

**ANALYTICAL BALANCE (DU)**

**Model : XS205DU**

**Serial No. : 1126323724**



Certificate No. : 23-148799  
Sample Code : 23-56200-001

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapibarn 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 : 22 December 2023

Date of Calibration : 22 December 2023

Calibrated by : Mr. Somwang Sangdee  
Scientist

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

Issue date : 25 December 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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Certificate No. : 23-148799  
Sample Code : 23-56200-001

## REPORT OF CALIBRATION

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

### Result of Calibration

#### 1. Test weight and repeatability of reading

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

Unit : g	Range : 80	<input checked="" type="checkbox"/> Before adjustment	<input checked="" type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	40	80
<input checked="" type="checkbox"/> Adjustment	Standard weight	40.000054	80.000048
	Average reading of indicator	40.000026	80.000037
	Standard deviation	0.000015	0.000016
		0.000008	0.000009

Unit : g	Range : 200	<input checked="" type="checkbox"/> Before adjustment	<input checked="" type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100	200
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000042	200.000041
	Average reading of indicator	100.00003	200.00004
	Standard deviation	0.000005	0.000005
		0.000003	0.000005

Certificate No. : 23-148799  
Sample Code : 23-56200-001

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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	1.00748	0	1.0274
40	0.98753	100	0.9975
80	0.99751	200	0.9975

## 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	0.000012	2.05
0.01	0.0100025	0.01000	0.00000	0.000012	2.05
0.1	0.1000019	0.10001	-0.00001	0.000013	2.03
1	1.0000125	1.00001	0.00000	0.000015	2.02
5	5.0000208	5.00004	-0.00002	0.000021	2.00
10	10.000004	10.00008	-0.00008	0.000026	2.00
20	20.000030	20.00011	-0.00008	0.000036	2.00
50	50.000014	50.00014	-0.00013	0.000068	2.00
100	100.000042	100.0001	-0.0001	0.00016	2.00
150	150.000056	150.0001	0.0000	0.00022	2.00
200	200.000041	200.0002	-0.0002	0.00027	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.

Certificate No. : 23-148799  
Sample Code : 23-56200-001

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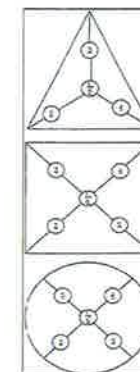
## REPORT OF CALIBRATION

## 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	<input type="radio"/> Circle	Test weight : 50 and 100
	<input type="radio"/> Triangular	
	<input checked="" type="radio"/> Rectangular	
Range	80	200
Position	Reading of indicator	Reading of indicator
1	50.00015	100.0001
2	50.00022	100.0001
3	50.00008	100.0001
4	50.00002	100.0000
5	50.00016	100.0002
6	50.00014	100.0001
Maximum difference	0.00013	0.0001



## Condition of Calibration

1. Calibration Method : WI-DL-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 tem: 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-79	23-105642	10 September 2024

End of Report

6. Ambient conditions	Min	Max
Temperature (°C)	22.8	23.0
Relative Humidity (%Rh)	43.5	51.1
Air pressure (hPa)	1012.5	1014.5

**ANALYTICAL BALANCE**

**Model : SECURA224-1S**

**Serial No. : 0036707137**

Certificate No. : 23-148800  
Sample Code : 23-56200-002

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapibarn 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 : 22 December 2023

Date of Calibration : 22 December 2023

Calibrated by Mr. Somwang Sangdee  
Scientist

Approved by (Mr. Somchai Neampunt)  
Signed for Director

Issue date : 25 December 2023

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

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

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

Certificate No. : 23-148800  
Sample Code : 23-56200-002

## REPORT OF CALIBRATION

Equipment : ELECTRONIC BALANCE  
Manufacturer : SARTORIUS  
Model : SECURA224-1S  
Capacity : Max 220 g  
Resolution : 0.0001 g  
Serial No. : 0036707137  
ID No. : LABE 05/2

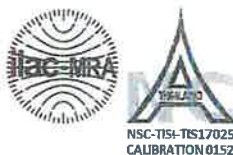
## Result of Calibration

## 1. Test weight and repeatability of reading

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

Unit : g	Range : 220	<input checked="" type="checkbox"/> Before adjustment	<input checked="" type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100	200
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000042	200.000041
	Average reading of indicator	99.9998	199.9998
	Standard deviation	0.00006	0.00007

Unit : g	Range : 220	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000042	200.000041
	Average reading of indicator	99.9998	199.9998
	Standard deviation	0.00006	0.00007



Certificate No. : 23-148800  
Sample Code : 23-56200-002

## 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

Range : -

Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.7980	-	-
100	0.8978	-	-
200	0.8978	-	-

## 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	0.000086	2.00
0.01	0.0100025	0.0100	0.0000	0.000086	2.00
0.1	0.1000019	0.1000	0.0000	0.000087	2.00
1	1.0000125	1.0000	0.0000	0.000087	2.00
2	2.0000089	2.0000	0.0000	0.000087	2.00
5	5.0000208	5.0001	-0.0001	0.000088	2.00
10	10.000004	10.0000	0.0000	0.000090	2.00
20	20.000030	20.0000	0.0000	0.000093	2.00
50	50.000014	50.0000	0.0000	0.00011	2.00
100	100.000042	100.0000	0.0000	0.00016	2.00
200	200.000041	200.0000	0.0000	0.00028	2.00

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



Certificate No. : 23-148800  
Sample Code : 23-56203-002

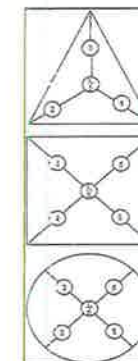
## REPORT OF CALIBRATION

## 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	<input checked="" type="radio"/> Circle <input type="radio"/> Triangular <input type="radio"/> Rectangular	Test weight : 100 Unit : g
Range	220	
Position	Reading of indicator	Reading of indicator
1	100.0000	-
2	100.0000	-
3	100.0000	-
4	99.9999	-
5	100.0000	-
6	100.0000	-
Maximum difference	0.0001	-



## 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-79	23-105642	10 September 2024

End of Report

6. Ambient conditions	Min	Max
Temperature (°C)	24.4	24.8
Relative Humidity (%Rh)	39.9	41.1
Air pressure (hPa)	1012.2	1012.8

**ATOMIC ABSORPTION SPECTROPHOTOMETER**


**Model : PinAAcle 900F**

**Serial No. : PFBS22080801**



### PinAAcle 900F Preventive Maintenance (PM)

Company Name:	Eastern Thai Consulting 1992 Co., Ltd.		
Address (Instrument Location):	683 Moo 11 Sukapibal 8 Rd. Nong Kham, Si Racha, Chonburi 20230		
Serial Number:	PFBS22080801	PM Number:	2 of 2
Customer Name (if applicable):		Telephone Number:	
Customer Support Engineer Name:	Khwanchai	Service Order Number:	WO-01886639
Date PM Performed: (DD-MMM-YYYY)	24-Oct-2023	Next PM Due Date: (DD-MMM-YYYY)	24-Apr-2024
Standard Labor Hours to Complete PM :		5 hours	

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

#### Scope

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

The customer should save their method before the PM begins.

#### General Instructions:

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

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

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

Update the PM sticker and instrument logbook as required.

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### Component List

Component / Specific Model	Serial #	Configuration Notes
FIAS100		

### Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
80501696	Fan Filters	NA
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	NA
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	NA
N9301714	Replacement Acetylene Filter Cartridge	NA
TH001022	Replacement Air Filter Cartridge	NA

#### Additional Reagents and Standards Required for PM

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

#### Additional Reagents and Standards Required for PM (Customer Support Solution)

Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO <sub>3</sub>	250 ml.	AR	AR

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Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-056
N1013002	1.0A Neutral density filter	1	MG2-054
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

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## Procedure Checklist

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

### 1. General:

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

### 2. PC Instrument Software:

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

### 3. Mechanical:

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

### 4. Electrical:

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

### 5. Optics:

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

### 6. Gasses:

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

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#### 7. Flame Interlock Check:

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

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

#### 8. After PM Performance tests:

##### 8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	1.0531	1.0230	Pass
0.2 A ND Filter	± 5% from Cert.	0.1806	0.1783	Pass

##### 8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

##### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

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##### 8.4 D<sub>2</sub> Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0054	Pass

##### 8.5 AA-BG Baseline Noise with Copper

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

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

##### 8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0002	Pass

##### 8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	NA
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3878	Pass

#### 10. Review:

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

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Additional Comments Regarding the PM	

<p><i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.</i></p>	
<p><i>This PinAAcle 900F Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></p>	
<p><b>Review of Preventive Maintenance:</b></p>	
<p>Authorized PerkinElmer Representative:</p> <p><i>KL S.</i></p>	<p>Date:</p> <p>24-Oct-2023 (DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p> <p><i>0212255216</i></p>	<p>Date:</p> <p>24-Oct-2023 (DD-MMM-YYYY)</p>

