

ภาคผนวก ง

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เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

**Primary Flow Calibrator**

**Serial No. : 110619 , 207510**

Certificate of Calibration

Customer: Eastern Thai Consulting 1992 Co., Ltd.  
Request No : Req-2024-0095

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

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator  
Manufacturer : Bios  
Model : Defender S10-L  
Serial Number : J10619  
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 (P-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	08000057	Qreborn	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 :   
Service Calibration Engineer  
Approved By :   
Calibration Engineer Supervisor  
Issue Date : 30 January 2024

COPY

Certificate No : 24-AFM-023  
Request No : Req-2024-0095

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	0.0058
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 :

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

where Q : Flow Rate P : Absolute Pressure T : Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates not accredited

End of Certificate

COPY

Certificate of Calibration

**Customer**

Name : Eastern Thai Consulting 1992 Co., Ltd.

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

**Unit Under Calibration Details**

Measurement Item : Primary Flow Calibrator

Manufacturer : MesaLabs

Model : Defender S10-M

Serial Number : 207510

ID : -

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

Sensor Model : -

Sensor Serial Number : -

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	0.0058
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 :

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

where Q Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref Standard Condition

\* Indicates non accredited

End of Certificate

Calibration By : [Signature]

Service Calibration Engineer

Approved By : [Signature]

Calibration Engineer Supervisor

Issue Date : 30 January 2024

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**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

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).

## 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
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	0.000003



Certificate No. : 23-148799

Sample Code : 23-56200-001

## 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	10.0000004	10.00008	-0.00008	0.000026	2.00
20	20.000030	20.00011	-0.00008	0.000036	2.00
50	50.0000014	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 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

## REPORT OF CALIBRATION

## Result of Calibration :

## 4. Eccentric or off-centre loading

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

Weighing pan		Test weight : 50 and 100	
		Unit : g	
		Range	Reading of indicator
		Position	Reading of indicator
<input type="radio"/> Circle <input type="radio"/> Triangular <input checked="" type="radio"/> Rectangular	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-CL-004 base on UKAS LAB 14: 2019
2. This result of calibration was found accurate as shown on date and place of calibration only.
3. Condition of Calibration item: Normal
4. This certification is traceable to the International System of Unit maintained at : -  
Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).
5. Reference standard instrument :  
Instrument  
1) STANDARD WEIGHT 1 mg to 1 kg

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

Certificate No. 23-103642  
Class E2  
ID.No. LB-WE-79  
Due Date 10 September 2024

- End of Report -

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

**CERTIFICATE OF ANALYSIS**

**EPA PROTOCOL GAS**

**Cylinder No. : EB0145030**

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E03N199E15AC0U4 Reference Number: 160-40224242-1  
Cylinder Number: E80145030 Cylinder Volume: 144.4 CF  
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2015 PSIG  
PGVP Number: A12021 Valve Outlet: 350  
Gas Code: CH4, PPN, BALN Certification Date: Oct 15, 2021

Expiration Date: Oct 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 009/R-12/021, using the assay procedures listed. Analytical methodology does not require correction for any of the impurities listed. This cylinder has a full analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable
PROpane	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
Assay Dates				
				10/15/2021
				10/15/2021
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%
NTRM	200602-06	6162660Y	243.3 PPM PROPANE/AIR	+/- 0.5%
Expiration Date				
				May 15, 2025
				Mar 17, 2027
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Last Multipoint Calibration	
Nicolet IS50 FTIR AUP2110295 CH4			FTIR	Oct 13, 2021
Nicolet IS50 FTIR AUP2110295 C3H8			FTIR	Oct 14, 2021

#### Triad Data Available Upon Request

#### NOTES:

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



**DRY GAS METER MC572V**

**Serial No. : 0504003**

## Certificate Of Calibration

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

## Meter Console Information

Console Model: MC572V  
 Console Serial: 0504003  
 DGM Model #: SK25EX  
 DGM Serial #: 00009854

## Calibration Condition

Cal Date: 22-Apr-24  
 Due Date: 23-Apr-25  
 Cal Report No: WDS-SV6704001  
 Ambient Temp (°C): 25  
 Pressure (mm Hg): 758  
 Relative Humidity (%): 60

## Factors/Conversion

Std. Temp (°K): 298  
 Std. Pressure (mm Hg): 760  
 K<sub>1</sub> (K/mm Hg): 0.3857

