tolerance	Control Limit	Deviation	Result	Deviation	Result
0.1%	0.0500 g	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

The weighing tolerance is met if the deviation is less than or equal to the corresponding control limit.

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METTLER TOLEDO Service

Error of Indication

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g
100.0001 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0001 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0001 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

The weighing tolerance is met if the error (of indication) for each test point is less than or equal to the corresponding control limit for that particular weighing tolerance. Results at or close to the zero point cannot be assessed.

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BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41

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

NSC-TISI-TIS 17025 CALIBRATION 0052

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: Sarayuth T.
(Mr. Sarayuth Tochua)

CERTIFIED MIT

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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 measurment 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 PROTOCAL GAS

Cylinder No. : EB0145030

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
6141 Easton Road
Bldg 2
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI99E15AC0U4	Reference Number:	160-402242242-1
Cylinder Number:	EB0145030	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12021	Valve Outlet:	350
Gas Code:	CH4,PPN,BALN	Certification Date:	Oct 15, 2021

Expiration Date: Oct 15, 2029

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

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

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable	10/15/2021
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable	10/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%	May 15, 2025
NTRM	200602-06	6162560Y	243.3 PPM PROPANE/AIR	+/- 0.5%	Mar 17, 2027

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet iS50 FTIR AUP2110295 CH4	FTIR	Oct 13, 2021
Nicolet iS50 FTIR AUP2110295 C3H8	FTIR	Oct 14, 2021

Triad Data Available Upon Request

NOTES:
Gross Weight: 28.0 Kg
Net Weight: 4.9 Kg
PO# 5221004861

Approved for Release

ACCREDITED
CERT 3082.05

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CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

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,NOX,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 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a 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	Concentration	Uncertainty	Expiration Date
NTRM	16060607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Jun 02, 2017
GMIS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Mar 15, 2019
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 07, 2022
NTRM	12060735	CC356192	2498 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 14, 2026

The SRM, PRM or RGM noted above is only in reference to the GMIS 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 NO2	FTIR	Feb 16, 2018
Nicolet 6700 APW1100391 SO2	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 re... ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certi... are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncer... document shall not be reproduced in full without written approval of the issuer.

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TESTING CERT No. 3082.05

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DRY GAS METER MC-572V

Serial No. : 0504003

WISDOM SCIENCE

Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

Meter Console Information

Console Model :	MC572V
Console serial :	0504003
DGM Model #:	SK25EX
DGM Serial #:	0009854

Calibration Condition

Calibration Date:	3-Apr-23
Issue Date	3-Apr-23
Cal. Report No. :	WDS-SV660039
Ambient Temp (°c)	25
Pressure (mm Hg)	758
Relative Humidity (%)	80

Factors/Conversion

Std. Temp (°K)	298
Std. Pressure (mm Hg):	760
K_1 (K/mm Hg):	0.3857

Reference Equipment

WTM Model:	W-NKoDa-5B	WTM Cal. Due Date:	Nov. 2022
WTM Serial:	600245	Gamma:	1.0000

UUT Meter (DGM) / **Reference Meter (WTM)**

Run Time (minutes)	DGM Orifice ($mm H_2O$)	UUT Volume Initial	UUT Volume Final	UUT Outlet Temp Initial	UUT Outlet Temp Final	Ref Volume Initial	Ref Volume Final	Ref Outlet Temp Initial	Ref Outlet Temp Final
θ	P_{mhg}	V_{mi}	V_{mf}	t_{mi}	t_{mf}	V_{wi}	V_{wf}	t_{wi}	t_{wf}
15.00	13.0	2.1249	2.2873	26	26	11.24924	11.40853	25	25
10.00	25.0	1.9384	2.0964	26	26	11.06645	11.22136	25	25
8.00	50.0	1.7294	1.9105	26	26	10.86093	11.03905	25	25
7.00	80.0	1.4887	1.6921	26	26	10.62322	10.82407	25	25
5.00	120.0	1.1950	1.3736	26	26	10.33100	10.50914	25	25

Standardized Data / **Calibration Results**

Test Meter Std. Volume $V_{m(std)}$ (m^3)	Test Meter Std. Flow Rate $Q_{m(std)}$ m^3/min	Reference Meter Std. Volume $V_{w(std)}$ (m^3)	Reference Meter Std. Flow Rate $Q_{w(std)}$ m3/min	Correction Factor "Gamma" (Y)	Correction Factor Variation (ΔY)	Flow Rate Std & Corr $Q_{m(std)(corr)}$	ΔH@ ($mm H_2O$) 0.0212 SCMM $\Delta H_{@}$	ΔH@ Variation $\Delta\Delta H_{@}$
0.159	0.011	0.156	0.010	0.983	-0.001	0.010	52.990	5.531
0.155	0.015	0.152	0.015	0.981	-0.002	0.015	47.999	0.540
0.178	0.022	0.175	0.022	0.982	-0.002	0.022	46.696	-0.763
0.200	0.029	0.197	0.028	0.983	-0.001	0.028	45.249	-2.210
0.177	0.035	0.175	0.035	0.989	0.006	0.035	44.361	-3.098
				0.984	= Y Avg		47.459	= ΔH@ Avg

Pass/Fail Result: Pass

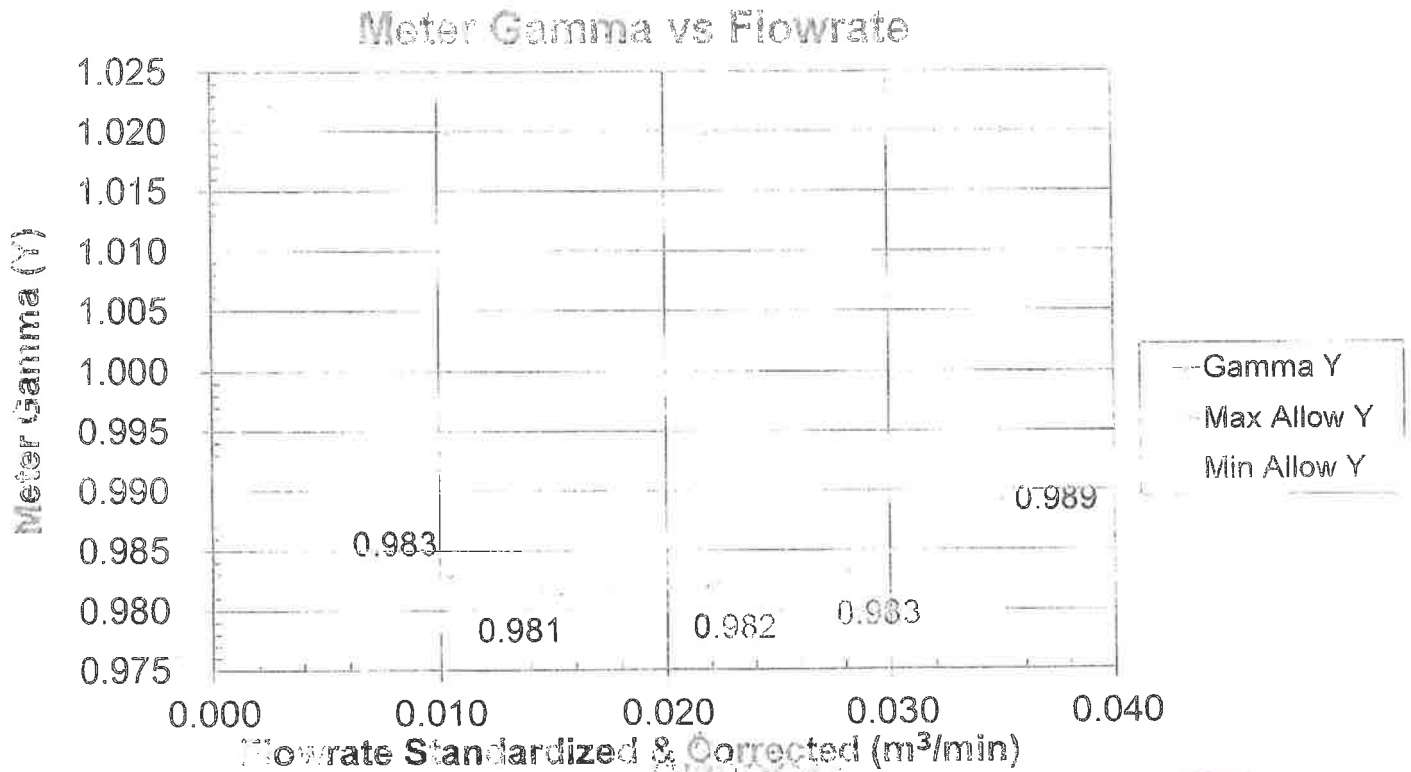
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02

Note: For $\Delta H_{@}$, orifice pressure differential that equates to 0.75cfm (0.0212m^3/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H_2O

Approved By: _____ Date 3-Apr-23

(Patpasu Chaisana)

Service Manager



Console Serial 0504003

Console Model MC572V

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model :	MC572V
Console serial :	0504003
Temp. Indicator Model :	765-KF
Temp. Indicator Serial :	JC17852

Calibration Conditions

Cal. Date :	3-Apr-23
Issue Date	3-Apr-23
Cal. Report No. :	WDS-SV660039
Ambient Temp. (°C)	25
Pressure (mm Hg) :	758
Humidity (%) :	60

Reference Equipment

Temp. Simulator Model :	FLUKE 714B
Serial No	60590035

Temperature Sensor Calibration

Reference Point	Ref. Thermocouple Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	92.0	1.0
4	149.0	148.0	1.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1038.0	0.0
		Maximum [1]	1.0
			PASS

Note

[1] For valid test results , the maximum difference between temperature readings should ≤1.0°C (EPA Method 5, Section 6.1.1.8) Perform all TC Channel calibrations. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermocouple Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ambient	26.5	26.0	0.5
Heat	100.5	102.0	-1.5

Difference Rang

DGM Out Temp. Diff. ±3 °C PASS

Approved By : _____

(Potjas Chaisena)

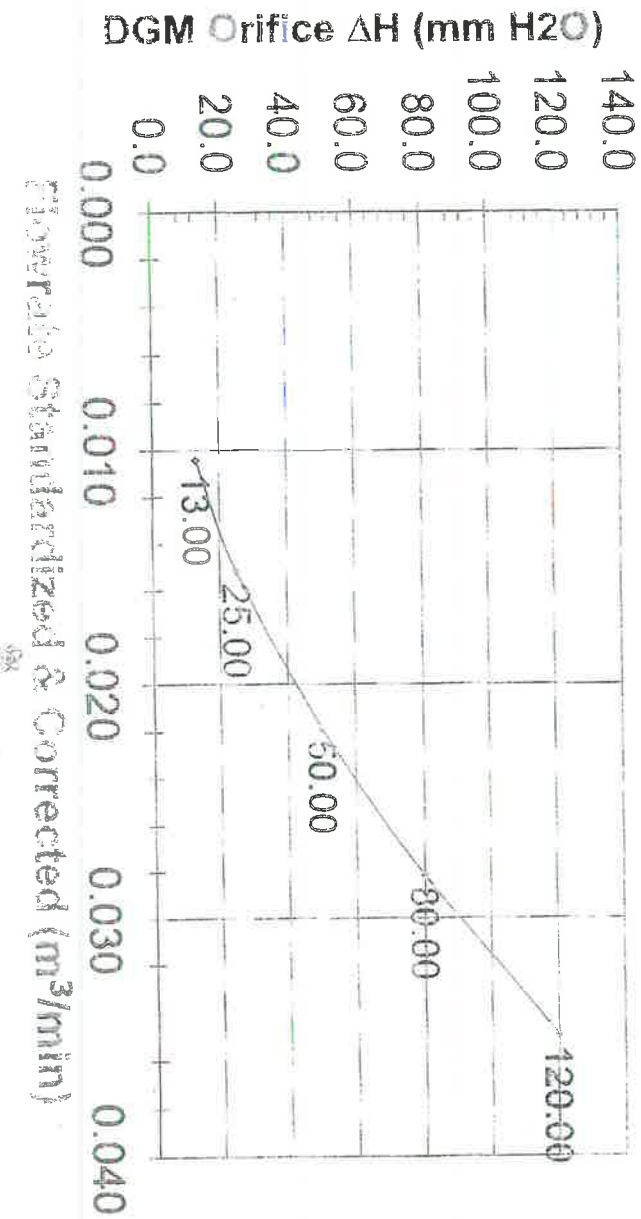
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Console Serial: 0504003