*Handwritten signature*  
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**BOD INCUBATOR**

**Model : TC445S**

**Serial No. : 0223/007275**

SK

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



## 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 Chalyaporn	

### 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 coverage factor  $k = 2.0$  ,providing a level of confidence level of approximately 95 %

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Certificate No. : S2309-3014

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Table1 General Information

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

Table2 Chamber Performance

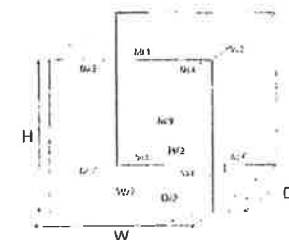
Setting Temperature ( °C )	Average Indicating Temperature ( °C )	Measured Stability ( ± °C )	Measured Uniformity ( °C )	Overall Variation ( °C )
20.0	20.0	0.37	0.64	0.98

Table3 Temperature Distribution

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

Resolution : 0.1 ( °C )

\* Probe No. 9 is Reference Probe



Notes : 1. The temperature stability is the one-half 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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*[Signature]*

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CALIBRATION 0152

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## REPORT OF CALIBRATION

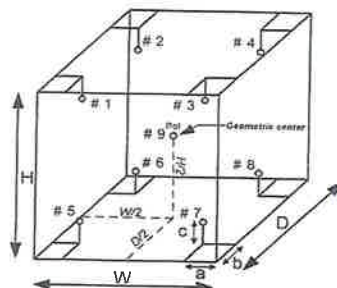
Certificate No. : 22-136844

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 -

COPY

**BOD INCUBATOR**

**ID No. : LABE 19/5**





Page 1 of 3

## 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

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).



Page 2 of 3

## 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 <sup>Ref</sup>		
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

NSC-TISI-TIS17025  
CALIBRATION 0152

Page 3 of 3

## REPORT OF CALIBRATION

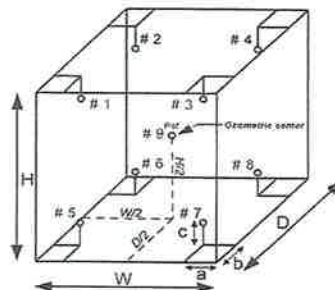
Certificate No. : 23-040768

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**

**ID No. : LABE 19/5**



Page 1 of 3

## CERTIFICATE OF CALIBRATION

Certificate No. : 24-046203

Sample Code : 24-18906-002

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapibarn 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 : 18 April 2024 Date of Calibration : 18 April 2024

## Condition of Calibration

1. Environment
- |                           |   |
|---------------------------|---|
| 1.1 Ambient temperature   | : Maximum 35.0 °C ; Minimum 33.7 °C     |
| 1.2 Relative humidity     | : Maximum 69.1 % ; Minimum 50.0 %       |
| 1.3 Line voltage supplied | : Maximum 222.5 VAC ; Minimum 218.8 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-248 to RTD-256)	23-084070	06 August 2024

## 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 19 April 2024

Approved by

(Mr. Nuttaput Timula)

Signed for Director

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

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

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



Page 2 of 3

## REPORT OF CALIBRATION

Certificate No. : 24-046203

Sample Code : 24-18906-002

## 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 <sup>ref</sup>		
20	20.5	20.0	20.28	19.86	19.90	19.91	19.82	20.10	20.01	19.89	19.75	0.59	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.45	0.85	1.31

## Notes

- UUC\* = Unit Under Calibration

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## REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 24-046203

Sample Code : 24-18906-002

## 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.

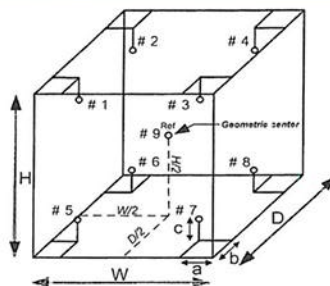


Figure: Example of sensor  
installation Positions

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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**GAS CHROMATOGRAPH**

**Model. : GC-2010 PLUS AF**

**Serial No. : C12095200986**

# SHIMADZU GAS CHROMATOGRAPH SYSTEM GC-2010Plus Series

## Operational Qualification

### Operational Qualification Report

System Name \_\_\_\_\_

System ID No. Gas Chromatograph LABE 0413

Installation Site Instrument Room GC/IC

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

• Performer

Signature	<u>[Signature]</u>	Date	
Print	Thunthul Pungken		16 / 02 / 2023
Title	Service Engineer		
Company	Parascientific Co., Ltd		

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

• Reviewer

Signature	<u>[Signature]</u>	Date	
Print	Panupong Bumrungron		16 / 02 / 2023
Title	Scientist		
Company	Eastern Thai Consulting 1992 Co., Ltd		

• Manager

Signature	<u>[Signature]</u>	Date	
Print	Nannaphul Bakhunlod		16 / 02 / 2023
Title	HS		
Company	Eastern Thai Consulting 1992 Co., Ltd		

## Operational Qualification

## Definitions

### 1-2 Scope

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

(Address): 672 Moo 11 Sukhaphan 3 Rd Nongkham, Siracha, Chonburi 20110

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

(Department):

(Installation Site): Instrument Room GC/IC

(Equipment ID No.): Gas Chromatograph LABE 0413

(Product Model Name): GC-2010Plus / AOC-201 / AOC-205

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

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## 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

Component ID		Model Name		GC-2010Plus AF	
Serial Number (S/N)		C 1 2 0 9 k 2 0 0 9 3 6			
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation.	All LEDs light. Screen contrast adjustment is possible.	LED <input checked="" type="checkbox"/> Display <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Standard self-diagnostic test	Verify the status and operation of all parts.	"Good" displayed as the result of the self-diagnostic test.	Good <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Ver. <input checked="" type="checkbox"/> Controlled Ver. No. <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green. Displayed actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$ .	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Inspection pressure gauge reading $\checkmark 10.0 \pm 3.0 \text{ kPa}$	Pressure gauge correction value	0.1 kPa
			Pressure gauge reading	9.9 kPa	
			Post-correction reading	9.9 kPa	
			Inspection pressure gauge reading $\checkmark 200.0 \pm 20.0 \text{ kPa}$	Pressure gauge correction value	0.4 kPa
			Pressure gauge reading	199.6 kPa	
			Post-correction reading	199.2 kPa	
			Inspection pressure gauge reading $\checkmark 500.0 \pm 35.0 \text{ kPa}$	Pressure gauge correction value	0.2 kPa
			Pressure gauge reading	499.8 kPa	
			Post-correction reading	499.6 kPa	

Performer (signature):

Date: 16 / 02 / 2023

Reviewer (signature):

Date: 18 / 2 / 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 $250.0 \pm 5.0 \text{ kPa}$ Inspection pressure gauge reading 8 minutes after start $250.0 \pm 20.0 \text{ kPa}$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate $3.0 \pm 1.0 \text{ mL/min}$ $\checkmark$ Total of septum purge and split vent flow rate values $10.0 \pm 3.0 \text{ mL/min}$ $\checkmark$ Total of septum purge and split vent flow rate values $200 \pm 20 \text{ mL/min}$ $\checkmark$ Total of septum purge and split vent flow rate values $300 \pm 28 \text{ mL/min}$ (Carrier gas: $\text{N}_2$ ) $\checkmark$ Total of septum purge and split vent flow rate values $500 \pm 35 \text{ mL/min}$ (Carrier gas: $\text{He}$ )	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature.	Inspection temperature sensor displayed value $\checkmark 150.0 \pm 3.2^{\circ}\text{C}$ Temp. correction value $-1.0^{\circ}\text{C}$ Temp. sensor reading $50.1^{\circ}\text{C}$ Corrected temp. value $51.1^{\circ}\text{C}$ Inspection temperature sensor displayed value $\checkmark 150.0 \pm 4.2^{\circ}\text{C}$ Temp. correction value $-0.9^{\circ}\text{C}$ Temp. sensor reading $149.2^{\circ}\text{C}$ Corrected temp. value $150.1^{\circ}\text{C}$ Inspection temperature sensor displayed value $\checkmark 280.0 \pm 5.5^{\circ}\text{C}$ Temp. correction value $-1.1^{\circ}\text{C}$ Temp. sensor reading $279.4^{\circ}\text{C}$ Corrected temp. value $280.7^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
9	Temperature program test	Verify that the column temperature program operates normally.	Monitored temperature 6 minutes after start $200 \pm 1^{\circ}\text{C}$ $\checkmark$ Inspection temperature reading 8 minutes after start $200.0 \pm 4.7^{\circ}\text{C}$ $\square$ Using a temperature sensor with $1^{\circ}\text{C}$ minimum display increment $200 \pm 3^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity.	FD ( <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> Not Applicable) Calculated S value $46498 \mu\text{V}\cdot\text{s}$ Inj. unit (5 $\mu\text{L}$ ) $\checkmark$ Make-up gas: $\text{N}_2$ $10.0 \times 10^{-3} \text{ C/g min.}$ $\square$ Make-up gas: $\text{He}$ $7.00 \times 10^{-3} \text{ C/g min.}$ TCD ( <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> Not Applicable) Calculated S value $149.6 \times 10^{-3} \text{ C/g}$ Inj. unit ( ) $4.00 \times 10^{-3} \text{ mV}\cdot\text{mL/mg min.}$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Performer (signature):