## Reference Equipment

WTM Model: W-NKoDa-5B WTM Cal. Due Date: Dec. 2023  
 WTM Serial: 600245 Gamma: 1.0000

## UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	144 5926	144 7699	26	27	60 06607	60 24392	29	28
10.00	25.0	144 8168	144 9795	27	27	60 29098	60 45472	27	27
8.00	50.0	145 0164	145 2002	28	28	60 49135	60 67317	29	27
7.00	80.0	145 2238	145 4291	28	28	60 69691	60 90186	29	28
5.00	120.0	145 4909	145 6692	28	29	60 96349	61 14145	27	26

## Reference Meter (WTM)

## Standardized Data

Test Meter		Reference Meter		Correction Factor		Flow Rate		
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
$V_{m(std)}$ (m <sup>3</sup> )	$Q_{m(std)}$ (m <sup>3</sup> /min)	$V_{ref(std)}$ (m <sup>3</sup> )	$Q_{ref(std)}$ (m <sup>3</sup> /min)	(Y)	(ΔY)	$Q_{m(std)corr}$	$\Delta H_p$	$\Delta \Delta H_p$
0.173	0.012	0.173	0.012	0.997	0.003	0.012	43.309	-0.858
0.159	0.016	0.160	0.016	1.004	0.011	0.016	43.381	-0.787
0.179	0.022	0.176	0.022	0.984	-0.009	0.022	45.447	1.280
0.201	0.029	0.199	0.028	0.989	-0.005	0.028	44.202	0.035
0.175	0.035	0.174	0.035	0.994	0.000	0.035	44.497	0.330
				0.993	= Y Avg	44.167 = ΔH@ Avg		

Pass/Fail Result: Pass

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

Note: For ΔH<sub>p</sub>, orifice pressure differential that equates to 0.75cfm (0.0212m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H<sub>2</sub>O

Approved By: \_\_\_\_\_

Service Manager

Date: 22-Apr-24

## Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

## Nomenclature

P<sub>3</sub> - Barometric Pressure  
 DGM - Dry Gas Meter  
 K<sub>1</sub> - Constant based on standard temp and press  
 t - Run time, in minutes  
 P<sub>m</sub> - ΔH (Meter Pressure, gauge)  
 V<sub>m</sub> - Volume collected by test meter, corrected for STP  
 Q<sub>m(std)</sub> - Calculated flow rate of test meter  
 K' - Critical orifice coefficient  
 P<sub>ref</sub> - Measured pressure of reference meter  
 t<sub>ref</sub> - Temperature measured in reference meter  
 t<sub>m</sub> - Temperature measured in test meter  
 Y - Ratio of volume collected from test meter and orifice  
 sc - Scaling Factor  
 Counts<sub>sc</sub> - Number of pulse counts, standardized  
 Counts<sub>raw</sub> - Number of raw pulse counts of a calibration run

## Equations

$$V_{m(std)} = Y * K_1 \frac{V_{ref} * P_{ref} - \frac{P_{ref}}{T_{ref}}}{T}$$

$$V_{m(std)} = Counts_{std} * Y_{sc(avg)}$$

$$Counts_{std} = K_1 \frac{Counts * (P_{ref} + \frac{P_{ref}}{T_{ref}})}{T_{ref}}$$

$$Q_{m(std)} = \frac{V_{m(std)}}{t}$$

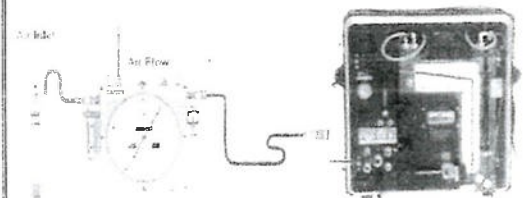
$$Y_{sc} = \frac{V_{m(std)}}{Counts_{std}}$$

$$K_1 = \frac{T_{ref}}{P_{ref}}$$

$$Y = \frac{V_{m(std)}}{V_{ref}}$$

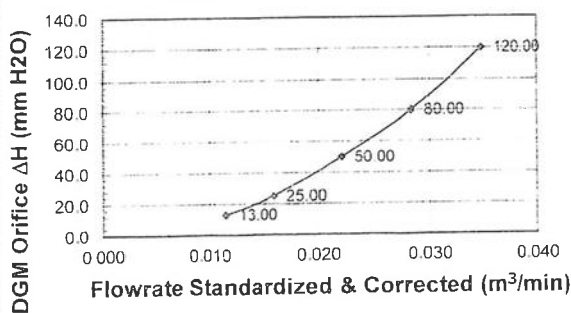
$$V_{ref} = \Delta H_p \cdot \frac{P_{ref} - 0.00116296 + P_{ref} + \frac{P_{ref}}{T_{ref}}}{T_{ref}} \cdot \left( \frac{T_{ref}}{T} \right)^{1.2}$$