Console Model: MC572V

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DRY GAS METER XC-572-OV

Serial No. : A2204323

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Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m

Meter Console Information

Console Model :	XC-572-OV
Console serial :	A2204323
DGM Model #:	SK25EX
DGM Serial #:	00008294

Calibration Condition

Calibration Date:	2-May-2023
Due Date :	1-May-2024
Cal. Report No. :	WDS-SV660066
Ambient Temp (°c):	25
Pressure (mm Hg):	756
Relative Humidity (%):	55

Factors/Conversion

Std. Temp. (°K):	298
Std. Pressure (mm Hg):	760
K_1 (K/mm Hg):	0.3857

Reference Equipment

WTM Model:	W-NKoDa-5B	WTM Cal. Date:	22-Nov-2022
WTM Serial:	600245	Gamma:	1.0000

	UUT Meter (DGM)				Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice (mm H_2O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
θ	$P_{m@}$	V_{mi}	V_{mf}	t_{mi}	t_{mf}	V_{wi}	V_{wf}	t_{wi}	t_{wf}
15.00	13.0	18.0685	18.2252	25	26	17.55844	17.71573	25	25
10.00	25.0	18.2477	18.3984	25	26	17.73837	17.88948	25	25
8.00	50.0	18.4339	18.6056	25	26	17.92517	18.09730	25	25
7.00	80.0	18.6458	18.8344	25	27	18.13775	18.32707	25	25
5.00	120.0	18.8639	19.0510	25	27	18.37705	18.54526	25	25

	Standardized Data			Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH@ (mm H_2O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
$V_{m(std)}$ (m^3)	$Q_{m(std)}$ m^3/min	$V_{w(std)}$ (m^3)	$Q_{w(std)}$ m3/min	(Y)	(ΔY)	$Q_{m(std)(corr)}$	$\Delta H_@$	$\Delta\Delta H_@$
0.154	0.010	0.154	0.010	1.004	0.003	0.010	54.437	3.293
0.148	0.015	0.148	0.015	1.002	0.001	0.015	50.528	-0.616
0.169	0.021	0.169	0.021	0.999	-0.001	0.021	50.086	-1.058
0.186	0.027	0.186	0.027	0.999	-0.001	0.027	50.928	-0.216
0.165	0.033	0.165	0.033	0.999	-0.002	0.033	49.741	-1.403
				1.001	= Y Avg.		51.144	= ΔH@ Avg.

Pass/Fail Result: PASS

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

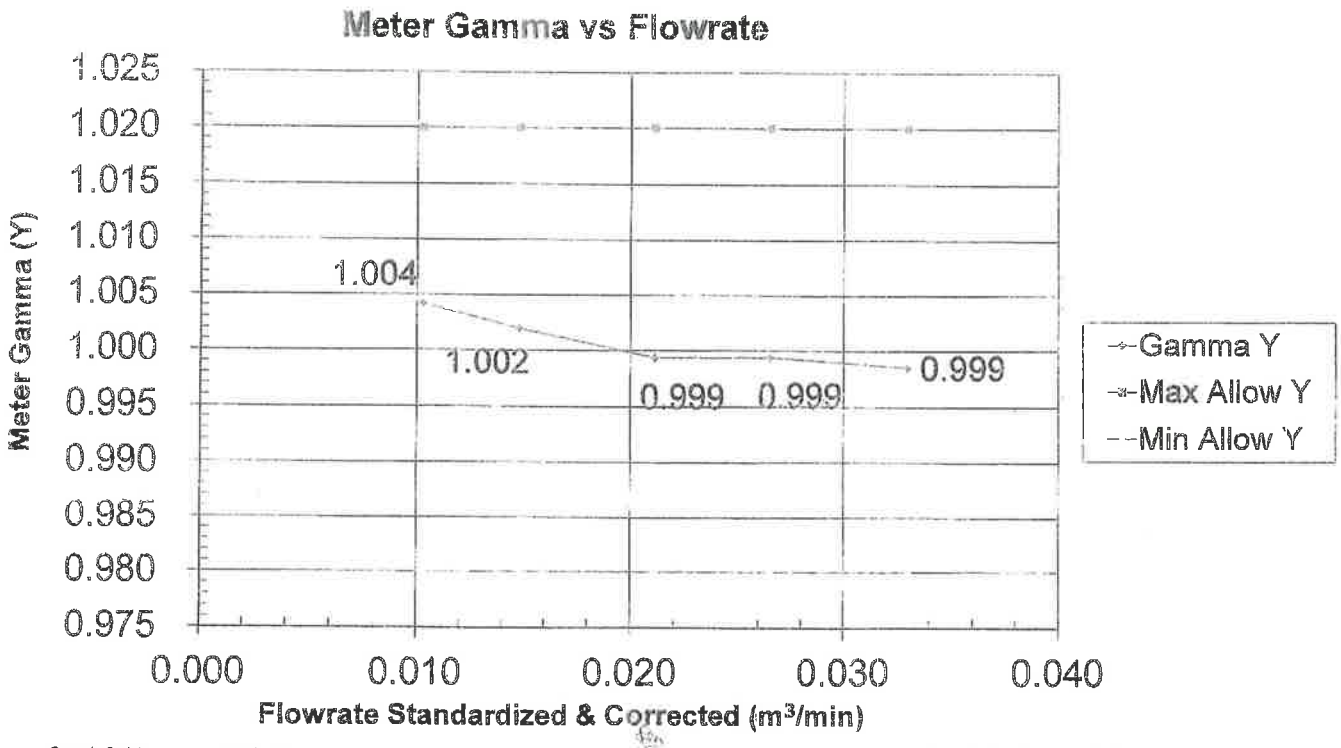
ote: For $\Delta H_@$, orifice pressure differential that equates to 0.75cfm (0.0212m^3/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H_2O.

Approved By: _____
(Patpasu Chaisana)
Service Manager

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Date 2-May-2023

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Console Serial: A2204323

Console Model: XC-572-OV

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Mocel :	XC-572-OV
Console Serial :	A2204323
Temp.Indicator Model :	765-KF
Temp. Indicator Serial :	JC19022

Calibration Conditions

Cal. Date :	2-May-2023
Due Date :	1-May-2024
Cal. Report No. :	WDS-SV660066
Ambient Temp. (°C) :	25
Pressure (mm Hg) :	758
Humidity (%) :	55

Reference Equipment

Temp. Simulator Model :	FLUKE 714B
Serial No. :	60590035
Calibration Date.:	14-Feb-2023

Temperature Sensor Calibration

Reference Point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	25.0	25.0	0.0
3	90.0	90.0	0.0
4	120.0	120.0	0.0
5	250.0	249.0	1.0
6	380.0	380.0	0.0
7	500.0	500.0	0.0
8	620.0	620.0	0.0
9	740.0	739.0	1.0
10	860.0	860.0	0.0
		Maximum [1]	1.0

PASS

Note

[1] For valid test results , the maximum difference between temperature readings should ≤1.0°C (EPA Method 5, Section 6.1.1.8). Perform AUX, STACK, PROBE, OVEN, FILTER, EXIT. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ambient	28.8	29.0	-0.2
Heat	100.0	101.3	-1.3

Difference Rang

DGM Out Temp. Diff. ±3 °C

PASS

Approved By :

(Patoosu Chaisana)

Service Manager

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Console Serial: A2204323

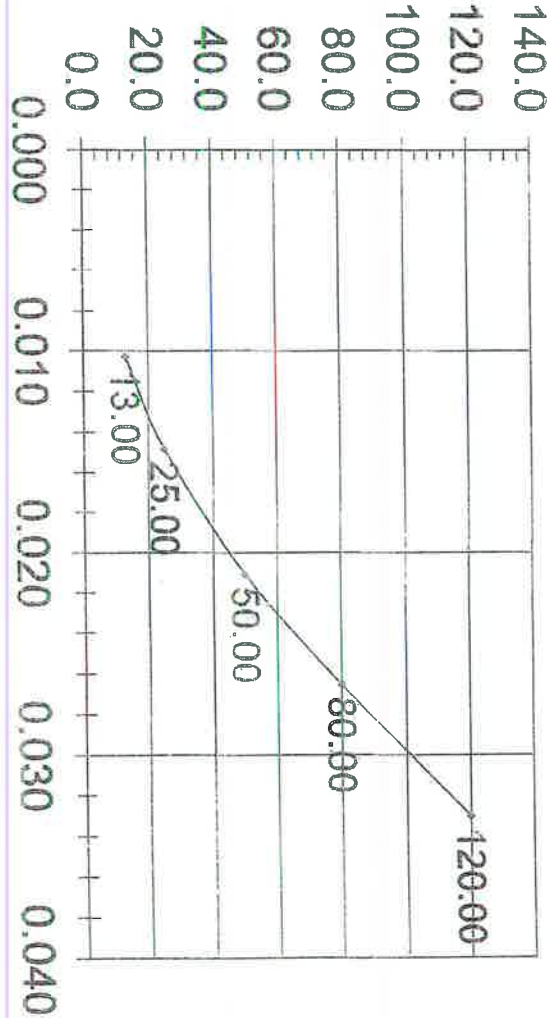
Console Model: XC-572-OV

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Flowrate Standardized & Corrected (m³/min)

DGM Orifice ΔH (mm H2O)



Meter Pressure vs Flowrate

DRY GAS METER XC572V

Serial No. : 1110070

WDS
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Certificate Of Calibration

Method 5 Pre-Test Console Calibration - Cubic meter (m3)

Meter Console Information

Console Model :	XC572V
Console serial :	1110070
DGM Model #:	SK25EX
DGM Serial #:	0005413

Calibration Condition

Calibration Date:	3-Jul-23
Due Date :	2-Jul-24
Cal. Report No. :	WDS-SV660107
Ambient Temp (°C):	25
Pressure (mm Hg):	758
Relative Humidity (%):	60

Factors/Conversion

Std. Temp. (°K):	298
Std. Pressure (mm Hg):	760
K_1 (K/mm Hg):	0.3857

Reference Equipment

WTM Model:	W-NKoDa-5B	WTM Cal. Due Date:	Nov. 2022
WTM Serial:	600245	Gamma:	1.0000

UUT Meter (DGM)						Reference Meter (WTM)			
Run Time (minutes)	DGM Orifice ($mm H_2O$)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
θ	$P_{m@d}$	V_{mi}	V_{mf}	t_{mi}	t_{mf}	V_{wi}	V_{wf}	t_{wi}	t_{wf}
15.00	13.0	599.3828	599.5462	27	27	20.05690	20.22163	28	27
10.00	25.0	599.5689	599.7246	27	26	20.24425	20.39999	27	27
8.00	50.0	599.7405	599.9176	26	26	20.41592	20.59344	27	27
7.00	80.0	599.9333	600.1337	26	26	20.60920	20.81034	27	27
5.00	120.0	600.1559	600.3319	26	26	20.83271	21.00950	27	27