Date: 16 / 02 / 2023

Reviewer (signature):

Date: 18 / 2 / 2023

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## Operational Qualification

## Operational Qualification Record

## 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.		<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000"	Display: 000	<input checked="" type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No. 3.46	<input checked="" type="checkbox"/>
			The version number matches the controlled version number.	Controlled Ver. No. 3.46	<input checked="" type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct.	Sample injected into the GC and GC operation starts.		<input checked="" type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

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.		<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000"	Display:	<input type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No.	<input type="checkbox"/>
			The version number matches the controlled version number.	Controlled Ver. No.	<input type="checkbox"/>
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.		<input type="checkbox"/>

Performer (signature):

Date: 16 / 08 / 2023

Reviewer (signature):

Date: 18 / 8 / 2023

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## Operational Qualification

## Operational Qualification Record

## 3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Model Name		AOC-20s			
Component ID					
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 9 1 0			
No.	Item	Criteria	Results	Pass	Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.	LED lights green, not red.		<input checked="" type="checkbox"/>
2	Firmware version check	Verify the program version.	Version number is displayed.	Version No. 3.50	<input checked="" type="checkbox"/>
			The version number matches the controlled version number.	Controlled Ver. No. 3.50	<input checked="" type="checkbox"/>

Performer (signature):

Date: 16 / 08 / 2023

Reviewer (signature):

Date: 18 / 8 / 2023

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**Hot Air Oven**

**Model : UM 400**

**Serial No. : 900982**

## CERTIFICATE OF CALIBRATION

Certificate No. : 24-001944  
Sample Code : 24-00963-001Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapibarn 8 Rd., Nongkham,  
Sriracha, Chonburi 20230Location 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 : 09 January 2024 Date of Calibration : 09 January 2024

## Condition of Calibration

1. Environment
- |                           |           |           |           |           |
|---------------------------|-----------|-----------|-----------|-----------|
| 1.1 Ambient temperature   | : Maximum | 30.6 °C   | : Minimum | 29.2 °C   |
| 1.2 Relative humidity     | : Maximum | 57.5 %    | : Minimum | 46.4 %    |
| 1.3 Line voltage supplied | : Maximum | 229.5 VAC | : Minimum | 222.5 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-10 (RTD-257 to RTD-265)	23-066256	29 June 2024

## 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 Nearnpunt)

Signed for Director

Issue date 09 January 2024

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. : 24-001944  
Sample Code : 24-00963-001

## 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 <i>k</i>
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 <sup>Ref</sup>		
60	60.0	60.0	60.04	59.90	59.81	59.84	59.47	59.91	60.08	59.98	59.87	0.25	2.00
85	85.0	85.0	86.07	85.75	85.58	85.62	84.69	85.83	86.28	85.94	85.77	0.34	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
60	0.11	0.49	0.80
85	0.09	1.13	1.72

## Notes

- UUC\* = Unit Under Calibration



## REPORT OF CALIBRATION

Certificate No. : 24-001944

Sample Code : 24-00963-001

## Results of Calibration

## Notes

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

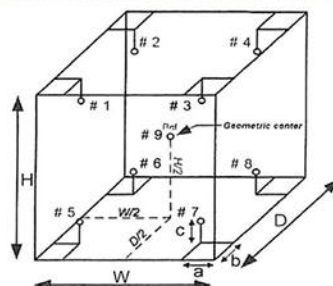


Figure: Example of sensor  
installation Positions

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty 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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**INDUCTIBELY COUPLED PLASMA SPECTROMETER**

**Model : Prodigy 7**

**Serial No. : P70177**





## Instrument Performance Certificate For ICP-OES

PRODUCT ID  
Serial Number

*Prodigy 7, Teledyne Leeman Labs*  
P70177

Customer Name  
Address

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

Date of Qualified  
Next Due date

Dec 13, 2023  
May 13, 2024

This certifies for products which was performed in acceptable criteria specifications

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

PASSED  
PASSED  
PASSED  
PASSED  
PASSED  
PASSED  
PASSED

Provided by

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

Certified by *Esman*  
Thunraphol Sakdayos

Service Engineer

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## Preventive Maintenance Report

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

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

2.Spectrometer	Status
Optical view position	
Axial peak positions x 3325 y 1205	OK <input checked="" type="checkbox"/>
Radial peak positions x 4206 y 1220	OK <input checked="" type="checkbox"/>
Hg lamp peak positions x 2245 y 1615	OK <input checked="" type="checkbox"/>
Wavelength Calibrate with HG Lamp	OK <input checked="" type="checkbox"/>
Full Frame Image	OK <input checked="" type="checkbox"/>
Temperature controlled 31 °C	OK <input checked="" type="checkbox"/>
Purge gas flow control Low/High	OK <input checked="" type="checkbox"/>
Purge gas flow for Detector	OK <input checked="" type="checkbox"/>
Camera Support Module	OK <input checked="" type="checkbox"/>

Engineer Sign

*Esman*  
COPY



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

6.Hardware Diagnostics Test			
Power Supply		Value	Status
-12 VDC	(+/- 5 %)	-12.7 V	Passed ✓
+12 VDC	(+/- 5 %)	11.91 V	Passed ✓
+3.3VDC	(+/- 5 %)	3.3 V	Passed ✓
+5.0 VDC	(+/- 5 %)	4.995 V	Passed ✓
+13.5 VDC	(+/- 5 %)	13.41 V	Passed ✓
Plasma Generator			
ICP Current	0.500A = 1kW	0.502 A	Passed ✓
ICP Ref	5.0Vdc = 1kW	5.002 V	Passed ✓
ICP Current	0.00 Vdc = 0kW	0 A	Passed □
ICP Ref	0.00Vdc = 0kW	0 V	Passed □
RF Water (Hz)	OFF (1 Hz)	0 Hz	Passed ✓
RF Water (Hz)	ON (25-35 Hz)	25 Hz	Passed ✓
Air Knife Pres.	(0.00V) OFF	0 V	Passed ✓
Air Knife Pres.	(3.0 – 7.0 V) ON	3.56 V	Passed ✓
Neb	setting to 25 psi	reading 25 psi	Passed ✓
Cool	setting to 16 lpm	reading 16 lpm	Passed ✓
Aux	setting to 0.5 lpm	reading 0.5 lpm	Passed ✓
Camera Water pump			
Pump Current	(0.000 A) OFF	0 A	Passed ✓
Pump Voltage	(0.000 V) OFF	0 V	Passed ✓
Pump Current	(0.8 to 4.0A) ON	1.1 A	Passed ✓
Pump Voltage	(8 to 13 V) ON	12.49 V	Passed ✓
Set Points			
Cam Tec Temperature (-30 to -38°C)	Set -32 °C Read -31 °C		Passed ✓
Op Purge Low (0-15.5 lpm)	Set 5 lpm Read 5.1 lpm		Passed ✓
Op Purge High (0-15.5 lpm)	Set 10 lpm Read 10.1 lpm		Passed ✓
Cam Wtr T (25-30 °C)	Set 25 °C Read 25 °C		Passed ✓

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

Engineer Sign


*Signature*  
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Engineer Sign

*Signature*  
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8.Safety Interlock	Status
Argon pressure	OK <input checked="" type="checkbox"/>
Air Knife	OK <input checked="" type="checkbox"/>
RF power regulator	OK <input checked="" type="checkbox"/>
RF power temp	OK <input checked="" type="checkbox"/>
RF power current	OK <input checked="" type="checkbox"/>
RF water	OK <input checked="" type="checkbox"/>
Oscillator cover	OK <input checked="" type="checkbox"/>
Door switch	OK <input checked="" type="checkbox"/>
Camera purge	OK <input checked="" type="checkbox"/>
Camera TE cooler	OK <input checked="" type="checkbox"/>
Water chiller	OK <input checked="" type="checkbox"/>
Heater Fans	OK <input checked="" type="checkbox"/>