## Calibration Train



## Calibration Graphs

## Meter Pressure vs Flowrate



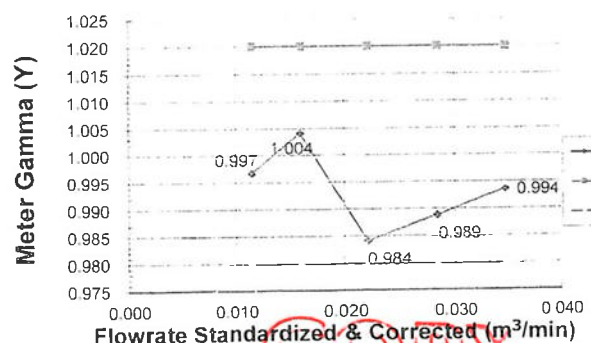
Console Serial

0504003

Console Model

MC572V

## Meter Gamma vs Flowrate



Console Serial

0504003

Console Model

MC572V



WISDOM SCIENCE

## TEMPERATURE DISPLAY CALIBRATION

### Meter Console Information

Console Model	MC572V
Console serial	0504003
Temp Indicator Model	785-KF
Temp Indicator Serial	JC05630

### Calibration Conditions

Cal Date	22-Apr-24
Due Date	23-Apr-25
Cal Report No	WDS-SVG704001
Ambient Temp (°C)	25
Pressure (mm Hg)	759
Humidity (%)	60

### Reference Equipment

Temp Meter Model	Fluke 714B
Serial No	60590035
Cal Date	07-Apr-24
Temp Meter Model	Fluke 179
Serial No	54620112
Cal Date	06-Feb-24

### Temperature Sensor Calibration

Reference Point	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	150.0	-1.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	591.0	2.0
9	815.0	815.0	0.0
10	1038.0	1038.0	0.0
Maximum <sup>1</sup>			1.0

### Note

<sup>1</sup> For valid test results, the maximum difference between temperature readings should  $\leq 1.0^{\circ}\text{C}$  (EPA Method 5, Section 6.1.1.8) Perform all TC Channel calibrations. Except meter (DGM) channel

PASS

### DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
Ice	0.0	1.0	-1.0
Ambient	26.5	26.0	0.5
Heat	109.3	110.0	-0.7

Temp Difference  $\pm 2^{\circ}\text{F}$  or  $\pm 1^{\circ}\text{C}$

PASS

### Note

The temperatures of the thermocouple and reference thermometers shall agree to within  $\pm 2^{\circ}\text{F}$  (EPA Method 5, section 10.5)

Approved By :

Service Manager

WISDOM SCIENCE



**DRY GAS METER XC-572-OV**

**Serial No. : A2204323**



WISDOM SCIENCE

## Certificate Of Calibration

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

## Meter Console Information

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

## Calibration Condition

Cal. Date: 22-May-24  
Due Date: 22-May-25  
Cal. Report No.: WDS-SV6704018  
Ambient Temp (°C): 25  
Pressure (mm Hg): 758  
Relative Humidity (%): 60

## Factors/Conversion

Std Temp (°K): 298  
Std. Pressure (mm Hg): 760  
K<sub>1</sub> (K/mm Hg): 0.3857

## Reference Equipment

WTM Model: W-NKoDa-SB WTM Cal. Due Date: Dec. 2024  
WTM Serial: 600245 Gamma: 1.0000

UUT Meter (DGM)				Reference Meter (WTM)					
Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
9	P <sub>avg</sub>	V <sub>in</sub>	V <sub>out</sub>	T <sub>in</sub>	T <sub>out</sub>	V <sub>in</sub>	V <sub>out</sub>	T <sub>in</sub>	T <sub>out</sub>
15.00	13.0	194.6567	194.8274	26	27	61.39400	61.56423	28	27
10.00	25.0	195.0941	195.2514	28	28	61.82541	61.98088	29	28
8.00	50.0	195.2786	195.4572	28	28	62.00769	62.10342	28	27
7.00	80.0	195.4877	195.6846	28	29	62.21353	62.40748	28	27
5.00	120.0	195.7085	195.8796	29	29	62.43108	62.60020	26	27