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH@ ($mm H_2O$)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
$V_{m(std)}$ (m^3)	$Q_{m(std)}$ m^3/min	$V_{w(std)}$ (m^3)	$Q_{w(std)}$ m3/min	(Y)	(ΔY)	$Q_{(std)corr}$	$\Delta H_{@}$	$\Delta\Delta H_{@}$
0.159	0.011	0.160	0.011	1.005	0.010	0.011	50.181	2.747
0.152	0.015	0.152	0.015	0.996	0.000	0.015	48.096	0.662
0.174	0.022	0.173	0.022	0.995	-0.001	0.022	47.605	0.171
0.197	0.028	0.196	0.028	0.993	-0.003	0.028	45.668	-1.747
0.174	0.035	0.172	0.034	0.990	-0.006	0.034	45.602	-1.832
				0.996	= Y Avg.		47.434	= ΔH@ Avg

Pass/Fail Result: Pass

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

Note: For $\Delta H_{@}$, orifice pressure differential that equates to 0.75cfm (0.0212m^3/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H_2O

Approved By: _____
(Patpasu Chaisana)
Service Manager

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Date 3-Jul-23

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model :	XC572V
Console serial :	1110070
Temp.Indicator Model :	765-KF
Temp. Indicator Serial :	JC17852

Calibration Conditions

Cal. Date :	3-Jul-23
Due Date :	2-Jul-24
Cal. Report No. :	WDS-SV660107
Ambient Temp. (°C) :	25
Pressure (mm Hg) :	758
Humidity (%) :	60

Reference Equipment

Temp. Simulator Model :	FLUKE 714B	Serial No. :	60590035

Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	149.0	0.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1039.0	-1.0
		Maximum [1]	1.0

PASS

DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ambient	26.5	27.0	-0.5
Heat	100.5	102.5	-2.0

PASS

Difference Rang

DGM Out Temp. Diff. ±3 °C

Note

[1] For valid test results , the maximum difference between temperature readings should ≤1.0°C (EPA Method 5, Section 6.1.1.8).
Perform all TC Channel calibrations. Except meter (DGM) channel

Approved By : _____
(Patpasu Chaisana)
Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
Address 9/115 Lumpini Town Ville Ratchaphruek-Pinklao Village.No 4. Bang Khanun. Bang Kruai. Nonthaburi 11130 Thailand
Tel. 090-660-1392, 064-596-1944, 064-704-1620

WISDOM SCIENCE

ELAPSED TIMER CALIBRATION

Meter Console Information

Model #:	XC572V
Serial #:	1110070
Elapsed Timer Model #:	C342-1464
Elapsed Timer Serial #:	-

Calibration Conditions

Cal. Date :	03-Jul-23
Due Date :	02-Jul-24
Cal. Report No. :	WDS-SV660107
Ambient Temp. (°C) :	25
Pressure (mm Hg) :	758
Humidity (%) :	60

Reference Equipment

Calibration Standard:	JS-307
Method Reference:	Compare

Calibration Results

Run Time Elapsed STD	Elapsed Timer 1	2	3	4	Average Time	Deviation
Minute	Minute	Minute	Minute	Minute	Minute	Minute
2.00	2.00	2.00	2.00	2.00	2.000	0.000
3.00	3.00	3.00	3.00	3.00	3.000	0.000
5.00	5.00	5.00	5.00	5.00	5.000	0.000
7.00	7.00	7.00	7.00	7.00	7.000	0.000
9.00	9.00	9.00	9.00	9.00	9.000	0.000

Approved By

(Patpasu Chaisana)
Service Engineer

WISDOM SCIENCE
บริษัท วิสดอม ไซน์เอนซ์ เซลล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

COPY

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
Address 9/113 Lumpini Town Villa Ratchaphruek-Pinklao Village,No. 4, Bang Khanun, Bang Kruai, Nonthaburi 11130 Thailand
Tel. 090-660-1392, 084-598-1944, 084-704-1620

Flue gas Analyzer

Testo 350 NEW

Serial No. 60378478

ENTECH
Where Begin

Calibration Certificate

NSC-TISI-TIS 17025 CALIBRATION 0157

Certificate No: G 660353
Date of issue : 20-Jun-23

Instrument description	:	Flue Gas Analyzer
Instrument model	:	Testo 350 NEW
Instrument serial no.	:	60378478
ID no. or control no.	:	-
Manufacturer	:	Testo SE & Co. KGaA
Probe description	:	-
Probe model	:	-
Probe serial	:	-
Customer name	:	Eastern Thai Consulting 1992 Company Limited
Customer address	:	683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280
Total pages of certificate	:	2 Pages
Receiving no.	:	L-231787
Receiving date.	:	16-Jun-23
Parameter of calibration	:	Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,309.9,1003 ppm Nitrogen Dioxide 80.96 ppm, Nitric Oxide 151.5 ppm, Sulphur Dioxide 100.8 ppm)
Condition of UUC.	:	Used
Ambient condition	:	All of the Measurment ware caried out the stabilized labotary Temperature : 23 ±5 °C Humidity : 55 ± 15 %RH
Calibration place	:	17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no.	:	This instrument was calibrated by comparison with Standard gas mixture according to calibration work instration no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.

This calibration certificate documents are tracebility to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 20-Jun-23

Mr. Kwanchai Khamdoung
Calibration Technician

Mrs. Nongluck Wongsettee
Technical Manager

COPY
Issued Date 26/02/16

Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th

ENTECH
Where Begin

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 309.9 ppm	2803/21	Linde	22-Jun-23
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide (NO2) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24

Measured room conditions

Temperature : 22.9 °C Humidity : 65.2 %RH Pressure : 1008.2 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1019.4 mbar

Calibration Results (before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.53	0.032	0.15
O2 (%Vol)	10.04	10.08	0.04	0.20
O2 (%Vol)	21.02	21.09	0.07	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	309.9	311	1.1	6.0
CO (ppm)	1003	1005	2	12
*NO2 (ppm)	80.96	72.1	-8.86	8.0
*NO (ppm)	151.5	142	-9.5	8.0
*SO2 (ppm)	100.8	102	1.2	6.0

Calibration Results (after adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.53	0.032	0.15
O2 (%Vol)	10.04	10.08	0.04	0.20
O2 (%Vol)	21.02	21.09	0.07	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	309.9	311	1.1	6.0
CO (ppm)	1003	1005	2	12
*NO2 (ppm)	80.96	81.2	0.24	8.0
*NO (ppm)	151.5	152	0.5	8.0
*SO2 (ppm)	100.8	102	1.2	6.0

Remark : 1 cmol/mol = 1 %vol. , 1 µmol/mol = 1 ppm.
* Calibrations marked Not TISI Accredited "in this Certificate have been included for completeness."

End of Report

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Entech Industrial Solution Co.,Ltd.
17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND Tel. 0-2779-8888 Calibration@entech.co.th

GAS CHROMATOGRAPH

Model. : GC-2010 PLUS AF

Serial No. : C12095200986

ZEMC-3379F

Document No. OQR-TK-6607-0423

SHIMADZU GAS CHROMATOGRAPH SYSTEM
GC-2010Plus Series

Operational Qualification

Operational Qualification Report

System Name

System ID No. Gas Chromatograph LABE 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 [signature] Date

Print Thunsunai Pumpuka 16 / 08 / 2023

Title Service Engineer

Company Perkscientific Co.,Ltd

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

- Reviewer

Signature [signature] Date

Print Panupong Bumrungsri 16 / 08 / 2023

Title Scientist

Company Eastern Thai Consulting 1992 Co.,Ltd

- Manager

Signature [signature] Date

Print Nunnaphat Batkhuntod 16 / 08 / 2023

Title HS

Company Eastern Thai Consulting 1992 Co.,Ltd

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1-2 Scope

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

(Address): 692 Moo 11 Sukhapibarn 3 Rd Nongkham Sriracha Chonburi 20110

(Company): Eastern Thai Consulting 1992 Co.,Ltd

(Department):

(Installation Site): Instrument Room GC/IC

(Equipment ID No.): Gas Chromatograph LABE 04/3

(Product Model Name) GC-2010Plus /AOC-20i / AOC-20s

COPY

Performer (signature): [signature] Date: 16 / 08 / 2023

Reviewer (signature): [signature] Date: 18 / 08 / 2023

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.

3-1 Gas Chromatograph GC-2010Plus ☑ Applicable ☐ Not Applicable

Model Name	GC-2010Plus AF							
Component ID	LABF 0413							
Serial Number (S/N)	C 1 2 0 9 5 2 0 0 9 8 6							
No.	Item	Criteria				Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation.	All LEDs light.	LED			☑	☐
			Screen contrast adjustment is possible.	Display			☑	☐
2	Standard self-diagnostic test	Verify the status and operation of all parts.	"Good" displayed as the result of the self-diagnostic test.			Good	☑	☐
3	Firmware version check	Verify the program version.	Version number and build number are displayed.	Ver.		Version: 2.10A0 Build No.: 000	☑	☐
			The version No. and build No. matches the controlled version number.	Controled Ver. No.		Version: 2.10A0 Build No.: 000		
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green.				☑	☐
			Displayed actual values agree to the set values within ±1.0°C.	Temperature controller	(Name)	Set value / Measured value	☑	☐
				☑ COL	Column	50.0 °C / 50.0 °C		
				☑ INJ1	SPL1	50.0 °C / 50.0 °C		
				☐ INJ2		°C / °C		
				☑ DET1	FID1	50.0 °C / 50.0 °C		
				☐ DET2		°C / °C		
				☐ AUX3		°C / °C		
				☐ AUX4		°C / °C		
				☐ AUX5		°C / °C		
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Inspection pressure gauge reading ☑10.0±3.0kPa	Pressure gauge correction value		0.1 kPa	☑	☐
				Pressure gauge reading		9.9 kPa		
				Post-correction reading		9.8 kPa		
			Inspection pressure gauge reading ☑200.0±20.0kPa	Pressure gauge correction value		0.4 kPa		
				Pressure gauge reading		198.2 kPa		
				Post-correction reading		197.8 kPa		
			Inspection pressure gauge reading ☑500.0±35.0kPa	Pressure gauge correction value		0.3 kPa		
				Pressure gauge reading		494.4 kPa		
				Post-correction reading		494.1 kPa		

Performer (signature): [signature] Date: 16 / 08 / 2023
Reviewer (signature): [signature] Date: 18 / 8 / 2023