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

Customer Sign	Engineer Sign
<u>Kenneth Seal</u>	<u></u> 13/12/2023


*Handwritten signature*

**ICP-OES/Avio550**

**Serial No. : M81S2210101**

### ICP-OES/Avio550 Preventive Maintenance (PM)

Company Name:	Eastern Thai Consulting 1992 Co., Ltd.		
Address (Instrument Location):	683 Moo 11 Sukhapibarn 8 Rd., Siracha, Chon Buri 20230		
Serial Number:	M8152210101	PM Number:	1 OF 2 W
Customer Name (if applicable):	K.Nunnaphat	Telephone Number:	038 481 197
Service Engineer Name:	K.Piyawit	Service Order Number:	WO-02754304
Date PM Performed: (DD-MMM-YYYY)	25-Apr-2024	Next PM Due Date: (DD-MMM-YYYY)	25-Oct-2024
Standard Labor Hours to Complete PM :		4 hours	

Part Number	Release	Publication Date	
TH09370188 Rev.2	B	July 2020	

#### Scope

The purpose of this PM is to ensure the continued functionality of the PerkinElmer / Avio550 by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

#### General Instructions:

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

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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### Component List

Component / Specific Model	Serial #	Configuration Notes
Avio550Max	M8152210101	Syngistix 5.1.0.0293

### Parts Lists

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

### Additional Reagents and Standards Required for PM

Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N0691579	Muti-Element Standard	AR	61-176CRX1	30-JUN-2025
N9300221	DL Standard diluted 100 X	AR	59-091CRY1	30-JUN-2024
N0582152	Wave Cal Solution	AR	59-150CRX1	30-SEP-2024
N9302946	VIS Wavecal Solution	AR	59-113CRT1	28-FEB-2025

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## Procedure Checklist

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

### 1. General:

- ☒ Ask customer about unit's performance since last visit.
- ☒ Check incoming AC line voltage under load for proper levels and grounding.
- ☒ Is the instrument operational? If not, please comment.

### 2. Mechanical:

- ☒ Inspect and clean all fans and filters.
- ☒ Inspect and replace torch components and necessary.

Torch Components Replaced: ☐ Yes ☒ No

- ☒ Inspect all tubing for signs of cracking or leaking and replace as necessary.

Tubing Replaced: ☒ Yes ☐ No

- ☒ Inspect the peristaltic pump for proper operation.
- ☒ Check and adjust if necessary, the external nitrogen, argon shear gas and water supply pressures.
- ☒ Check and adjust if necessary, the internal nitrogen, main argon, torch argon and shear gas pressures.

Regulator	Measured Pressure	Set Pressure
Nitrogen		NA (calibrated in Factory)
Main Argon	76 psig	76 psig
Torch Argon	67 psig	67 psig
Shear Gas	65 psig	65 psig
Water	35 psig	35 psig

- ☒ Check shear gas nozzle for blockages and proper, uniform flow.
- ☒ Inspect nitrogen Hi/Low purge and shear gas solenoids for proper function.
  - ☒ Inspect the function of all spectrometer motors. Drive the motors from the Spectrometer DCM. (slits, XY motor)
- ☒ Inspect the function of the pneumatic shutter for proper operation.
  - ☒ Perform preventative maintenance on the chiller as required. Make the customer aware of the importance of maintaining the chiller fluid level and filter replacement.
- ☒ Drain air compressor surge tank.
- ☒ Clean exterior of instrument.
- ☒ Visually inspect all PC boards for cleanliness and signs of corrosion.

### 3. Electrical

- ☒ Check all RF generator and spectrometer power supply voltages.
- ☒ Run instrument diagnostic checks from the appropriate Device Control Module.

#### RF Generator:

- ☒ Check the RF generator status screens.
- ☒ Check the function of all interlocks.

#### Spectrometer:

- ☒ Check the spectrometer status screens. Ensure Ready mode with no fatal errors.
- ☒ Check the spectrometer optical tub temperatures (top, bottom, fin, optical base).
- ☒ Check detector temperatures.
- ☒ Check TEC voltages (6.5VDC)

### 4. Optical:

- ☒ Clean or replace the axial and radial view windows as necessary.

Axial Window Replaced: ☐ Yes ☒ No

Radial Window Replaced: ☐ Yes ☒ No

### 5. PM Performance Tests:

- ☒ Perform View Align.

#### Test Spectral Resolution:

- ☒ Measure the spectrometers ability to separate two adjacent wavelengths.

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.007	0.00534	Passed
Ni 231.604 - Resolution	≤0.008	0.00725	Passed
Ni 341.476 - Resolution	≤0.012	0.00891	Passed
La 408.672 - Resolution	≤0.020	0.01603	Passed
Ba 455.403 - Resolution	≤0.025	0.02190	Passed

#### Test Precision:

- ☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
As 193.696	%RSD ≤ 1 %	0.65%	Passed
Zn 213.856	%RSD ≤ 1 %	0.66%	Passed
Mn 257.610	%RSD ≤ 1 %	0.41%	Passed
La 379.478	%RSD ≤ 1 %	0.51%	Passed
Ba 455.403	%RSD ≤ 1 %	0.32%	Passed
Ba 493.408	%RSD ≤ 1 %	0.30%	Passed



- ☒ Run an Axial & Radial BEC according to the A&T spec.

**Test Axial BEC Cd:**

Method "BEC-XL" For Samples "IB (2%HNO3)" and "IS (N930-0221/100)", record intensities.

Calculated BEC:  $BEC = (IB * Conc of Std) / (IS - IB)$ . Where Conc of Std = 500 PPB

Element	Conc.	IB	IS	
<b>Cd 226</b>	500	2,028.9	162,248.4	
IB*Conc	IS-IB	BEC	Spec	Pass/Fail
1,014,450	160,219.5	6.33	<150 PPB	Passed

**Test Radial BEC Mn:**

Method "BEC-RL" For Samples "IB (2%HNO3)" and "IS (N069-1579)", record intensities.

Calculated BEC:  $BEC = (IB * Conc of Std) / (IS - IB)$ . Where Conc of Std = 1,000 PPB

Element	Conc.	IB	IS	
<b>Mn 257</b>	1,000	2,166.8	91,410.0	
IB*Conc	IS-IB	BEC	Spec	Pass/Fail
2,166,800	89,243.2	24.28	<45 PPB	Passed

**6. Review:**

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

## Additional Comments

Additional Comments Regarding the PM

## Review

The preventive maintenance checks and if applicable performance tests for ICP-OES/Avio550 have been completed.

This ICP-OES/Avio550 Passes ☒ Fails ☐ the preventive maintenance.

**Review of Preventive Maintenance:**

Authorized PerkinElmer Representative:	<i>Pijavit S.</i>	Date: 25-Apr-2024 (DD-MMM-YYYY)
Authorized Customer Representative:		Date: 25-Apr-2024 (DD-MMM-YYYY)

**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



CERTIFICATE No : 23T10864  
REFERENCE No : 71117-1

PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : LIQUID IN GLASS THERMOMETER  
**MANUFACTURER** : PRECISION  
**MODEL** : 0 °C TO 100 °C  
**SERIAL No** : 43560  
**ID No** : LABE 16/1  
**RESOLUTION** : 0.1 °C  
**TYPE** : TOTAL IMMERSION  
**CONDITION AS RECEIVED** : USED ITEM  
**SUBMITTED BY** : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 MOO 11, SUKHAPIBAN 8 ROAD, NONGKHAM,  
SRIRACHA, CHONBURI 20230

**CALIBRATED BY** : CHARUKIT L.  
**CALIBRATION DATE** : 09-Nov-23  
**APPROVED BY** : PONGSAK J.  
**ISSUED DATE** : 09-Nov-23  
**RECEIVED DATE** : 02-Nov-23

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

CERTIFICATE No : 23T10864

PAGE : 2 OF 2

## Calibration Report

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

### CONDITION OF THIS RESULTS OF CALIBRATION

- THIS INSTRUMENT WAS CALIBRATED BASED ON ASTM E77:1992 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	23T3927	08-Mar-24
2) SPRT PROBE	5614	636636	23T3927	08-Mar-24
3) PRECISION BATH	7320	A21105	22T13199	14-Dec-23
4) PRECISION BATH	CTR-40	A68155	22T13198	09-Dec-23
5) PRECISION BATH	6045	3C023	22T13200	19-Dec-23
- THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

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

### UUC\* : UNIT UNDER CALIBRATION

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

**COPY**

**MERCURY ANALYZER**

**Model : RA-4500**

**Serial No. : 21780504**

# Eastern Thai Consulting 1992 Co., Ltd.

## Automatic Mercury Analyzer

Model RA-4500

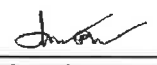
## Preventive Maintenance Report

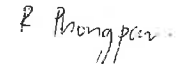
Serial No. : 21780504

Soft version : Ver 2.0.7

ROM version : Ver 2.0.1

Date : August 9, 2023

PM by :   
( Pathom S. )