## Standardized Data

Test Meter		Reference Meter		Correction Factor		Flow Rate		ΔH (mm H <sub>2</sub> O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation	
V <sub>avg</sub> (m <sup>3</sup> )	Q <sub>avg</sub> m <sup>3</sup> /min	V <sub>avg</sub> (m <sup>3</sup> )	Q <sub>avg</sub> m <sup>3</sup> /min	(Y)	(ΔY)	Q <sub>avg</sub> m <sup>3</sup> /min	ΔH <sub>avg</sub>	ΔH <sub>avg</sub>	
0.167	0.011	0.166	0.011	0.994	0.008	0.011	47.022	-1.348	
0.153	0.015	0.151	0.015	0.986	0.000	0.015	48.311	-0.059	
0.174	0.022	0.171	0.021	0.981	-0.005	0.021	48.458	0.089	
0.192	0.027	0.189	0.027	0.981	-0.004	0.027	48.869	0.499	
0.167	0.033	0.165	0.033	0.986	0.000	0.033	49.189	0.819	

Pass/Fail Result: **Pass**

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

Note: For ΔH<sub>avg</sub>, orifice pressure differential that equates to 0.75cfm (0.0212m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H<sub>2</sub>O

Approved By: \_\_\_\_\_

Service Manager

Date: 22-May-24

WISDOM SCIENCE  
บริษัท วิสโดม ไซนซ์ จำกัด  
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

COPY

## Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

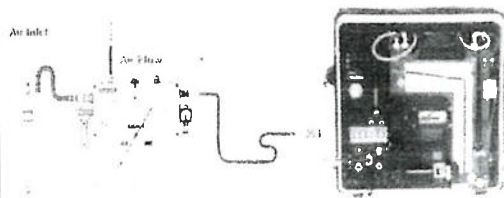
## Nomenclature

## Equations

## Calibration Train

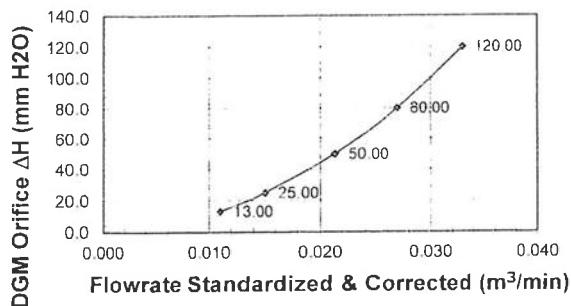
P<sub>B</sub> - Barometric Pressure  
DGM - Dry Gas Meter  
K<sub>1</sub> - Constant based on standard temp and press  
Q - Run time, in minutes  
P<sub>m</sub> - ΔH (Meter Pressure, gauge)  
V<sub>m</sub> - Volume collected by test meter, corrected for STP  
Q<sub>m</sub> - Calculated flow rate of test meter  
K' - Critical orifice coefficient  
P<sub>w</sub> - Measured pressure of reference meter  
T<sub>w</sub> - Temperature measured in reference meter  
T<sub>m</sub> - Temperature measured in test meter  
Y - Ratio of volume collected from test meter and orifice  
sc - Scaling Factor  
Counts<sub>std</sub> - Number of pulse counts, standardized  
Counts<sub>std</sub> - Number of raw pulse counts of a calibration run

$$V_{std} = Y * K_1 * \frac{V_w * (P_{bar} + \frac{P_w}{1.36})}{T_w}$$
$$V_{mstd} = Counts_{std} * Y_{sc(avg)}$$
$$Counts_{std} = K_1 * \frac{Counts * (P_{bar} + \frac{P_w}{1.36})}{T_w}$$
$$Q_{std} = \frac{V_{std}}{t} = Y * \frac{V_w}{Counts_{std}}$$
$$K_1 = \frac{T_{std}}{P_{std}} = Y * \frac{V_w}{V_{mstd}}$$
$$Y = \frac{P_{std} * 0.001146 * (P_{bar} + \frac{P_w}{1.36})}{P_w} * \left( \frac{T_w}{T_{std}} \right)$$