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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 ± 5.0 kPa		251 kPa	☑	☐
			Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa		250.0 kPa		
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate 3.0± 1.0mL/min		Septum purge 3.2 mL/min	☑	☐
			☑Total of septum purge and split vent flow rate values 10.0± 3.0mL/min		Split vent 7.6 mL/min Total 10.7 mL/min	☑	☐
			☑Total of septum purge and split vent flow rate values 200± 20mL/min		Split vent 199 mL/min Total 202 mL/min		
			☐Total of septum purge and split vent flow rate values 300± 28mL/min(Carrier gas:N2) ☑Total of septum purge and split vent flow rate values 500± 35mL/min(Carrier gas:He)		Split vent 501 mL/min Total 504 mL/min		
8	Column oven test	Verify the accuracy of the column oven temperature.	Inspection temperature sensor displayed value ☑50.0±3.2°C	Temp. correction value	-1.0 °C	☑	☐
				Temp. sensor reading	51.1 °C		
				Corrected temp. value	51.1 °C		
			Inspection temperature sensor displayed value ☑150.0±4.2°C	Temp. correction value	-0.9 °C		
				Temp. sensor reading	149.2 °C		
				Corrected temp. value	150.1 °C		
			Inspection temperature sensor displayed value ☑280.0±5.5°C ☐280±4°C	Temp. correction value	-1.1 °C		
				Temp. sensor reading	279.6 °C		
				Corrected temp. value	280.7 °C		
9	Temperature program test	Verify that the column temperature program operates normally.	Monitored temperature 6 minutes after start 200 ± 1°C		200 °C	☑	☐
			☑Inspection temperature reading 8 minutes after start 200.0 ± 4.7°C		200.1 °C		
			☐Using a temperature sensor with 1°C minimum display increment 200 ±3°C		___ °C		
10	Sensitivity test	Verify the detector sensitivity.	FID (☑ Applicable ☐ Not Applicable) Calculated S value Inj. unit (SPL1) ☑Make-up gas: N2 10.0 × 10⁻³C/g min. ☐Make-up gas: He 7.00 × 10⁻³C/g min.	C16AREA value	62498 µV·s	☑	☐
				Calculated S value	14.96×10⁻³C/g		
			TCD (☐ Applicable ☑ Not Applicable) Calculated S value Inj. unit ( ) 4.00 × 10³mV·ml/mg min.	C16AREA value	µV·s	☐	☐
				Flowrate at vent	___ mL/min		
				Calculated S value	×10³mV·mL/mg		

Performer (signature): [signature] Date: 16 / 08 / 2023
Reviewer (signature): [signature] Date: 18 / 8 / 2023

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3-2 AOC-20i Auto Injector

☐ Applicable ☐ Not Applicable

☑ Single ☐ 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.				☑	☐
2	ROM , RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000"			Display: 000	☑	☐
3	Firmware version check	Verify the program version.	Version number is displayed.		Version No.	3.40	☑	☐
			The version number matches the controlled version number.		Controled Ver. No.	3.40		
4	Basic operation test	Verify that the auto injector basic operation is correct.	Sample injected into the GC and GC operation starts.				☑	☐

☑ Not Applicable ☐ Dual system, sub injector

		Model Name	AOC-20i					
Component ID								
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.					☐
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.		Controled 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): [signature] **Date:** 16 / 08 / 2023

Reviewer (signature): [signature] **Date:** 18 / 8 / 2023

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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 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.				☑	☐
2	Firmware version check	Verify the program version.	Version number is displayed.		Version No.	3.50	☑	☐
			The version number matches the controlled version number.		Controled Ver. No.	3.50		

Performer (signature): [signature] **Date:** 16 / 08 / 2023

Reviewer (signature): [signature] **Date:** 18 / 8 / 2023

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Hot Air Oven

Model : UFE 500

Serial No. : G511.0182

CERTIFICATE OF CALIBRATION

Certificate No. : 23-006679

Sample Code : 23-02820-002

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.
(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Serial No. : G511.0182

Date of Receipt : 20 January 2023

Model : UFE 500

ID No. : LABE 17/4

Date of Calibration : 20 January 2023

Condition of Calibration

1. Environment
   - 1.1 Ambient temperature : Maximum 27.9 °C : Minimum 25.3 °C
   - 1.2 Relative humidity : Maximum 50.9 % : Minimum 38.5 %
   - 1.3 Line voltage supplied : Maximum 221.9 VAC : Minimum 218.5 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-Pt100)	LB-DA-11 (RTD-138 to RTD-146)	22-040309	21 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. Sarawoot Thammo
Scientist

Approved by : (Mr. Somchai Neampunt)
Signed for Director

Issue date : 24 January 2023

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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

Certificate No. : 23-006679

Sample Code : 23-02820-002

Results of Calibration

Resolution : 0.5 °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*		
104	103.5	103.5	104.10	104.08	103.87	103.99	104.08	104.08	103.96	104.01	103.84	0.47	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104.0	0.08	0.32	0.39

Notes
- UUC* = Unit Under Calibration

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REPORT OF CALIBRATION

Certificate No. : 23-006679

Sample Code : 23-02820-002

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 = 56 cm ; D = 40 cm ; H = 48 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 ".

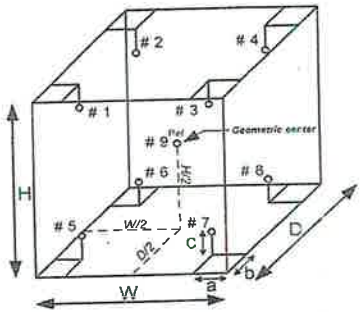


Figure: Example of sensor installation Positions

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 -

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ORIFICE TRANSFER STANDARD CERTIFICATION

WORKSHEET TE-5025A

ROOTSMETER S/N 0438320

TISCH Environmental

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 24, 2016 Rootsmeter S/N 0438320 Ta (K) - 295
Operator Tisch Orifice I.D. - 0136 Pa (mm) - 742.95

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3400	3.2	2.00
2	NA	NA	1.00	0.9510	6.3	4.00
3	NA	NA	1.00	0.8510	7.8	5.00
4	NA	NA	1.00	0.8130	8.6	5.50
5	NA	NA	1.00	0.6690	12.6	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9832	0.7337	1.4054		0.9957	0.7430	0.8911
0.9791	1.0296	1.9875		0.9915	1.0426	1.2603
0.9770	1.1481	2.2221		0.9894	1.1626	1.4090
0.9760	1.2006	2.3305		0.9884	1.2157	1.4778
0.9707	1.4510	2.8107		0.9830	1.4694	1.7825
Qstd slope (m) =	1.96262			Qa slope (m) =	1.22896	
intercept (b) =	-0.03249			intercept (b) =	-0.02060	
coefficient (r) =	0.99993			coefficient (r) =	0.99993	
y axis = SQRT[H2O(Pa/760)(298/Ta)]				y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}

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Primary Flow Calibrator

Serial No. : 110619 , 207510

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAEO.
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

Certificate of Calibration

Certificate No : 23-AFM-022

Request No : Req-2023-0128

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.

Address : 683 Moo 11, Sukhapibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : BIOS

Model : Defender 510-L

Serial Number : 110619

ID : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Sensor Model : -

Sensor Serial Number : -

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 20 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	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	15 June 2023
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023

Traceability :

This certificate providoes 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. Noppadon Luangart

Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date : 6 February 2023

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

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SUNTINAKORN 11 TAMBON BANG KAEO.
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

Certificate No : 23-AFM-022

Request No : Req-2023-0128

Result of Calibration :

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

Note

STD : Standard

UUC : Unit Under Calibration

End of Certificate

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

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13. SOI SUNTINAKORN 11 TAMBON BANG KAEO.
AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

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, Sukhapibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : Mesa Labs

Model : Defender 510-M

Serial Number : 207510

ID : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Sensor Model : -

Sensor Serial Number : -

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	Traceble	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023

Traceability :

This certificate providoes 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. Noppadon Luangart

Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date : 6 February 2023

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AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

Certificate No : 23-AFM-024

Request No : Req-2023-0196

Result of Calibration :

Calibration Point	STD Flow Reading	UUC Flow Reading	Correction Flow	Uncertainty (±)
(cc/min)	(cc/min)	(cc/min)	(cc/min)	(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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THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737

AMARC | ASIA MEDICAL AND AGRICULTURAL LABORATORY AND RESEARCH CENTER

NSC-TISI-TIS17025
CALIBRATION 0152

CERTIFICATE OF CALIBRATION

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 Lohabal
Scientist
Issue date : 31 May 2023

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

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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
TEL 02-516-2422
FAX 02-516-6949
CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH

AMARC | ASIA MEDICAL AND AGRICULTURAL LABORATORY AND RESEARCH CENTER

NSC-TISI-TIS17025
CALIBRATION 0152

REPORT OF CALIBRATION

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	Average of standard reading		Unit under calibration		Expanded uncertainty
	Controlled humidity	Temperature	Average reading	Correction value	
°C	%RH	°C	°C	°C	°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	Average of standard reading		Unit under calibration		Expanded uncertainty
	Air temperature	Calculated humidity	Average reading	Correction value	
%RH	°C	%RH	%RH	%RH	%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 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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UV/VIS SPECTROPHOTOMETER

Model : UV - 1800

Serial No. : A11635101643 CD

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

NSC-TISI-TIS 17025 CALIBRATION 0209

Certificate of Calibration

Certificate No.	BSCC-UV-152/23
Equipment	UV/Vis Spectrophotometer
Model	UV-1800
Manufacturer	Shimadzu
Serial No.	A11635101643 CD
ID No.	N/A
Date of receipt	25 April 2023
Date of calibration	25 April 2023
Date of issue	27 April 2023
Customer name	Eastern Thai Consulting 1992 Co.,Ltd
Address	683 Moo 11, Sukkhaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230
Temperature	(22.4-23.1) °C (On site)
Humidity	(44.5-45.2) %RH (On site)
Equipment condition	Good Operation
Calibration Location	Analysis Department
Calibration Procedure	In-house method WI-UV-702-01 based on ASTM E275-01
Traceability	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 traceble to SI unit through Starna Scientific Ltd. (UKAS accredited calibration laboratory NO. 0659)
Calibrated by	Mr.Pannaphong Phanmekakul

Approved by

Mr.Kanchit Choothep
Technical Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com

NSC-TISI-TIS 17025 CALIBRATION 0209

Certificate of Calibration

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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NSC-TISI-TIS 17025

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	Unit Under Calibration(UUC)		
cut-off wavelenght (nm)	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.75±0.11nm	200.72	0.9630	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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SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34302326

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

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. Petchurai.
(Thanakul Petchurai)

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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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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 lavel of confidence of approximately 95 %

End of Calibration Certificate

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SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 01120953

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23103
Pages : 1 of 8

Calibration Certificate

Equipment :	SOUND LEVEL METER
Manufacturer :	RION
Model :	NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.:	01120953 / 22355 / 22342
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 :	24 JANUARY 2023
Calibration Date :	26-30 JANUARY 2023
Date of Issue :	01 FEBRUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai

(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	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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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T. Petchurai

Summary of Measurement Result :

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

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SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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

Frequency Weighting	Measured value (dB)
A - weight	9.8
C - weight	14.6
Flat	20.2

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	Acceptance Limits
125	0.2	0.2	0.2	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	-0.3	-0.3	-0.3	+ 1.5, - 2.5

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±1.0
125	0.0	0.1	0.0	±1.0
250	0.1	0.0	0.0	±1.0
500	0.0	0.1	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	±0.1

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CALIBRATION LABORATORY

Continuation of Calibration Certificate

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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	54.0	0.0	±0.8
49.0	49.0	0.0	±0.8
44.0	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	28.9	-0.1	±0.8
28.0	28.0	0.0	±0.8
27.0	26.9	-0.1	±0.8
26.0	26.0	0.0	±0.8
25.0	25.0	0.0	±0.8

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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	±0.8

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	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.7	-0.7	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.5	0.0	±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	±0.1

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. : 01120944

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23095
Pages : 1 of 8

Calibration Certificate

Equipment :	SOUND LEVEL METER
Manufacturer :	RION
Model :	NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.:	01120944 / 21950 / 22333
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 :	24 JANUARY 2023
Calibration Date :	26-30 JANUARY 2023
Date of Issue :	01 FEBRUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai

(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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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-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

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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Summary of Measurement Result :

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

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Continuation of Calibration Certificate

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.8

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	15.2
Flat	20.9

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	Acceptance Limits
125	0.2	0.2	0.2	± 1.0
1000	0.1	0.1	0.1	± 0.7
8000	-0.4	-0.3	-0.3	+ 1.5, - 2.5

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	-0.1	±1.0
125	0.0	0.0	0.0	±1.0
250	0.0	0.0	0.0	±1.0
500	0.0	0.0	0.0	±1.0
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±1.0
4000	0.0	0.0	0.0	±1.0
8000	0.0	0.1	0.1	+ 1.5, - 2.5
16000	0.0	-1.2	-1.2	+ 2.5, -16.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.1

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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	±0.8
136.0	136.0	0.0	±0.8
135.0	135.0	0.0	±0.8
134.0	134.0	0.0	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.0	0.0	±0.8
99.0	99.0	0.0	±0.8
94.0	94.0	0.0	±0.8
89.0	89.0	0.0	±0.8
84.0	84.0	0.0	±0.8
79.0	79.0	0.0	±0.8
74.0	74.0	0.0	±0.8
69.0	69.0	0.0	±0.8
64.0	64.0	0.0	±0.8
59.0	59.0	0.0	±0.8
54.0	53.9	-0.1	±0.8
49.0	48.9	-0.1	±0.8
44.0	43.9	-0.1	±0.8
39.0	38.9	-0.1	±0.8
34.0	33.9	-0.1	±0.8
30.0	29.9	-0.1	±0.8
29.0	28.9	-0.1	±0.8
28.0	27.9	-0.1	±0.8
27.0	26.8	-0.2	±0.8
26.0	25.8	-0.2	±0.8
25.0	24.8	-0.2	±0.8

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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	±0.8

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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±2.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±1.0
Negative half cycle	135.4	135.2	-0.2	±1.0

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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.8	89.6	-0.2	±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	±0.1

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

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SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230992

Request No. 21-66/0343 **MTC No.** EEL. BP. 154/0266

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd..