Approved by :   
( Phongpan R. )



**Coax Group Corporation Ltd.**

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

Kwang ThanonNakornchaisri, Dusit, Bangkok 10300 Thailand

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

## Inspection result

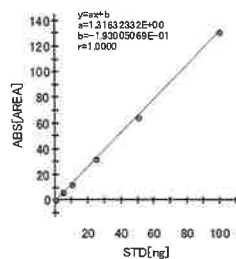
ITEM	STANDARD	RESULT	JUDGE
1. Self Check			
1.1 Leak check	0.14 - 2.0 L/min.	0.18 L/min	PASS
1.2 Sig/Ref check	3.0 - 4.0 volte	Sig:4.01V., Ref:4.09V.	PASS
1.3 Drift check	0.0000047 - 0.0000014	0.0000038	PASS
2. Analytical curve inspection(AREA)			
2.1 No Pretreatment	Correlation coefficient ( r ) $\geq$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

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**COPY**

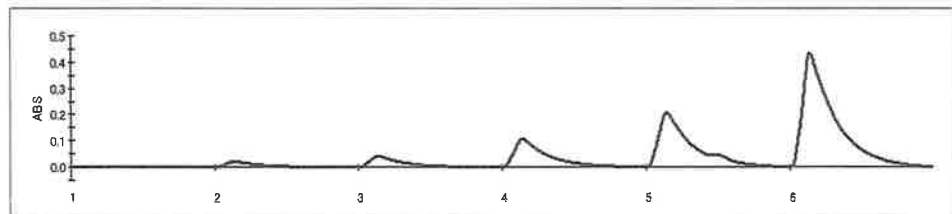
Title : RA-4500 Preventive Maintenance  
 Date : 9/8/2566  
 Name : Coax Group  
 Memo : Calibration curve (No Pretreatment)

Calib



STD

No.	STD [ppb]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	0.000	5.000	5.000	5.000	0.000	0.3869	0.4405	-	
2	50.000	0.100	5.000	5.000	5.000	6.6907	5.2295	4.6	
3	50.000	0.200	5.000	5.000	10.000	12.4017	9.5681	4.3	
4	50.000	0.500	5.000	5.000	25.000	32.5205	24.8522	0.6	
5	50.000	1.000	5.000	5.000	50.000	65.2046	49.6820	0.6	
6	50.000	2.000	5.000	5.000	100.000	131.7390	100.2277	0.2	

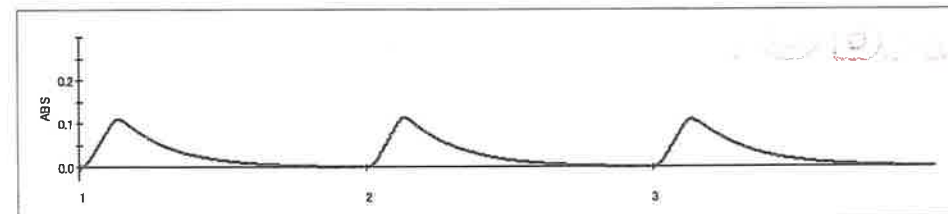


SMP

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

Statistics

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



Self Check

Heat check:PASS!! ( 26.0degC[05:00] -> 30.0degC[03:06])  
 Sensor check:PASS!! (1113- 58=1055)  
 Leak check:PASS!! (0.18L/min)  
 Sig/Ref check:PASS!! (Sig:4.01V, Ref:4.09V)  
 Drift check:PASS!! ( 0.0000036 - -0.0000002 = 0.0000038)

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**pH Meter**

**Model : SevenCompact S220**

**Serial No. : B448305208**



## CERTIFICATE OF CALIBRATION

Page 1 of 3

Supersede to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 8 Rd., Nongkham,  
Sriracha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.  
(Laboratory)

Equipment : pH Meter

Manufacturer : METTLER TOLEDO

Model : SevenCompact S220

Serial No. : B448305208

ID No. : LABE 11/4

Date of Receipt : 09 January 2024

Date of Calibration : 09 January 2024

## Condition of Calibration

## 1. Environment

1.1 Ambient temperature : 22.4 ± 0.2 °C 1.2 Relative humidity : 56.4 % ± 2.1 %

## 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	23E3244	03 October 2024
3.2 Digital Thermometer	LB-TH-33	23-098974	25 August 2024
Certified Reference Material	Lot. No.	Ref No.	Expire Date
3.3 Buffer Solution pH 4.008	919273	PH216.L5	24 September 2025
3.4 Buffer Solution pH 6.986	941727	PH107.L5	06 November 2024
3.5 Buffer Solution pH 9.997	919278	PH220.L5	24 September 2024

## 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 (CPA RefN HARNED CELL LotN 61275737; CPA RefN HARNED CELL LotN 61273986 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. Nuttaput Timula

Approved by

(Mr. Sornchai Neampunt)

Scientist

Signed for Director

Issue date 31 January 2024

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

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

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



## REPORT OF CALIBRATION

Page 2 of 3

Supersede to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

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
		mV	pH		
0	414.113	413.9	0.00	± 0.083	2.00
4	177.477	177.4	4.00	± 0.083	2.00
7	0.000	0.1	7.00	± 0.083	2.00
10	-177.477	-177.3	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. : 2453982

Three-Point Calibration at pH4, pH7 and pH10 Percent Slope : 98.3

Standard Buffer Solution	Average indicator reading		Error Value	Uncertainty	Coverage factor
	pH	mV			
pH (@ 25 °C)					
4.008	4.01	182.1	0.002	± 0.010	2.00
6.986	7.00	7.8	0.014	± 0.011	2.00
9.997	10.01	-167.2	0.013	± 0.011	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.

NSC-TISI-TIS17025  
CALIBRATION 0152

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## REPORT OF CALIBRATION

Supersede to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

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. : 2453982 ID No. : N/A

## Condition of Calibration

1. Environment 1.1 Ambient temperature : 22.6 °C ± 0.1 °C  
 1.2 Relative humidity : 55.1 % ± 3.3 %

## 2. Calibration method

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

## 3. Reference standard instrument

Instrument	Model	ID. No.	Certificate No.	Due date
3.1 Resistance Thermometer	PT-100	RTD-90	23-098974	25 August 2024
3.2 Thermometer Readout	GT-11	LB-TH-33	23-098974	25 August 2024

## 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	25.000	120	25.0	0.000	± 0.14	2.00

## Notes

- Calibration results without adjustment

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

- End of report -

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**STANDARD WEIGHT 50 g**



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

## CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by Mr. Somwang Sangdee  
Scientist

Issue date 31 May 2022

Approved by

( Mr. Somchai Neampunt )

Signed for Director

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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. : 22-052238  
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 ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

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

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

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Certificate No. : 22-052238

Sample Code : 22-19150-003

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## REPORT OF CALIBRATION

## Condition of Calibration:

1. Ambient Conditions : Temperature  $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ , Relative humidity  $50\% \pm 10\%$  and air density  $1.20 \text{ kg/m}^3$ 

2. Calibration Method : Direct comparison weighing according to OIML R111-1 : 2004(E)

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

## 6. Description of Calibrated Item :

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

- End of Report -

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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

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 ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

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

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## REPORT OF CALIBRATION

## Condition of Calibration

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

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

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

( Instrument number 1).

5. Condition of Calibration item: Normal

## 6. Description of Calibrated Item :

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

- End of Report -

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**STANDARD WEIGHT 50 g**





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

## CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee  
Scientist

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

Issue date : 31 May 2022

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

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

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



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

## REPORT OF CALIBRATION

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

### Result of Calibration :

☒ Without adjustment

☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature ( $t_{ref}$ ) of 20°C, the conventional mass is the mass of a reference weight of a density ( $\rho_{ref}$ ) of 8000 kg.m<sup>-3</sup> which it balances in air of a reference density ( $\rho_0$ ) of 1.2 kg.m<sup>-3</sup>

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

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## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature  $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$ , Relative humidity  $50\% \pm 10\%$  and air density  $1.18 \text{ kg/m}^3$
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 $\pm$ 0.005	0.000	0.000
0.000	525	0.000 $\pm$ 0.005	0.000	0.000
0.000	690	0.000 $\pm$ 0.005	0.000	0.000

CERTIFICATE No. **WO-02514383**



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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 Absorbance (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	$\pm$ 0.040	0.985	Yes
445-4	1.492	$\pm$ 0.050	1.475	Yes
525-1	0.197	+ 0.020	0.195	Yes
525-2	0.494	$\pm$ 0.030	0.491	Yes
525-3	0.986	$\pm$ 0.040	0.984	Yes
525-4	1.482	$\pm$ 0.050	1.480	Yes
690-1	0.197	$\pm$ 0.020	0.197	Yes
690-2	0.498	$\pm$ 0.030	0.497	Yes
690-3	0.985	$\pm$ 0.040	0.978	Yes
690-4	1.485	$\pm$ 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					
No visual flaws, no burrs, no loose parts and fastenings					P