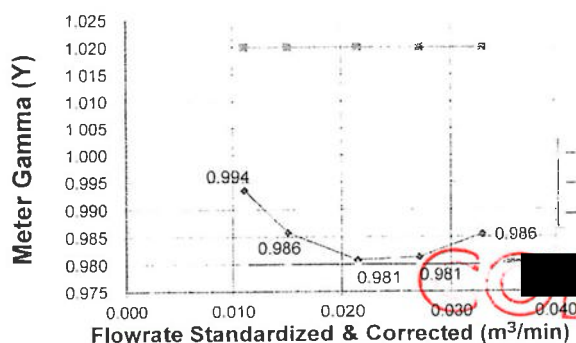
## Calibration Graphs

Meter Pressure vs Flowrate

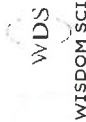


Console Serial: A2204323 Console Model: XC-572-OV

Meter Gamma vs Flowrate



Console Serial: A2204323 Console Model: XC-572-OV



## TEMPERATURE DISPLAY CALIBRATION

WISDOM SCIENCE

### Meter Console Information

Console Model	XC-572-OV
Console serial	A2204323
Temp Indicator Model	755-KF
Temp Indicator Serial	JC05630

### Calibration Conditions

Cal Date	22-May-24
Due Date	22-May-25
Cal Report No	WDS-SV704018
Ambient Temp (°C)	25
Pressure (mm Hg)	758
Humidity (%)	60

### Reference Equipment

Temp Meter Model	Fuke 714B
Serial No	60590035
Cal Date	07-Apr-24
Temp Meter Model	Fuke 179
Serial No	58620112
Cal Date	06-Feb-24

### Temperature Sensor Calibration

Reference Point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	150.0	-1.0
5	260.0	255.0	5.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	593.0	0.0
9	815.0	815.0	0.0
10	1036.0	1033.0	3.0
Maximum <sup>1</sup>			1.0

### Note

<sup>1</sup> For valid test results, the maximum difference between temperature readings should be  $\leq 1.0^{\circ}\text{C}$  (EPA Method 5, Section 6.1.1.8).  
Perform all TC Channel calibrations. Except meter (DGM) channel

PASS

### DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ice	0.0	1.0	-1.0
Ambient	27.5	27.0	0.5
Heat	108.6	105.0	3.6

### Difference Range

Temp. Difference  $\pm 2^{\circ}\text{F}$  or  $\pm 1^{\circ}\text{C}$

PASS

### Note

The temperatures of the thermocouple and reference thermometers shall agree to within  $\pm 2^{\circ}\text{F}$  (EPA Method 5, section 10.5)

Approved By : \_\_\_\_\_

Service Manager

**WISDOM SCIENCE**

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

**DRY GAS METER XC-572-V**

**Serial No. : 1110070**

## Certificate Of Calibration

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

### Meter Console Information

Console Model : XC-572-V  
Console serial : 1110070  
DGM Model #: SK25EX  
DGM Serial #: 00006432

### Calibration Condition

Cal. Date: 28-Jun-24  
Due Date: 28-Jun-25  
Cal. Report No.: WDS-SV6706007  
Ambient Temp (°C): 25  
Pressure (mm Hg): 758  
Relative Humidity (%): 60

### Factors/Conversion

Std. Temp. (°K): 298  
Std. Pressure (mm Hg): 760  
K<sub>f</sub> (K/mm Hg): 0.3857

### Reference Equipment

WTM Model: W-NKoDa-5B WTM Cal. Due Date: Dec. 2024  
WTM Serial: 600245 Gamma: 1.0000

### UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
0	P <sub>mit</sub>	V <sub>mi</sub>	V <sub>mf</sub>	t <sub>mi</sub>	t <sub>mf</sub>	V <sub>wi</sub>	V <sub>wf</sub>	t <sub>wi</sub>	t <sub>wf</sub>
15.00	13.0	239.7603	239.9212	27	27	63.63889	63.79843	27	27
10.00	25.0	239.9406	240.0979	27	27	63.81777	63.97353	27	27
8.00	50.0	240.1147	240.2952	27	28	63.99028	64.16968	26	26
7.00	80.0	240.3308	240.5352	28	28	64.20536	64.40956	26	26
5.00	120.0	240.5641	240.7422	29	29	64.43852	64.61730	26	26