Address : 683 Moo 11 Sukhapibarn 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.	: 00230992
Microphone	: Type UC-59 No.22769
Preamplifier	: Type NH-25 No.22428

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

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Request No. 21-66/0343 MTC No. EEL. BP. 154/0266

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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Request No. 21-66/0343 **MTC No.** EEL. BP. 154/0266

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.89	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 123.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.8	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	10.8	0.10	N/A
C-Weight	15.2	0.10	N/A
Flat	20.8	0.10	N/A

Date of Calibration : 21-23 Mar. 2023

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Request No. 21-66/0343 **MTC No.** EEL. BP. 154/0266

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.4	0.5	0.3	±1.0	0.45	0.6
1 000	-0.2	-0.2	-0.2	±0.7	0.45	0.6
8 000	-1.2	-1.2	-1.3	+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 1 (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	0.0	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	0.1	0.0	±1.0	0.20	0.6
4 000	0.0	0.0	0.0	±1.0	0.20	0.6
8 000	0.1	0.1	0.0	+1.5; -2.5	0.20	0.7
16 000	-1.3	-1.3	0.1	+2.5; -16.0	0.20	0.7

Date of Calibration : 21-23 Mar. 2023

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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

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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	133.0	0.0	0.8	0.30	0.3
132	132.0	0.0	0.8	0.30	0.3
131	131.0	0.0	0.8	0.30	0.3
130	130.0	0.0	0.8	0.30	0.3
129	129.0	0.0	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 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
74	74.0	0.0	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	43.9	-0.1	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	28.9	-0.1	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	24.9	-0.1	0.8	0.30	0.3

8. Level linearlity 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	0.00	0.3

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8. Level linearlity 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
SEL	200	120.0	0.0	±0.5	0.20	0.3
	2	100.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	90.9	-0.1	+1.0; -3.0	0.20	0.3

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 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 Phasingsri)

Approved by : .....

(Mr. Prawate Khuoypad)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 20112660227008250O7

Date of Calibration : 21-23 Mar. 2023

Date of Issue : 23 Mar. 2023

End of Certificate

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SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230989

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0343 **MTC No.** EEL. BP. 152/0266

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.

Address : 683 Moo 11, Sukhapibarn 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.	: 00230989
Microphone	: UC-59 No.22337
Preamplifier	: NH-25 No.22425

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 : 24 Mar. 2023

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 24 Mar. 2023

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Request No. 21-66/0343 **MTC No.** EEL. BP. 152/0266

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value(dB)	Acceptance limit class 1(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.93	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 113.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
16.2	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	10.0	0.10	N/A
C-Weight	14.5	0.10	N/A
Flat	19.7	0.10	N/A

Date of Calibration : 24 Mar. 2023

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve(dB)			Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.5	0.7	0.6	±1.0	0.45	0.6
1 000	-0.4	-0.4	-0.4	±0.7	0.45	0.6
8 000	0.3	0.3	0.2	+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 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	0.0	0.0	±1.0	0.20	0.6
125	0.0	0.1	0.0	±1.0	0.20	0.6
250	0.0	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	0.1	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

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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	94.0	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 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

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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	137.0	0.0	0.8	0.30	0.3
136	136.0	0.0	0.8	0.30	0.3
135	135.0	0.0	0.8	0.30	0.3
134	134.0	0.0	0.8	0.30	0.3
133	133.0	0.0	0.8	0.30	0.3
132	132.0	0.0	0.8	0.30	0.3
131	131.0	0.0	0.8	0.30	0.3
130	130.0	0.0	0.8	0.30	0.3
129	129.0	0.0	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	79.0	0.0	0.8	0.30	0.3
74	74.0	0.0	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 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	44.1	0.1	0.8	0.30	0.3
39	39.5	0.5	0.8	0.30	0.3

8. Level linearlity 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 : 24 Mar. 2023

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Request No. 21-66/0343 **MTC No.** EEL. BP. 152/0266

8. Level linearlity 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	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	119.5	-0.1	±0.5	0.20	0.3
	2	99.9	-0.1	+1.0; -3.0	0.20	0.3
SEL	200	120.0	0.0	±0.5	0.20	0.3
	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

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10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 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 : Wittawat Supanich

(Mr. Wittawat Supanich)

Approved by : Prawate Khaypa

(Mr. Prawate Khaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24 Mar. 2023

Date of Issue : 24 Mar. 2023

Ref : 20112660227008250O5

End of Certificate

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SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230995

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0343 **MTC No.** EEL. BP. 157/0266

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd..

Address : 683 Moo 11 Sukhapibarn 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. : 00230995

Microphone : Type UC-59 No.22778

Preamplifier : Type NH-25 No.22431

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

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 21-23 Mar. 2023

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Request No. 21-66/0343 **MTC No.** EEL. BP. 157/0266

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.89	114.5	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 124.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.8	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	9.6	0.10	N/A
C-Weight	13.5	0.10	N/A
Flat	19.2	0.10	N/A

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Request No. 21-66/0343 **MTC No.** EEL. BP. 157/0266

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.6	0.5	0.3	±1.0	0.45	0.6
1 000	-0.3	-0.3	-0.3	±0.7	0.45	0.6
8 000	0.1	0.2	0.0	+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 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	-0.1	-0.2	±1.0	0.20	0.6
125	-0.1	0.0	0.0	±1.0	0.20	0.6
250	0.0	-0.1	-0.1	±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	0.1	0.0	±1.0	0.20	0.6
4 000	0.0	0.1	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	-1.4	-1.4	0.0	+2.5; -16.0	0.20	0.7

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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

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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	136.9	-0.1	0.8	0.30	0.3
136	136.0	0.0	0.8	0.30	0.3
135	134.9	-0.1	0.8	0.30	0.3
134	133.9	-0.1	0.8	0.30	0.3
133	132.9	-0.1	0.8	0.30	0.3
132	131.9	-0.1	0.8	0.30	0.3
131	130.9	-0.1	0.8	0.30	0.3
130	129.9	-0.1	0.8	0.30	0.3
129	129.0	0.0	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	79.0	0.0	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 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
74	74.0	0.0	0.8	0.30	0.3
69	69.0	0.0	0.8	0.30	0.3
64	63.9	-0.1	0.8	0.30	0.3
59	58.9	-0.1	0.8	0.30	0.3
54	53.9	-0.1	0.8	0.30	0.3
49	48.9	-0.1	0.8	0.30	0.3
44	43.9	-0.1	0.8	0.30	0.3
39	39.0	0.0	0.8	0.30	0.3
34	33.9	-0.1	0.8	0.30	0.3
29	28.9	-0.1	0.8	0.30	0.3
28	28.0	0.0	0.8	0.30	0.3
27	26.9	-0.1	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 linearlity 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	0.00	0.3

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Request No. 21-66/0343 **MTC No.** EEL. BP. 157/0266

8. Level linearlity 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	126.1	0.1	±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
SEL	200	120.1	0.1	±0.5	0.20	0.3
	2	100.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	90.9	-0.1	+1.0; -3.0	0.20	0.3

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SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230993

Request No. 21-66/0343 **MTC No.** EEL. BP. 155/0266

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd..

Address : 683 Moo 11 Sukhapibarn 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.	: 00230993
Microphone	: Type UC-59 No.22776
Preamplifier	: Type NH-25 No.22429

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

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Request No. 21-66/0343 **MTC No.** EEL. BP. 155/0266

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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Request No. 21-66/0343 **MTC No.** EEL. BP. 155/0266

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.91	114.5	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 124.1 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.9	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	11.2	0.10	N/A
C-Weight	15.8	0.10	N/A
Flat	21.5	0.10	N/A

Date of Calibration : 21-23 Mar. 2023

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Request No. 21-66/0343 **MTC No.** EEL. BP. 155/0266

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.6	0.7	0.5	±1.0	0.45	0.6
1 000	-0.4	-0.4	-0.4	±0.7	0.45	0.6
8 000	-1.8	-1.7	-1.9	+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 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	-0.1	0.0	±1.0	0.20	0.6
125	0.0	0.1	0.1	±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	0.1	0.0	±1.0	0.20	0.6
4 000	0.0	0.1	0.0	±1.0	0.20	0.6
8 000	0.1	0.1	0.0	+1.5; -2.5	0.20	0.7
16 000	-1.3	-1.4	0.1	+2.5; -16.0	0.20	0.7

Date of Calibration : 21-23 Mar. 2023

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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

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Request No. 21-66/0343 **MTC No.** EEL. BP. 155/0266

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	134.0	0.0	0.8	0.30	0.3
133	133.0	0.0	0.8	0.30	0.3
132	132.0	0.0	0.8	0.30	0.3
131	131.0	0.0	0.8	0.30	0.3
130	130.0	0.0	0.8	0.30	0.3
129	129.0	0.0	0.8	0.30	0.3
124	123.9	-0.1	0.8	0.30	0.3
119	119.1	0.1	0.8	0.30	0.3
114	114.1	0.1	0.8	0.30	0.3
109	108.9	-0.1	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	98.9	-0.1	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 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
74	74.0	0.0	0.8	0.30	0.3
69	69.0	0.0	0.8	0.30	0.3
64	64.1	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	39.0	0.0	0.8	0.30	0.3
34	34.0	0.0	0.8	0.30	0.3
29	28.9	-0.1	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	24.9	-0.1	0.8	0.30	0.3

8. Level linearlity 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	0.00	0.3

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Request No. 21-66/0343 MTC No. EEL. BP. 155/0266

8. Level linearlity 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	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
SEL	200	120.0	0.0	±0.5	0.20	0.3
	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

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Request No. 21-66/0343 **MTC No.** EEL. BP. 155/0266

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 : Pannasit Ph.

(Mr. Pannasit Phasingsri)

Approved by :

(Mr. Prawate Kaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 20112660227008250O8

Date of Calibration : 21-23 Mar. 2023

Date of Issue : 23 Mar. 2023

End of Certificate

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SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322754

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23143
Pages : 1 of 8

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	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 :
   - 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. : ACL23143
Job No. : VC66AC0047
Pages : 3 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.