## 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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**SPECTROPHOTOMETER**

**Model : PROVE 100**

**Serial No. : 1613110857**

## CERTIFICATE OF CALIBRATION

**Instrument** : SPECTROPHOTOMETER  
**Model** : PROVE 100  
**Date of Calibration** : Feb 9, 2024  
**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-02723295**

## 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	0.197	± 0.020	0.189	Yes
445-2	0.497	± 0.030	0.481	Yes
445-3	0.990	± 0.040	0.970	Yes
445-4	1.494	± 0.050	1.474	Yes
525-1	0.198	± 0.020	0.191	Yes
525-2	0.493	± 0.030	0.485	Yes
525-3	0.988	± 0.040	0.966	Yes
525-4	1.485	± 0.050	1.471	Yes
690-1	0.204	± 0.020	0.197	Yes
690-2	0.504	± 0.030	0.494	Yes
690-3	0.987	± 0.040	0.989	Yes
690-4	1.498	± 0.050	1.493	Yes

\* Spectroquant Photocheck (Check Solution) **Lot : HC299606**

- 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 Solution Standard 6	361.1 nm	359.1 – 363.1 nm	361.0 nm	P	
	386.3 nm	382.3 – 390.3 nm	385.5 nm	P	
	417.1 nm	413.1 – 421.1 nm	416.4 nm	P	
	451.4 nm	447.4 – 455.4 nm	450.0 nm	P	
	485.3 nm	481.3 – 489.3 nm	485.2 nm	P	
	537.6 nm	533.6 – 541.6 nm	537.3 nm	P	
641.4 nm	637.4 – 645.4 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	1.074 A	P
	546 nm	1.012 A	1.004 - 1.020 A	1.010 A	P
	635 nm	1.050 A	1.042 - 1.058 A	1.048 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					



## 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 : Feb 9, 2024

## APPROVED SIGNATORY

NAME : Mr.Rawat Rattanachetthakul  
(SERVICE ENGINEER)

SIGNATURE : \_\_\_\_\_

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CERTIFICATE No. **WO-02723295**



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**THERMO-HYGROMETER**

**Model : 608-H1**

**Serial No. : 45106737**

NSC-TISI-TIS17025  
CALIBRATION 0152

Page 1 of 2

## 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

Approved by

(Mr. Somchai Neampunt)

Signed for Director

Issue date

31 May 2023

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

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to 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).

NSC-TISI-TIS17025  
CALIBRATION 0152

Page 2 of 2

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

## Humidity measurement

Resolution : 0.1 %RH

Range : 10 %RH to 95 %RH

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

## Notes

- Calibration results without adjustment.

The result expanded uncertainty of measurement  $U$  is stated as the standard uncertainty 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

**THERMO-HYGROMETER**

**Model : 608-H1**

**Serial No. : 45106737**

## CERTIFICATE OF CALIBRATION

Certificate No. : 24-062442  
Sample Code : 24-25546-002Customer : EASTERN THAI CONSULTING 1992 CO., LTD.  
683 Moo 11, Sukhapibarn 8 Rd., Nongkham,  
Sriracha, Chonburi 20230Location 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 : 23 May 2024 Date of Calibration : 27-28 May 2024

## 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 401	LB-DP-03 & LB-DP-03 (DP)	TH-0064-23	07 August 2024
3.2 Digital Thermometer	Optidew 401	LB-DP-03 & LB-DP-03 (Temp.)	23-103423	03 September 2024
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	23-101374	05 September 2024

## 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 Approved by

Scientist

Issue date 30 May 2024

  
(Mr. Somchai Neampunt)  
Signed for Director

COPY

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. : 24-062442  
Sample Code : 24-25546-002

## Results of Calibration

## Temperature measurement

Resolution : 0.1 °C  
Range : 0 °C to 50 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.00	20.1	- 0.10	± 0.39
25	50	25.00	25.0	0.00	± 0.39
30	50	30.00	29.9	+ 0.10	± 0.39

## Humidity measurement

Resolution : 0.1 %RH  
Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.02	45.10	48.4	- 3.30	± 1.3
60	25.01	60.07	63.4	- 3.33	± 1.5
75	25.01	75.15	78.5	- 3.35	± 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 -

COPY

**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



# Certificate of Calibration

Number of Page(s) 1 of 3

**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, Sukkaphibarn 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 traceable to SI unit through Sarna 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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www.barascientific.com



# Certificate of Calibration

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

**Number of Page(s)** 2 of 3

## 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 0.7311	0.0000 0.7313	0.0000 0.0002	0.0075 0.0075
257	CNR CNR	CNR CNR	CNR CNR	CNR CNR
313	CNR CNR	CNR CNR	CNR CNR	CNR CNR
350	0.0000 0.6306	0.0000 0.6314	0.0000 0.0008	0.0075 0.0075

\*CNR = Customer not request

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# Certificate of Calibration

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

Number of Page(s) 3 of 3

## Calibration Results:

### 3. Photometric Accuracy (Visible)

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

\*CNR = Customer not request

### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.75 $\pm$ 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\*\*\*

The above results are valid exclusively for the calibrated item(s) as mention in this report / Certificate.  
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.

**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



## Certificate of Calibration

Number of Page(s) 1 of 3

**Certificate No.** BSCC-UV-146/24  
**Equipment** UV/Vis Spectrophotometer  
**Model** UV-1800  
**Manufacturer** Shimadzu  
**Serial No.** A11635101643 CD  
**ID No.** LABE 03/2  
**Date of receipt** 22 April 2024  
**Date of calibration** 22 April 2024  
**Date of issue** 29 April 2024

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

**Address** 683 Moo 11, Sukkhaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

**Temperature** (22.9-24.1) °C (On site)  
**Humidity** (41.7-46.9) %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. 116614 and 116613  
Photometric Accuracy is traceable to certificate No. 116210 and 116224  
Stray Light is traceable to certificate No. 116616  
The above certificate are traceable to SI unit through Starna Scientific Ltd.  
(UKAS accredited calibration laboratory NO. 0659)

**Calibrated by** Mr.Poomjai Korsawatvorakul

Approved by

**Mr.Sonthi Temboonsakdi**  
Service Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.  
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## Certificate of Calibration

**Certificate No.** BSCC-UV-146/24

Number of Page(s) 2 of 3

### Calibration Results:

#### 1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.75	0.04	0.18
445.82	445.89	0.07	0.18
536.52	536.50	-0.02	0.18
741.02	741.01	-0.01	0.18
879.41	879.33	-0.08	0.18

#### 2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000 0.7415	0.0000 0.7387	0.0000 -0.0028	0.0075 0.0075
257	CNR CNR	CNR CNR	CNR CNR	CNR CNR
313	CNR CNR	CNR CNR	CNR CNR	CNR CNR
350	0.0000 0.6406	0.0000 0.6395	0.0000 -0.0011	0.0075 0.0075

\*CNR = Customer not request

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# Certificate of Calibration

Certificate No. **BSCC-UV-146/24** Number of Page(s) **3 of 3**

## Calibration Results:

### 3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ( $\pm A$ )
420.0	0.0000	0.0000	0.0000	0.0042
	0.5715	0.5729	0.0014	0.0042
	0.7087	0.7087	0.0000	0.0042
	1.0987	1.1005	0.0018	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5561	0.5578	0.0017	0.0042
	0.6968	0.6969	0.0001	0.0042
	1.0757	1.0774	0.0017	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
	0.5193	0.5213	0.0020	0.0042
	0.6937	0.6940	0.0003	0.0042
	1.0411	1.0428	0.0017	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
	0.5605	0.5624	0.0019	0.0042
	0.7579	0.7583	0.0004	0.0042
	1.1131	1.1138	0.0007	0.0042

\*CNR = Customer not request

### 4. Stray Light\*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
201.33 $\pm$ 0.11nm	200.80	0.9750	2.0111

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

\*\*\*End of Certificate\*\*\*

The above results are valid exclusively for the calibrated item(s) as mentioned in this report / certificate.  
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## **BAROMETER**

**Equipment : Analog Barometer**

**ID No. / Tag No. : BM001/41**



## CALIBRATION CERTIFICATE

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

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

**Equipment** : Analog Barometer

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

Calibration Method or Calibration Procedure Used

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

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

### Result of Calibration

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

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

Approved by: *Sarayuth T.*  
 ( Mr. Sarayuth Tochua )



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

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

STD = Standard

UUC = Unit Under Calibration

**Calibrated condition :** Pressure Medium Air : Density = 1.19 kg/m<sup>3</sup> @ 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	Calibration Range	Scale Interval	Resolution
	990 - 1030	990 - 1030	1 mbar	0.5 mbar Absolute