### Standardized Data

Test Meter		Reference Meter		Correction Factor		Flow Rate		ΔH@ (mm H <sub>2</sub> O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	ΔH <sub>g</sub>	Variation	ΔΔH <sub>g</sub>
V <sub>m(std)</sub> (m <sup>3</sup> )	Q <sub>m(std)</sub> m <sup>3</sup> /min	V <sub>w(std)</sub> (m <sup>3</sup> )	Q <sub>w(std)</sub> m <sup>3</sup> /min	(Y)	(ΔY)	Q <sub>m(std)corr</sub>	ΔH <sub>g</sub>		ΔΔH <sub>g</sub>
0.157	0.010	0.155	0.010	0.991	-0.003	0.010	53.303	6.250	
0.154	0.015	0.152	0.015	0.989	-0.005	0.015	47.860	0.807	
0.176	0.022	0.175	0.022	0.993	-0.001	0.022	46.233	-0.820	
0.200	0.029	0.199	0.028	0.997	0.003	0.028	43.895	-3.158	
0.174	0.035	0.175	0.035	1.001	0.007	0.035	43.973	-3.080	

0.994 = Y Avg.

47.053 = ΔH@ Avg.

Pass/Fail Result: **Pass**

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

Note: For ΔH<sub>g</sub>, orifice pressure differential that equates to 0.75cfm (0.0212m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H<sub>2</sub>O.

Approved By: \_\_\_\_\_

Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date: 28-Jun-24

## Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

### Nomenclature

P<sub>a</sub> - Barometric Pressure  
DGM - Dry Gas Meter  
K<sub>f</sub> - Constant based on standard temp and press  
θ - Run time, in minutes  
P<sub>m</sub> - ΔH (Meter Pressure, gauge)  
V<sub>m</sub> - Volume collected by test meter, corrected for STP  
Q<sub>m(std)</sub> - Calculated flow rate of test meter  
K' - Critical orifice coefficient  
P<sub>w</sub> - Measured pressure of reference meter  
t<sub>w</sub> - Temperature measured in reference meter  
t<sub>m</sub> - Temperature measured in test meter  
Y - Ratio of volume collected from test meter and orifice  
sc - Scaling Factor  
Counts<sub>std</sub> - Number of pulse counts, standardized  
Counts<sub>total</sub> - Number of raw pulse counts of a calibration run

### Equations

$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_w}$$

$$V_{m(std)} = Counts_{std} * Y_{sc(avg)}$$

$$Counts_{std} = K_1 \frac{Counts_{total} * (P_{bar} + \frac{P_{m(std)}}{13.6})}{T_m}$$

$$Q_{w(std)} = \frac{V_{w(std)}}{\theta}$$

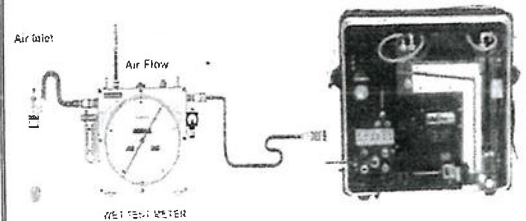
$$Y_{sc} = \frac{V_{m(std)}}{Counts_{std}}$$

$$K_1 = \frac{T_{std}}{P_{std}}$$

$$Y = \frac{V_{m(std)}}{V_{w(std)}}$$

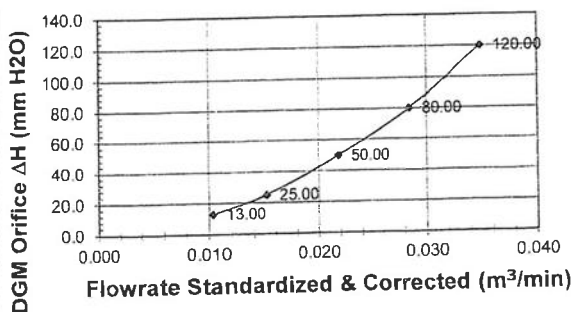
$$Metric \Delta H_g = \frac{P_{m(std)} + 0.0011696 * (P_{m(std)} + \frac{P_{m(std)}}{13.6})}{T_{std}} * \left( \frac{T_{std} + \theta}{T_w + P_{std}} \right)$$