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CALIBRATION LABORATORY

Continuation of Calibration Certificate

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

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	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.0	0.1	0.1	±5.0

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QF-TS12-04-04-020664

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	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	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	± 0.5

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Continuation of Calibration Certificate

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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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, Lcpeak (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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Continuation of Calibration Certificate

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.8	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. : 00222593

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23165
Pages : 1 of 8

Calibration Certificate

Equipment :	SOUND LEVEL METER
Manufacturer :	RION
Model :	NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No.:	00222593 / 195905 / 15425
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)

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

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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.

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Continuation of Calibration Certificate

Cert. No. : ACL23165
Job No. : VC66AC0058

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)
14.2

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

Frequency Weighting	Measured value (dB)
A - weight	13.4
C - weight	16.2
Flat	22.1

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	Acceptance Limits
125	0.2	0.3	0.3	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.1	0.1	0.1	±5.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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	94.1	0.1	± 0.3

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Continuation of Calibration Certificate

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	134.1	0.1	± 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	104.1	0.1	± 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	29.0	0.0	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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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	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.1	-0.3	±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

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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±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 lavel of confidence of approximately 95 %

End of Calibration Certificate

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SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322744

Request No. 21-66/0321 **MTC No.** EEL. BP. 115/0266

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.

Address : 683 Moo 11, Sukhapibarn 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-42A
Serial No.	: 00322744 (No.39)
Microphone	: UC-52 No.196467
Preamplifier	: NH-24 No.15476

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 : 20 Feb. 2023

Date of Calibration : 16 Mar. 2023

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

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NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321 **MTC No.** EEL. BP. 115/0266

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 : 16 Mar. 2023

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321 **MTC No.** EEL. BP. 115/0266

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value(cB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.99	114.5	114.0	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.6 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
14.6	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	11.3	0.10	N/A
C-Weight	17.1	0.10	N/A
Flat	22.3	0.10	N/A

Date of Calibration : 16 Mar. 2023

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Request No. 21-66/0321 **MTC No.** EEL. BP. 115/0266

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve(dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.3	0.4	0.5	1.5	0.45	0.6
1 000	-0.4	-0.4	-0.4	1.0	0.45	0.6
8 000	1.6	1.7	1.6	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve(dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.1	0.1	1.8	2.0	0.20	0.6
125	0.0	0.1	1.9	1.5	0.20	0.6
250	0.0	0.1	1.9	1.5	0.20	0.6
500	0.0	0.1	1.9	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.1	-0.1	-0.1	2.0	0.20	0.6
4 000	-0.3	-0.3	-0.3	3.0	0.20	0.6
8 000	0.0	0.0	0.0	5.0	0.20	0.7

Date of Calibration : 16 Mar. 2023

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Request No. 21-66/0321 **MTC No.** EEL. BP. 115/0266

5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

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

6.2 Time weightings at 1 kHz

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

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Request No. 21-66/0321 **MTC No.** EEL. BP. 115/0266

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
128	128.1	0.1	1.1	0.30	0.3
127	127.1	0.1	1.1	0.30	0.3
126	126.1	0.1	1.1	0.30	0.3
125	125.1	0.1	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.1	0.1	1.1	0.30	0.3
109	109.1	0.1	1.1	0.30	0.3
104	104.1	0.1	1.1	0.30	0.3
99	99.1	0.1	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.1	0.1	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3

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Request No. 21-66/0321 **MTC No.** EEL. BP. 115/0266

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

Anticipated value (dB)	Measured value (dB)	Deviated (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
44	44.0	0.0	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	27.0	0.0	1.1	0.30	0.3
26	26.0	0.0	1.1	0.30	0.3
25	25.0	0.0	1.1	0.30	0.3

8. Level linearlity including the level range control

At reference sound level on the reference level range

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

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Request No. 21-66/0321 **MTC No.** EEL. BP. 115/0266

8. Level linearlity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
40-130	45	45.0	0.0	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.0	0.0	1.1	0.30	0.3
20-100	25	25.0	0.0	1.1	0.30	0.3
20-90	25	25.0	0.0	1.1	0.30	0.3
20-80	25	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2(dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	116.1	0.1	±1.0	0.20	0.3
	2	99.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.0	0.0	+1.5; -5.0	0.20	0.3
Slow	200	109.6	0.0	±1.0	0.20	0.3
	2	90.1	0.1	+1.0; -5.0	0.20	0.3
SEL	200	110.0	0.0	±1.0	0.20	0.3
	2	90.1	0.1	+1.0; -2.5	0.20	0.3
	0.25	81.0	0.0	+1.5; -5.0	0.20	0.3

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Request No. 21-66/0321

MTC No. EEL. BP. 115/0266

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.3	-0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
136.5	136.5	0.0	1.5	0.20	0.25

12. High-level stability

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

Calibrated by : Wittawat Supanich

(Mr. Wittawat Supanich)

Approved by : Prawate Kluaypa

(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 16 Mar. 2023

Date of Issue : 17 Mar. 2023

Ref : 20112660220007250O3

End of Certificate

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SOUND LEVEL METER

MODEL : NL-42

SERIAL No. : 00322757

Request No. 21-66/0321 **MTC No.** EEL. BP. 118/0266

CALIBRATION CERTIFICATE

Submitted by : Eastern Thai Consulting 1992 Co., Ltd.

Address : 683 Moo 11 Sukhapibarn 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-42

Serial No. : 00322757 (No.52)

Microphone : Type UC-52 No.196481

Preamplifier : Type NH-24 No.15489

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 : 20 Feb. 2023

Date of Calibration : 13-17 Mar. 2023

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Request No. 21-66/0321 MTC No. EEL. BP. 118/0266

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 : 13-17 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321

MTC No. EEL. BP. 118/0266

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.96	114.5	114.0	0.0	1.0	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 123.6 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20.2	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	11.1	0.10	N/A
C-Weight	16.6	0.10	N/A
Flat	22.5	0.10	N/A

Date of Calibration : 13-17 Mar. 2023

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Request No. 21-66/0321

MTC No. EEL. BP. 118/0266

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weigh	C-weight	Flat			
125	0.1	0.3	0.1	1.5	0.45	0.6
1 000	-0.2	-0.2	-0.2	1.0	0.45	0.6
8 000	-2.2	-2.2	-2.3	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

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

Date of Calibration : 13-17 Mar. 2023

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5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-weight	94.0	0.0	0.2	0.20	0.2
C-weight	94.0	0.0	0.2	0.20	0.2
Flat	94.1	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 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	94.0	0.0	0.1	0.20	0.2
Slow	94.0	0.0	0.1	0.20	0.2
Leq	94.0	0.0	0.1	0.20	0.2

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NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321 **MTC No.** EEL. BP. 118/0266

7. Level linearity on the reference level range

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321 **MTC No.** EEL. BP. 118/0266

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

Anticipated value (dB)	Measured Value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	44.0	0.0	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
28	27.9	-0.1	1.1	0.30	0.3
27	27.0	0.0	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-130	94.0	94.0	0.0	1.1	0.30	0.3

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Date of Calibration : 13-17 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0321 **MTC No.** EEL. BP. 118/0266

8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
20-130	25	25.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	100.0	0.0	+1.5; -5.0	0.20	0.3
Slow	200	119.5	-0.1	±1.0	0.20	0.3
	2	100.0	0.0	+1.0; -5.0	0.20	0.3

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Date of Calibration : 13-17 Mar. 2023

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 118/0266

Request No. 21-66/0321

10. Peak C sound level

Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.5	0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative half cycle	124.4	124.1	-0.3	2.0	0.20	0.35

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
135.4	135.4	0.0	1.5	0.55	0.25

12. High-level stability

Time	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Begin	119.0	0.0	0.3	0.10	0.1
End	119.0				

Calibrated by : Pannasit Ph.

(Mr. Pannasit Phasingsri)

Approved by :

(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Mar. 2023

Date of Issue : 17 Mar. 2023

Ref : 201126602200072500 6

End of Certificate

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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322751

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23140
Pages : 1 of 8

Calibration Certificate

Equipment :	SOUND LEVEL METER
Manufacturer :	RION
Model :	NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No.:	00322751 / 196474 / 15483
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 : T. Petchurai

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

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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.

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CALIBRATION LABORATORY

Continuation of Calibration Certificate

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)
14.2

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	16.6
Flat	22.3

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	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.0	0.0	0.0	±5.0

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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	-0.2	-0.1	-0.2	±2.0
125	-0.1	-0.1	-0.1	±1.5
250	-0.1	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	-0.1	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.0	0.0	±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	94.1	0.1	±0.3

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Continuation of Calibration Certificate

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 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	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 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	29.9	-0.1	± 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	25.0	0.0	± 1.1

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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	116.9	-0.1	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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.2	-0.2	±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

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Continuation of Calibration Certificate

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Fositive one-half cycle	Negative one-half cycle		
89.5	89.6	0.1	±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 - weigh:	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 lavel of confidence of approximately 95 %

End of Calibration Certificate

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0640

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **12 January 2023** CERTIFICATE NUMBER **185802**

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

Approved signatory
N.Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc

Model: CR:110A

Serial number: CB0640

Firmware version: 5.4

Notes:

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	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:	98.95 kPa	Temperature:	20.9 °C	Humidity: 37.0 %
After	Pressure:	98.97 kPa	Temperature:	21.1 °C	Humidity: 37.3 %

Test results summary

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

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0641

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **12 January 2023** CERTIFICATE NUMBER **185804**

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

Approved signatory
N.Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB0641
Firmware version: 5.4

Notes:

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:	98.95 kPa	Temperature:	20.9 °C	Humidity:	37.0 %
After	Pressure:	98.97 kPa	Temperature:	21.1 °C	Humidity:	37.3 %

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. : CB0642

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **12 January 2023** CERTIFICATE NUMBER **185806**

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

Approved signatory
N.Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc

Model: CR:110A

Serial number: CB0642

Firmware version: 5.4

Notes:

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	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	92610

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:	99.14 kPa	Temperature:	22.4 °C	Humidity:	43.1 %
After	Pressure:	99.12 kPa	Temperature:	22.4 °C	Humidity:	43.3 %

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. : CB0643

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **12 January 2023** CERTIFICATE NUMBER **185805**

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

Approved signatory
N.Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB0643
Firmware version: 5.4

Notes:

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	TTi	TG4001	395851
Attenuator	Cirrus Research	ZE:952	52200
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before	Pressure:	98.92 kPa	Temperature:	20.7 °C	Humidity:	36.5 %
After	Pressure:	98.96 kPa	Temperature:	20.9 °C	Humidity:	36.5 %

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. : CB0644

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **12 January 2023** CERTIFICATE NUMBER **185807**

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

Approved signatory
N.Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc

Model: CR:110A

Serial number: CB0644

Firmware version: 5.4

Notes:

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

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before	Pressure:	99.14 kPa	Temperature:	22.5 °C	Humidity:	43.1 %
After	Pressure:	99.13 kPa	Temperature:	22.5 °C	Humidity:	43.6 %

Test results summary

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

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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
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
N.Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

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

Notes:

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

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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

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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
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Approved signatory
N.Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc

Model: CR:110A

Serial number: CB0958

Firmware version: 5.4

Notes:

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

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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

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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

Approved signatory
N.Smith
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc

Model: CR:110A

Serial number: CB0957

Firmware version: 5.4

Notes:

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

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1497

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **13 February 2023** CERTIFICATE NUMBER **187452**

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

Approved signatory
R.Thomas
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB1497
Firmware version: 5.4

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

Test summary

Date of calibration: 10 February 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	40088

Notes

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before	Pressure:	102.28 kPa	Temperature:	22.6 °C	Humidity: 36.4 %
After	Pressure:	102.28 kPa	Temperature:	22.6 °C	Humidity: 36.7 %