Condition As-Received : Used Item

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

**Measurement Standards Used & Traceability :**

The International System of Units (SI) through

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

End of Certificate

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**CERTIFICATE OF ANALYSIS**

**EPA PROTOCOL GAS**

**Cylinder No. : EB0062815**



## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E04N199E15ACX8C 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,S02,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	Assay Dates
NOX	50.00 PPM	50.55 PPM	G1	03/06/2018, 03/13/2018
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	03/06/2018, 03/13/2018
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	03/06/2018, 03/13/2018
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	03/06/2018
NITROGEN	Balance			

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTRM	1606007	CC442564	Jun 27, 2020
PRM	12367	APEX1099237	Jun 02, 2017
GMIS	0315201604	CC503358	Mar 15, 2019
NTRM	16011025	CC473218	Jun 07, 2022
NTRM	12060735	CC356192	Dec 14, 2026

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

ANALYTICAL EQUIPMENT	
Instrument/Make/Model	Analytical Principle
Nicolet 6700 APWT100391 CO	FTIR
Nicolet 6700 APWT100391 NO	FTIR
Nicolet 6700 APWT100391 NO2	FTIR
Nicolet 6700 APWT100391 SO2	FTIR

Last Multipoint Calibration	
Feb 08, 2018	
Feb 15, 2018	
Feb 16, 2018	
Mar 01, 2018	

#### Triad Data Available Upon Request

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

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



TESTING CERT No. 3082.05

*Don Moran*  
Approved for Release

**GAS CHROMATOGRAPH**

**Model. : GC-2010 PLUS AF**

**Serial No. : C12095200986**

SHIMADZU GAS CHROMATOGRAPH SYSTEM  
GC-2010Plus Series

Operational Qualification

System Name			
System ID No. Gas Chromatograph 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	Date	
	Print Thannat Pungka	16/08/2023	
	Title Service Engineer		
	Company Parascientific Co.,Ltd		
The undersigned reviewer and manager report that the performer has completed the Operational Qualification Protocol successfully.			
• Reviewer	Signature	Date	
	Print Panupong Bunnayon	16/02/2023	
	Title Scientist		
	Company Eastern Thai Consulting 1992 Co.,Ltd		
• Manager	Signature	Date	
	Print Nuanphol Bothonlod	16/02/2023	
	Title HS		
	Company Eastern Thai Consulting 1992 Co.,Ltd		

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Operational Qualification Definitions

1-2 Scope

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

(Address):	679 Moo 11 Sukhaphum 3 Rd Nongthum Srisaka, (Ludern 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-201 /AOC-205

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Performer (signature):	Th	Date:	16 / 02 / 2023
Reviewer (signature):	panupong	Date:	18 / 08 / 2023





## Operational Qualification

## Operational Qualification Record

## 3-2 AOC-20i Auto Injector

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

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

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)					
No.	Item	Criteria		Results	Pass Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		Display:	Pass
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display shows "000"	Pass
3	Firmware version check	Verify the program version.		Version number is displayed.	Pass
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.	Pass

Performer (signature):

Date: 16 / 07 / 2023

Reviewer (signature):

Date: 18 / 8 / 2023

## Operational Qualification

## Operational Qualification Record

## 3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

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

Performer (signature):

Date: 16 / 08 / 2023

Reviewer (signature):

Date: 18 / 8 / 2023

**Primary Flow Calibrator**

**Serial No. : 110619 , 207510**

## Certificate of Calibration

**Customer**  
**Name** : Eastern Thai Consulting 1992 Co., Ltd.  
**Certificate No** : 24-AFM-023  
**Request No** : Req-2024-0095

### Unit Under Calibration Details

Measurement Item	: Primary Flow Calibrator
Manufacturer	: Bios
Model	: Defender 510-L
Serial Number	: I10619
ID	: -
Sensor Model	: -
Sensor Serial Number	: -

Location of Calibration : LAB 4 AIR VELOCITY METER

## Calibration Environment and Details

Temperature	: 23 °C ± 3 °C
Humidity	: 55 %RH ± 20 %RH
Barometric Pressure	: 1013 hPa ± 10 hPa
Received Date	: 11 January 2024
Calibration Date	: 30 January 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	1850.010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	1903.101.1003	Sensidyne	12 July 2024
Temperature meter	GT 11	080000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

**Traceability:**

This Certificate is traceable to SI Unit through Sensidyne No. 3943.01

**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 : mm

Mr. Noppadon Luangam  
Service Calibration Engineer

Approved By : ๑๗๑๑

Mr. Pacit Mathawon  
Calibration Engineer Supervisor

Issue Date : 30 January 2024

### Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
24.80	101.23	0	0.00	0.0000	0.0038
24.40	101.18	50	49.629	-0.4	3.3
24.40	101.16	100	100.73	0.7	2.8
24.30	101.13	200	198.30	-1.7	5.6
24.30	101.10	300	298.14	-1.9	8.4
24.40	101.06	400	397.45	-3	11
24.20	101.00	500	496.93	-3.1	7.1

Note	STD : Standard	UUC : Unit Under Calibration
------	----------------	------------------------------

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \chi \frac{P_{\text{ref}}}{P_{\text{meas}}} \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where  $O = \text{Flow Rate}$

**P = Absolute Pressure**

**\*T = Absolute Temperature**

**Mcas = Measurement Condition**

 $\rho_i' = \text{Standard Condition}$ 

\* Indicates non accredited

**End of Certificate**

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

FM-708-AFM-01 Rev.01 Issue date 25/01/24

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FM-708-AFM-01 Rev.01 Issue date 25/01/24



Certificate No : 24-AFM-022

Request No : Req-2024-0094

Result of Calibration : Without Adjustment						
Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	
24.80	101.33	0	0.00	0.0000	0.0058	
24.70	101.58	101	101.48	0.5	2.8	
24.80	101.50	200	201.14	1.1	5.6	
24.70	101.50	500	503.87	3.9	7.1	
24.80	101.50	1003	1010.1	7	14	
24.70	101.60	2002	2014.6	13	29	
24.60	101.33	2995	3007.6	13	43	
24.60	101.65	4027	4007.5	-19	57	
24.50	101.70	5035	5010.7	-24	72	

Note

STD : Standard

UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P} \times \frac{T_{meas}}{T_{ref}}$$

where

Q Flow Rate

P Absolute Pressure

T Absolute Temperature

Meas = Measurement Condition

ref Standard Condition

\* Indicates non accredited

End of Certificate

Certificate of Calibration

Certificate No : 24-AFM-022

Request No : Req-2024-0094

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.

Address : 683 Moo 11, Sukhaphibam 8 Rd., Nongkham, Srinacha, Chonburi 20230

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : MesaLabs

Model : Defender S10-M

Serial Number : 207510

ID : -

Sensor Model : -

Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 11 January 2024

Calibration Date : 30 January 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000037	Qrebon	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

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

Approved By :  Mr. Pakt Muthavorn

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 30 January 2024



**SOUND LEVEL CALIBRATOR**

**MODEL : NC-75**

**SERIAL No. : 34802645**



## Calibration Certificate

**Equipment :** SOUND CALIBRATOR

**Manufacturer :** RION

**Model :** NC-75

**Serial No.:** 34802645

**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 :** 06 SEPTEMBER 2023

**Calibration Date :** 12 OCTOBER 2023

**Date of Issue :** 16 OCTOBER 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-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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*T. Petchurai*

Continuation of Calibration Certificate

Cert. No. : ACC23037  
Job No. : VC56AC0097  
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	93.94	-0.06	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 (%)
0.24	0.10	3.0

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

\_\_\_\_\_ End of Calibration Certificate \_\_\_\_\_

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T. Ratan.