### Calibration Train



### Calibration Graphs

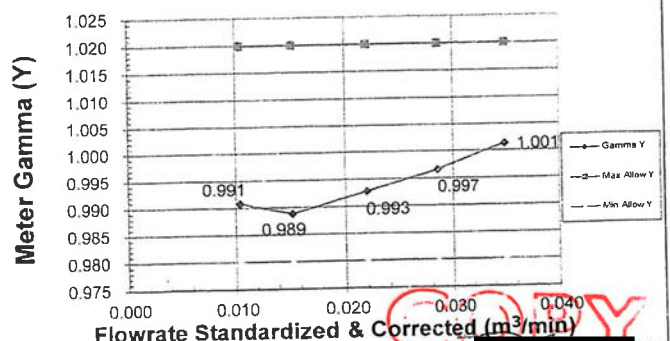
#### Meter Pressure vs Flowrate



Console Serial: 1110070

Console Model: XC-572-V

#### Meter Gamma vs Flowrate



Console Serial: 1110070

Console Model: XC-572-V



WISDOM SCIENCE

## TEMPERATURE DISPLAY CALIBRATION

### Meter Console Information

Console Model : XC-572-V  
Console serial : 1110070  
Temp Indicator Model : ID-85  
Temp Indicator Serial :

### Calibration Conditions

Cal Date : 28-Jun-24  
Due Date : 28-Jun-25  
Cal. Report No. : WDS-SV6706007  
Ambient Temp. (°C) : 25  
Pressure (mm Hg) : 756  
Humidity (%) : 60

### Reference Equipment

Temp. Meter Model : Fluke 71-4B  
Serial No. : 60590035  
Cal. Date : 07-Apr-24  
Temp. Meter Model : Fluke 17g  
Serial No. : 59620112  
Cal. Date : 06-Feb-24

### Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
1	-18.0	-17.0	1.0
2	38.0	39.0	-1.0
3	93.0	94.0	-1.0
4	148.0	150.0	-1.0
5	280.0	281.0	-1.0
6	371.0	372.0	-1.0
7	482.0	483.0	-1.0
8	593.0	593.0	0.0
9	816.0	815.0	1.0
10	1038.0	1038.0	0.0
Maximum			1.0

### Note

\* For valid test results, the maximum difference between temperature readings should  $\leq 1.0^{\circ}\text{C}$  (EPA Method 5, Section 6.1.1.8).  
Perform all TC Channel calibrations. Except meter (DGM) channel

PASS

### DGM Out Temperature Sensor Calibration

Temperature point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
Ice	1.0	2.0	-1.0
Ambient	24.2	25.0	-0.8
Heat	110.5	111.0	-0.5

### Difference Rang

Temp. Difference  $\pm 2^{\circ}\text{F}$  or  $\pm 1.1^{\circ}\text{C}$

PASS

### Note

The temperatures of the thermocouple and reference thermometers shall agree to within  $\pm 2^{\circ}\text{F}$  (EPA Method 5, section 10.5)

Approved By :

Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

**DRY GAS METER MC-572-V**

**Serial No. : 1007055**

## Certificate Of Calibration

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

## Meter Console Information

Console Model : MC-572-V  
 Console serial : 1007055  
 DGM Model #: SK25EX  
 DGM Serial #: 0009799

## Calibration Condition

Cal. Date: 04-Aug-24  
 Due Date: 04-Aug-25  
 Cal. Report No.: WDS-SV6707001  
 Ambient Temp (°C): 25  
 Pressure (mm Hg): 758  
 Relative Humidity (%): 60

## Factors/Conversion

Std. Temp. (°K): 298  
 Std. Pressure (mm Hg): 760  
 K<sub>1</sub> (K/mm Hg): 0.3857

## Reference Equipment

WTM Model: W-NKoDa-5B WTM Cal. Due Date: Dec. 2024  
 WTM Serial: 600245 Gamma: 1.0000

## UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H <sub>2</sub> O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
0	P <sub>m(0)</sub>	V <sub>m(0)</sub>	V <sub>m(0)</sub>	t <sub>m(0)</sub>	t <sub>m(0)</sub>	V <sub>m(0)</sub>	V <sub>m(0)</sub>	t <sub>m(0)</sub>	t <sub>m(0)</sub>
15.00	13.0	107.7550	107.9221	29	30	68.41024	68.57350	28	27
10.00	25.0	107.9308	108.0876	30	30	68.58202	68.73488	27	27
8.00	50.0	108.1027	108.2822	30	30	68.74958	68.92516	27	27
7.00	80.0	108.3029	108.5061	30	30	68.94550	69.14488	27	27
5.00	120.0	108.5139	108.6908	30	30	69.15251	69.32550	27	27