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. : CB1498

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **13 February 2023** CERTIFICATE NUMBER **187450**

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

Approved signatory
R.Thomas
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB1498
Firmware version: 5.4

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

Test summary

Date of calibration: 10 February 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	40088

Notes

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before	Pressure:	102.25 kPa	Temperature:	22.4 °C	Humidity:	36.9 %
After	Pressure:	102.24 kPa	Temperature:	22.7 °C	Humidity:	36.6 %

Test results summary

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

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1499

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **13 February 2023** CERTIFICATE NUMBER **187449**

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

Approved signatory
R.Thomas
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB1499
Firmware version: 5.4

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

Test summary

Date of calibration: 10 February 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

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before	Pressure:	102.26 kPa	Temperature:	22.4 °C	Humidity:	37.0 %
After	Pressure:	102.25 kPa	Temperature:	22.6 °C	Humidity:	36.6 %

Test results summary

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

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1500

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **13 February 2023** CERTIFICATE NUMBER **187451**

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

Approved signatory
R.Thomas
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CK:110A
Serial number: CB1500
Firmware version: 5.4

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

Test summary

Date of calibration: 10 February 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

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before	Pressure:	102.25 kPa	Temperature:	22.7 °C	Humidity:	37.1 %
After	Pressure:	102.24 kPa	Temperature:	22.6 °C	Humidity:	37.4 %

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. : CB1365

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **10 February 2023** CERTIFICATE NUMBER **187443**

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

Approved signatory
R.Thomas
Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB1365
Firmware version: 5.4

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

Test summary

Date of calibration: 10 February 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

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before	Pressure:	102.28 kPa	Temperature:	22.6 °C	Humidity: 36.4 %
After	Pressure:	102.28 kPa	Temperature:	22.5 °C	Humidity: 36.7 %

Test results summary

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

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ANALYTICAL BALANCE (DU)

Model. : XS205DU

Serial No. : 1126323724

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

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 : 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 Pholthep
Scientist

Approved by (Mr. Somchai Neampunt)
Signed for Director

Issue date 25 January 2023

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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

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
☑ No adjustment
☐ Adjustment

Range : 80	☐ Before adjustment		☐ After adjustment	
Nominal value	40	80	-	-
Standard weight	40.000042	80.000045	-	-
Average reading of indicator	40.00015	80.00019	-	-
Standard deviation	0.000004	0.000007	-	-

Unit : g
☑ No adjustment
☐ Adjustment

Range : 200	☐ Before adjustment		☐ After adjustment	
Nominal value	100	200	-	-
Standard weight	100.000022	200.000199	-	-
Average reading of indicator	100.0001	200.0004	-	-
Standard deviation	0.00004	0.00008	-	-

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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 : 80

Test Point	Sensitivity, S
0	0.99800
40	0.99800
80	0.99800

Range : 200

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	0.00000	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

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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.

AMARC | ASIA MEDICAL AND AGRICULTURAL LABORATORY AND RESEARCH CENTER

ilac-MRA THAILAND NSC-TISI-TIS17025 CALIBRATION 0152

REPORT OF CALIBRATION

Result of Calibration :

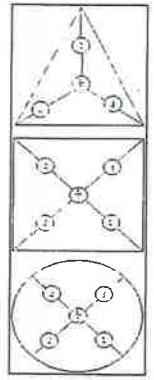
4. Eccentric or off-centre loading

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
- ○ Circle
- ○ Triangular
- ◉ Rectangular

Test weight : 50 and 100
Unit : g

Range	80	200
Position	Reading of indicator	Reading of indicator
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	0.00008	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	Class	ID No.	Certificate No.	Due Date
1) STANDARD WEIGHT 1 mg to 1 kg	E2	LB-WE-57	22-060639	27 June 2023

6.

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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- End of Report -

361 Soi Ladprao 122, Ladprao Road, Phlabphla, Wang Thonglang, Bangkok 10310
FM-CL-064

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

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

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

Approved by (Mr. Somchai Neampunt)
Signed for Director

Issue date 25 January 2023

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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.

			Before adjustment		After adjustment	
Unit : g	Range : 220					
	Nominal value		100	200	-	-
☑ No adjustment	Standard weight		100.000022	200.000199	-	-
☐ Adjustment	Average reading of indicator		99.9998	199.9999		-
	Standard deviation		0.00007	0.00007	-	-
Unit : -	Range : -		☐ Before adjustment		☐ After adjustment	
	Nominal value		-	-	-	-
☐ No adjustment	Standard weight		-	-	-	-
☐ Adjustment	Average reading of indicator		-	-	-	-
	Standard deviation		-	-		-

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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 : 220

Test Point	Sensitivity, S
0	0.9980
100	0.9980
200	0.9980

Range : -

Test Point	Sensitivity, S
-	-
-	-
-	-

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	10.000000	10.0000	0.0000	0.00011	2.03
20	20.000016	20.0000	0.0000	0.00012	2.03
50	50.000029	50.0000	0.0000	0.00013	2.02
100	100.000022	99.9998	0.0002	0.00017	2.01
200	200.000199	200.0000	0.0002	0.00028	2.00

COPY

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.

REPORT OF CALIBRATION

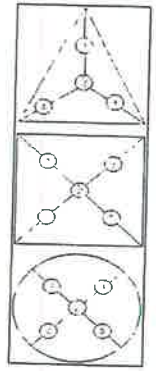
Result of Calibration :

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 : (●) Circle ( ) Triangular ( ) Rectangular

Test weight : 100 Unit : g



Range	220	
Position	Reading of indicator	Reading of indicator
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	Class	ID No.	Certificate No.	Due Date
1) STANDARD WEIGHT 1 mg to 1 kg	E2	LB-WE-57	22-060639	27 June 2023

6.

Amb ent conditions	Min	Max
Temperature (°C)	21.2	22.5
Relative Humidity (%Rh)	37.1	44.3
Air pressure (hPa)	1012.1	1013.0

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- End of Report -

BOD INCUBATOR

ID No. : LABE 19/2

AMARC | ASIA MEDICAL AND AGRICULTURAL LABORATORY AND RESEARCH CENTER

ilac-MRA THAILAND NSC-TISI-TIS17025 CALIBRATION 0152

CERTIFICATE OF CALIBRATION

Certificate No. : 22-136844

Sample Code : 22-51164-006

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.
(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
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-11 (RTD-148 to RTD-155, RTD-227)	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. Natthanan Phosri
Scientist

Approved by : (Mr. Somchai Neampunt)
Signed for Director

Issue date : 26 December 2022

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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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ilac-MRA THAILAND NSC-TISI-TIS17025 CALIBRATION 0152

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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NSC-TISI-TIS17025
CALIBRATION 0152

REPORT OF CALIBRATION

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.

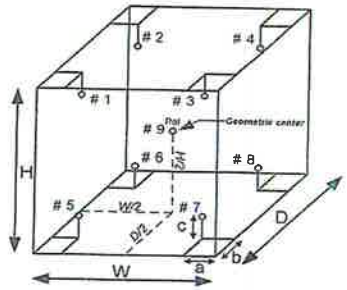


Figure: Example of sensor installation Positions

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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Phlabphla, Wang Thonglang, Bangkok 10310
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FAX 02-516-6949
CONTACT@AMARC.CO.TH
WWW.AMARC.CO.TH

BOD INCUBATOR

ID No. : LABE 19/5

AMARC | ASIA MEDICAL AND AGRICULTURAL LABORATORY AND RESEARCH CENTER

ilac-MRA THAILAND NSC-TISI-TIS17025 CALIBRATION 0152

CERTIFICATE OF CALIBRATION

Certificate No. : 23-040768

Sample Code : 23-16178-002

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.
(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-Pt100)	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

Approved by : (Mr. Somchai Neampunt)
Signed for Director

Issue date : 24 April 2023

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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)

AMARC | ASIA MEDICAL AND AGRICULTURAL LABORATORY AND RESEARCH CENTER

ilac-MRA THAILAND NSC-TISI-TIS17025 CALIBRATION 0152

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

COPY

REPORT OF CALIBRATION

Certificate No. : 23-040768

Sample Code : 23-16178-002

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.

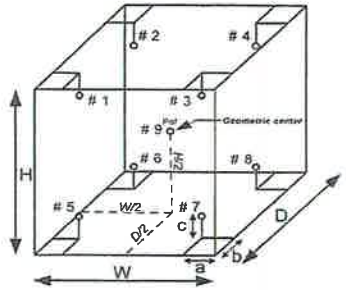


Figure: Example of sensor installation Positions

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

S K SALES AND SERVICE CO.,LTD.
194/56, 194/57 Thakham Rd. Samae Dam
Bang Khun Thian Bangkok 10150
Tel. : 02-417-2144 Fax : 02-417-2155

ilac-MRA
ISO-TISI-TIS17025
CALIBRATION 0261

Certificate of Calibration

Reference No. : C03190/2309-025
Certificate No. : S2309-3014
Customer : Eastern Thai Consulting 1992 Co.,Ltd.
Page 1 of 2
: 683 Moo 11, Sukhaphiban 8, Tambol Nongkham,
: Siracha District, Chonburi 20230, Thailand
Equipment : Incubator
Manufacturer : Lovibond
Model : TC445S
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-WI-23 base on Thai Laboratory Accreditation Scheme Publication Reference G-20

Condition of this result of calibration

1. Reference standard instrument

	Instrument	Serial No.	Certificate No.	Due Date
1)	Data acquisition/Switch unit	MY44047397	L2305-268	4 November 2023
2)	Multiplexer Module	MY41105123	L2305-268	4 November 2023

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

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

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Table1 General Information

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

Table2 Chamber Perfomance

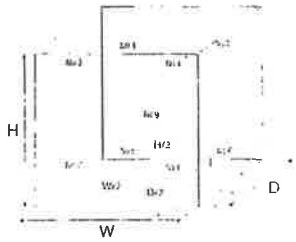
Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (± °C)	Measured Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.37	0.64	0.98

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 : 1. The temperature stability is the one-haft of greatest maximum difference of measured temperatures at any one probe.
2. 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
3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
4. The reported uncertainty of measurement were excluded Uniformity and Stability

** End of Calibration Report **

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GAS CHROMATOGRAPH

Model. : GC-2010 PLUS AF

Serial No. : C12095200986

ZEMC-3379F

Document No. OQR-TR-6607-0423

SHIMADZU GAS CHROMATOGRAPH SYSTEM
GC-2010Plus Series

Operational Qualification

Operational Qualification Report

System Name

System ID No. Gas Chromatograph LABE 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 [signature] Date

Print Thanawat Pumpuen 16/08/2023

Title Service Engineer

Company Bemscientific Co.,Ltd

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

- Reviewer

Signature [signature] Date

Print Panupong Burmrungros 16/08/2023

Title Scientist

Company Eastern Thai Consulting 1992 Co.,Ltd

- Manager

Signature [signature] Date

Print Nunnaphat Bakhuntod 16/08/2023

Title HS

Company Eastern Thai Consulting 1992 Co.,Ltd

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1-2 Scope

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

(Address): 692 Moo 11 Sukhapibarn 3 Rd Nongkham Sriracha Chonburi 20110

(Company): Eastern Thai Consulting 1992 Co.,Ltd

(Department):

(Installation Site): Instrument Room GC/IC

(Equipment ID No.): Gas Chromatograph LABE 04/3

(Product Model Name): GC-2010 Plus / AOC-20i / AOC-20s

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Performer (signature): [signature] Date: 16/08/2023

Reviewer (signature): [signature] Date: 18/08/2023

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.