**SOUND LEVEL METER**

**MODEL : NL-52A**

**SERIAL No. : 00230994**



NSC-TISI-TIS 17025  
CALIBRATION 0037



NSC-TISI-TIS 17025  
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 156/0266

Request No. 21-66/0343

## CALIBRATION CERTIFICATE

**Submitted by** : Eastern Thai Consulting 1992 Co., Ltd..  
**Address** : 683 Moo 11 Sukhaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

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

### Ambient Environment

**Instrument Calibrated :**  
**Description** : Sound Level Meter :  $(23 \pm 3) ^\circ\text{C}$   
**Manufacturer** : Rion : Relative Humidity :  $(50 \pm 15) \%$   
**Model** : NL-52A : Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

**Serial No.** : 00230994  
**Microphone** : Type UC-59 No.22777  
**Preamplifier** : Type NH-25 No.22430

### Standards used :

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

**Date of Receipt** : 27 Feb. 2023

**Date of Calibration** : 21-23 Mar. 2023

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

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NSC-TISI-TIS 17025  
CALIBRATION 0037



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Request No. 21-66/0343

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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1. Absolute Sensitivity

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

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

2. Self-generated noise

2.1 Normal test

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

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

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

Date of Calibration : 21-23 Mar. 2023

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)		Acceptance limit class I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
125	0.0	0.1	±1.0	0.45	0.6
1 000	-0.5	-0.5	±0.7	0.45	0.6
8 000	0.0	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 I (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight			
63	-0.1	-0.1	±1.0	0.20	0.6
125	0.1	0.0	±1.0	0.20	0.6
250	-0.1	0.0	±1.0	0.20	0.6
500	0.0	0.0	±1.0	0.20	0.6
1 000	0.0	0.0	±0.7	0.20	0.6
2 000	0.0	0.0	±1.0	0.20	0.6
4 000	0.0	0.0	±1.0	0.20	0.6
8 000	0.0	0.0	+1.5; -2.5	0.20	0.7
16 000	-1.3	-1.4	+2.5; -16.0	0.20	0.7

Date of Calibration : 21-23 Mar. 2023

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MTC No. BEL. BP. 156/0266

Request No. 21-66/0343

### 5. Long-term stability

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

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

#### 6.1 Frequency weightings at 1 kHz

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

Date of Calibration : 21-23 Mar. 2023

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MTC No. EEL. BP. 156/0266

Request No. 21-66/0343

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

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

Date of Calibration : 21-23 Mar. 2023

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

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

8. Level linearity including the level range control

At reference sound level on the reference level range

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

Date of Calibration : 21-23 Mar. 2023

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8. Level linearity including the level range control

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

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

9. Tone burst response

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

Date of Calibration : 21-23 Mar. 2023

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

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NSC-TISI-TIS 17025  
CALIBRATION 0037

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MTC No. EEL. BP. 156/0266

Request No. 21-66/0343

#### 10. Peak C sound level

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

#### 11. Overload indication

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

#### 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 Phasingri*

(Mr. Pannasit Phasingri)

Approved by :

(Mr. Prawale Klunypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 21-23 Mar. 2023

Date of Issue : 23 Mar. 2023

End of Certificate

Ref : 2011266022700825009

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E-mail : sumalee@tistr.or.th

**SOUND LEVEL METER**

**MODEL : NL-52A**

**SERIAL No. : 00230992**



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

MTC No. EEL. BP. 154/0266

Request No. 21-66/0343

MTC No. EEL. BP. 154/0266

## CALIBRATION CERTIFICATE

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.

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

Address : 683 Moo 11 Sukhaphibam 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 : (23 ± 3) °C  
Manufacturer : Rion : (50 ± 15) %  
Model : NL-52A : (101.325 ± 1.5) kPa

### Ambient Environment

Serial No. : 00230992

Microphone : Type UC-59 No.22769

Preamplifier : Type NH-25 No.22428

### 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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### 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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

Date of Calibration : 21-23 Mar. 2023

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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

Date of Calibration : 21-23 Mar. 2023

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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 linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
30-130	94.0	94.0	0.0	0.8	0.00	0.3

Date of Calibration : 21-23 Mar. 2023

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8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 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

Date of Calibration : 21-23 Mar. 2023

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Request No. 21-66/0343

MTC No. EEL. BP. 154/0266

### 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)
	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 Phasingtri)

Approved by :   
(Mr. Prayoon Kluyypa)

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 21-23 Mar. 2023  
Date of Issue : 23 Mar. 2023

Ref : 2011266022700825007

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FM.BLMTC.002 Rev.



**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00322752**



## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42A / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00322752 / 196475 / 15484  
**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 )

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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Continuation of Calibration Certificate

Cert. No. : ACL23141  
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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Continuation of Calibration Certificate

Cert. No. : ACI23141  
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	16.8
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.3	0.3	0.3
1000	0.0	0.0	0.0
8000	0.9	1.0	1.0
			Acceptance Limits
			± 1.5
			± 1.0
			±5.0

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Continuation of Calibration Certificate

Continuation of Calibration Certificate

Cert No. : ACL23141  
Job No. : VC66AC0047  
Pages : 5 of 8

Cert No. : ACL23141  
Job No. : VC66AC0047  
Pages : 6 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.1	0.1	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.1	0.1	± 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	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 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



Continuation of Calibration Certificate

Cert No. : ACL23141  
Job No. : VC66AC0047  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	2	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±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	133.1	0.1	±2.0
Positive half cycle	135.4	135.3	-0.1	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

Continuation of Calibration Certificate

Cert No. : ACL23141  
Job No. : VC66AC0047  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.2	±1.5
89.5	89.7		

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

**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00222593**



## 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.



**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).





Continuation of Calibration Certificate

Cert. No. : ACL23165  
Job No. : VC66AC0058  
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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Continuation of Calibration Certificate

Cert. No. : ACL23165  
Job No. : VC66AC0058  
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)
14.2

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

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Continuation of Calibration Certificate

Cert. No. : ACL23165  
Job No. : VC66AC0058  
Pages : 5 of 8

Cert. No. : ACL23165  
Job No. : VC66AC0058  
Pages : 6 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	0.0	0.0	0.0
125	0.0	0.1	0.0
250	0.0	0.0	0.0
500	0.0	0.1	0.0
1000	0.0	0.0	0.0
2000	0.0	0.1	0.1
4000	0.0	0.1	0.0
8000	0.1	0.1	0.1

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23165  
Job No. : VC66AC0058  
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	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

Continuation of Calibration Certificate

Cert. No. : ACL23165  
Job No. : VC66AC0058  
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	89.6	±1.5
89.6	89.6		

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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**NOISE DOSI METER**

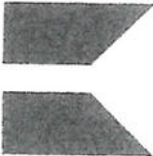
**MODEL : CR:110A**

**SERIAL No. : CB1365**

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 19 January 2024 CERTIFICATE NUMBER 206870



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

Page 1 of 2  
Approved signatory  
N Smith  
Electronically signed:

*N.D. Smith*

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd.  
Model: CR-110A 683 Moo 11, Sukaphibai 8 Rd., Nongkham,  
Serial number: CB1365 Sriracha, Chonburi 20230  
Firmware version: 5.4

Test summary

Date of calibration: 19 January 2024  
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	78713
Environmental Monitor	Cornet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:  
206870

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Environmental conditions

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

Before Pressure: 99.92 kPa Temperature: 21.7 °C Humidity: 33.2 %  
After Pressure: 99.96 kPa Temperature: 21.8 °C Humidity: 34.2 %

Test results summary

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

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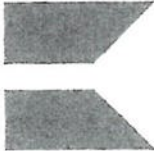
**MODEL : CR:110A**

**SERIAL No. : CB1497**




CERTIFICATE OF CALIBRATION

ISSUED BY                      Cirrus Research plc  
DATE OF ISSUE                19 January 2024      CERTIFICATE NUMBER   206868



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

Page 1 of 2
Approved signatory N Smith Electronically signed: 

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:                Cirrus Research plc                      Notes:    Eastern Thai Consulting 1992 Co.,Ltd.  
Model:                        CR:110A                                        683 Moo.11, Sukaphibai 8 Rd., Nongkham,  
Serial number:                CB1497                                        Siracha, Chonburi 20230  
Firmware version:            5.4

Test summary

Date of calibration:        19 January 2024  
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	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before    Pressure: 100.13 kPa    Temperature: 22.0 °C    Humidity: 37.0 %  
After      Pressure: 100.15 kPa    Temperature: 21.9 °C    Humidity: 35.4 %

Test results summary

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

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**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB1498**

Environmental conditions

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

Before	Pressure: 100.96 kPa	Temperature: 21.6 °C	Humidity: 33.2 %
After	Pressure: 100.97 kPa	Temperature: 21.5 °C	Humidity: 33.4 %

Test results summary

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

**Dosimeter : IEC 61252-1993+A1:2000**

Instrument information

Manufacturer:	Cirrus Research plc	Notes:	Eastern Thai Consulting 1992 Co., Ltd. 693 Moo.11, Sukaphibai 8 Rd., Nongkham, Sriracha, Chonburi 20230
Model:	CR:110A		
Serial number:	CB1498		
Firmware version:	5.4		

Test summary

Date of calibration: 19 January 2024

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	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

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**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0954**

CERTIFICATE OF CALIBRATION

ISSUED BY

Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206864



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

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Approved signatory  
N Smith  
Electronically signed:

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc  
Model: CR-110A  
Serial number: CB0954  
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: 19 January 2024  
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	78713
Environmental Monitor	Cornet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:  
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Environmental conditions

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

Before Pressure: 100.03 kPa Temperature: 21.9 °C Humidity: 34.8 %  
After Pressure: 100.06 kPa Temperature: 21.7 °C Humidity: 36.8 %

Test results summary

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

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