3-1 Gas Chromatograph GC-2010Plus ☑ Applicable ☐ Not Applicable

Model Name	GC-2010Plus AF								
Component ID	LABF 0413								
Serial Number (S/N)	C 1 2 0 9 5 2 0 0 9 8 6								
No.	Item	Criteria				Results		Pass	Fail
1	Display, LED test	Verify the display and LED operation.	All LEDs light.	LED				☑	☐
			Screen contrast adjustment is possible.	Display				☑	☐
2	Standard self-diagnostic test	Verify the status and operation of all parts.	"Good" displayed as the result of the self-diagnostic test.			Good		☑	☐
3	Firmware version check	Verify the program version.	Version number and build number are displayed.	Ver.		Version: 2.10Au Build No.: 2u2		☑	☐
			The version No. and build No. matches the controlled version number.	Controled Ver. No.		Version: 2.10Au Build No.: 2u2			
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green.					☑	☐
			Displayed actual values agree to the set values within ±1.0°C.	Temperature controller	(Name)	Set value	Measured value	☑	☐
				☑ COL	Colum	500 °C	500 °C		
				☑ INJ1	SPL1	500 °C	500 °C		
				☐ INJ2		°C	°C		
				☑ DET1	FID1	500 °C	500 °C		
				☐ DET2		°C	°C		
				☐ AUX3		°C	°C		
				☐ AUX4		°C	°C		
				☐ AUX5		°C	°C		
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Inspection pressure gauge reading ☑10.0±3.0kPa	Pressure gauge correction value			0.1 kPa	☑	☐
				Pressure gauge reading			9.9 kPa		
				Post-correction reading			9.8 kPa		
			Inspection pressure gauge reading ☑200.0±20.0kPa	Pressure gauge correction value			0.4 kPa		
				Pressure gauge reading			198.2 kPa		
				Post-correction reading			197.8 kPa		
			Inspection pressure gauge reading ☑500.0±35.0kPa	Pressure gauge correction value			0.8 kPa		
				Pressure gauge reading			494.4 kPa		
				Post-correction reading			493.6 kPa		

Performer (signature): [signature] **Date:** 16 / 02 / 2023
Reviewer (signature): [signature] **Date:** 18 / 8 / 2023

COPY

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 ± 5.0 kPa		250.1 kPa	☑	☐
			Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa		250.6 kPa		
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate 3.0± 1.0mL/min		Septum purge 1.2 mL/min	☑	☐
			☑Total of septum purge and split vent flow rate values 10.0± 3.0mL/min		Split vent 7.6 mL/min Total 10.7 mL/min		
			☑Total of septum purge and split vent flow rate values 200± 20mL/min		Split vent 194 mL/min Total 202 mL/min		
			☐Total of septum purge and split vent flow rate values 300± 28mL/min(Carrier gas:N2)		Split vent 301 mL/min		
			☑Total of septum purge and split vent flow rate values 500± 35mL/min(Carrier gas:He)		Total 504 mL/min		
8	Column oven test	Verify the accuracy of the column oven temperature.	Inspection temperature sensor displayed value ☑50.0±3.2℃	Temp. correction value	-1.0 ℃	☑	☐
				Temp. sensor reading	51.1 ℃		
				Corrected temp. value	51.1 ℃		
			Inspection temperature sensor displayed value ☑150.0±4.2℃	Temp. correction value	-0.9 ℃		
				Temp. sensor reading	149.2 ℃		
				Corrected temp. value	150.1 ℃		
			Inspection temperature sensor displayed value ☑280.0±5.5℃ ☐280.4℃	Temp. correction value	-1.1 ℃		
				Temp. sensor reading	279.6 ℃		
				Corrected temp. value	280.7 ℃		
9	Temperature program test	Verify that the column temperature program operates normally.	Monitored temperature 6 minutes after start 200 ± 1°C		200 ℃	☑	☐
			☑Inspection temperature reading 8 minutes after start 200.0 ± 4.7°C		200.1 ℃		
			☐Using a temperature sensor with 1°C minimum display increment 200 ±3°C		____ ℃		
10	Sensitivity test	Verify the detector sensitivity.	FID (☑ Applicable ☐ Not Applicable) Calculated S value Inj. unit (SPL1) ☑Make-up gas: N_2 10.0 × 10^{-3}C/g min. ☐Make-up gas: He 7.0 × 10^{-3}C/g min.	C_{16}AREA value	46498 μV·s	☑	☐
				Calculated S value	14.90×10^{-3}C/g		
			TCD ☐ Applicable ☑ Not Applicable) Calculated S value Inj. unit ( ) 4.00 × 10^{3}mV·mL/mg min.	C_{16}AREA value	____ μV·s	☐	☐
				Flowrate at vent	____ mL/min		
				Calculated S value	____ ×10^{3}mV·mL/mg		

Performer (signature): [signature] **Date:** 16 / 02 / 2023
Reviewer (signature): [signature] **Date:** 18 / 8 / 2023

COPY

3-2 AOC-20i Auto Injector

☐ Applicable ☐ Not Applicable

☑ Single ☐ 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.				☑	☐
2	ROM , RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000"			Display: 000	☑	☐
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No.		3.40	☑	☐
			The version number matches the controlled version number.	Controled Ver. No.		3.40		
4	Basic operation test	Verify that the auto injector basic operation is correct.	Sample injected into the GC and GC operation starts.				☑	☐

☑ Not Applicable ☐ Dual system, sub injector

		Model Name	AOC-20i					
Component ID								
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.					☐
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.	Controled 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): Date: 16 / 08 / 2023

Reviewer (signature): Date: 18 / 8 / 2023

COPY

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 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.				☑	☐
2	Firmware version check	Verify the program version.	Version number is displayed.	Version No.		3.60	☑	☐
			The version number matches the controlled version number.	Controled Ver. No.		3.60		

Performer (signature): Date: 16 / 08 / 2023

Reviewer (signature): Date: 18 / 8 / 2023

COPY

Hot Air Oven

Model. : UM 400

Serial No. : 900982

CERTIFICATE OF CALIBRATION

Certificate No. : 23-018635
Sample Code : 23-07651-001

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.
(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-Pt100)	LB-DA-12 (RTD-158 to RTD-166)	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

Calibrated by : Mr. Sarawoot Thammo
Scientist
Issue date : 24 February 2023

Approved by : (Mr. Somchai Neampunt)
Signed for Director

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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

Certificate No. : 23-018635
Sample Code : 23-07651-001

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		
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

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REPORT OF CALIBRATION

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 ".

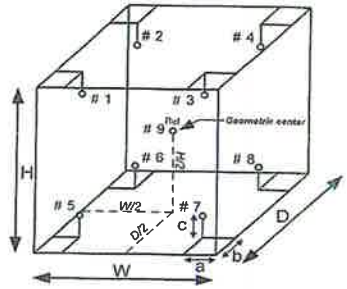


Figure: Example of sensor installation Positions

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 -

COPY

LIQUID IN GLASS THERMOMETER

Model : Total Immersion

Serial No. : 43560

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

NSC-TISI-TIS17025
CALIBRATION 0849

CERTIFICATE No : 23T10864
REFERENCE No : 71117-1

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

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

1. 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.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	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

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. 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

LIQUID IN GLASS THERMOMETER

Model : Total immersion

Serial No. : 43560

สถาบันอาหาร
มูลนิธิส่งเสริมอุตสาหกรรมและการส่งออก
Food Institute
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

NSC-TISI-TIS 17025
CALIBRATION 0061

Calibration Certificate

Certificate No.: 2300368-001-01
Client name: EASTERN THAI CONSULTIONG 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.Nuttapol Niyomchat
Specialist

Approved by
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 18 November 2022

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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.

NSC-TISI-TIS 17025
CALIBRATION 0061

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

Location: Temperature Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 23 °C ± 3 °C.
Relative Humidity 55 % ± 15 %.

Condition of this results of Calibration:

1. Calibration Method : - In-house method : W-TE-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.: aoa. 614/21
- Low Temperature Bath (Deep Well Compact Bath), Model: 7381, S/N: B53496.
- 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
7. Result of Calibration : [X] Without adjustment [ ] After adjustment

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สถาบันการพัฒนาอุตสาหกรรมอาหาร
กองบริการห้องปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

NSC-TISI-TIS 17025
CALIBRATION 0061

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

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

COPY

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, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

NSC-TISI-TIS 17025 CALIBRATION 0649

CERTIFICATE No : 23T10864
REFERENCE No : 71117-1

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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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

1. 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.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	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

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. 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

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pH Meter

Model. : SevenCompact S220

Serial No. : B448305208

CERTIFICATE OF CALIBRATION

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		Lot. No.	Ref No.	Expire Date
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
Scientist

Approved by (Ms. Pawana Pan-on)
Signed for Director

Issue date 03 February 2023

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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

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	Average indicator reading		Uncertainty	Coverage factor
pH	mV	mV	pH	mV	*k*
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 : 99.6 , at pH7 and pH10 Percent Slope : 98.4

Standard Buffer Solution	Average indicator reading		Error Value	Uncertainty	Coverage factor
pH (@ 25 °C)	pH	mV	pH	pH	*k*
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 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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NSC-TISI-TIS17025
CALIBRATION 0152

REPORT OF CALIBRATION

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

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO
Model : SevenCompact S220
Serial No. : B448305208
ID No. : LABE 11/4
Resolution : 0.1 °C
Range : -5.0 °C to 130.0 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO
Model : InLab Expert Pro-ISM
Serial No. : 2365921
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 % ± 5.0 %
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 stancarc 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-TH-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

AMARC | ASIA MEDICAL AND AGRICULTURAL LABORATORY AND RESEARCH CENTER

ilac-MRA THAILAND NSC-TISI-TIS17025 CALIBRATION 0152

Certificate No. : 22-052238

Sample Code : 22-19150-003

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

Approved by : (Mr. Somchai Neampunt)
Signed for Director

Issue date : 31 May 2022

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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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ilac-MRA THAILAND NSC-TISI-TIS17025 CALIBRATION 0152

Certificate No. : 22-052238

Sample Code : 22-19150-003

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 (mg)	Conventional Mass	Expanded Uncertainty (mg)	Maximum Permissible Error ± (mg)	ID No.
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

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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/m^3

2. Calibration Method : Direct comparison weighing according to O ML 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 -

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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

Approved by (Mr. Somchai Neampunt)
Signed for Director

Issue date 31 May 2022

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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_0) of 1.2 kg.m^{-3}

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

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

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Certificate No. : 22-052239

Sample Code : 22-19150-004

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 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-7E	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 Publ c 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 :	Recal bration

- End of Report -

COPY

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

Approved by (Mr. Somchai Neampunt)
Signed for Director

Issue date 31 May 2022

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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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ilac-MRA THAILAND
NSC-TISI-TIS17025
CALIBRATION 0152

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 Mass	Expanded Uncertainty	Maximum Permissible Error	ID No.
	(mg)		(mg)	± (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

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Certificate No. : 22-052237

Sample Code : 22-19150-002

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 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 -

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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

CERTIFICATE No. **WO-02514383**

Merck Ltd. Thailand
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Klongton, Klongtoey, Bangkok 10110
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Fax : +66 (0) 2667 8399
Customer Care Center : +66 (0) 2667 8333
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CERTIFICATE OF CALIBRATION

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-grey 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*					
Equipment		Nominal value	Tolerance limit**	Actual value	Result
Holmium Oxide Liquid Filter Hellma 667-UV5		361.25 nm	360.1 - 362.5 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 666-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					P
No visual flaws, no burrs, no loose parts and fastenings					

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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 Rattanachetthakul
(SERVICE ENGINEER)

SIGNATURE : _____

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CERTIFICATE No. **WO-02514383**

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