## Standardized Data

Test Meter		Reference Meter		Correction Factor		Flow Rate		ΔH@ (mm H <sub>2</sub> O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation	
V <sub>m(Std)</sub> (m <sup>3</sup> )	Q <sub>m(Std)</sub> m <sup>3</sup> /min	V <sub>r(Std)</sub> (m <sup>3</sup> )	Q <sub>r(Std)</sub> m <sup>3</sup> /min	(Y)	(ΔY)	Q <sub>m(Std)</sub> (m <sup>3</sup> /min)	ΔH <sub>25</sub>	ΔΔH <sub>25</sub>	
0.162	0.011	0.159	0.011	0.982	0.000	0.011	50.751	2.535	
0.152	0.015	0.149	0.015	0.982	0.001	0.015	49.300	1.084	
0.174	0.022	0.171	0.021	0.983	0.002	0.021	48.061	-0.155	
0.197	0.028	0.194	0.028	0.983	0.002	0.028	45.922	-2.293	
0.173	0.035	0.169	0.034	0.976	-0.005	0.034	47.046	-1.170	
				0.981	= Y Avg		48.216	= ΔH@ Avg	

Pass/Fail Result: **Pass**

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

Note: For ΔH<sub>25</sub>, orifice pressure differential that equates to 0.75cfm (0.0212m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H<sub>2</sub>O

Approved By: \_\_\_\_\_

Service Manager

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 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date: 04-Aug-24

## Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

## Nomenclature

P<sub>b</sub> - Barometric Pressure  
 DGM - Dry Gas Meter  
 K<sub>1</sub> - Constant based on standard temp and press  
 t - Run time, in minutes  
 P<sub>m</sub> - ΔH (Meter Pressure, gauge)  
 V<sub>m</sub> - Volume collected by test meter, corrected for STP  
 Q<sub>m(Std)</sub> - Calculated flow rate of test meter  
 K' - Critical orifice coefficient  
 P<sub>w</sub> - Measured pressure of reference meter  
 t<sub>w</sub> - Temperature measured in reference meter  
 t<sub>m</sub> - Temperature measured in test meter  
 Y - Ratio of volume collected from test meter and orifice  
 sc - Scaling Factor  
 Counts<sub>sc</sub> - Number of pulse counts, standardized  
 Counts<sub>total</sub> - Number of raw pulse counts of a calibration run

## Equations

$$V_{m(Std)} = Y * K_1 \frac{P_w * (P_{bar} + \frac{P_m}{1.315})}{T_w}$$

$$V_{m(Std)} = Counts_{Std} * Y_{sc(avg)}$$

$$Counts_{Std} = K_1 \frac{Counts_{total} * (P_{bar} + \frac{P_m}{1.315})}{T_w}$$

$$Q_{m(Std)} = \frac{V_{m(Std)}}{t}$$

$$Y = \frac{V_{m(Std)}}{V_{r(Std)}}$$

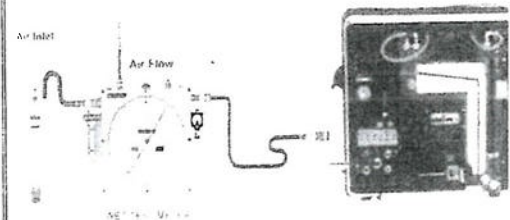
$$K_1 = \frac{T_{Std}}{P_{Std}}$$

$$Y = \frac{V_{m(Std)}}{V_{r(Std)}}$$

$$Y = \frac{Counts_{Std}}{Counts_{r(Std)}}$$

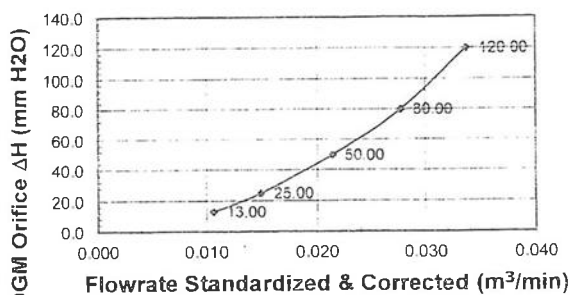
$$Y = \frac{Counts_{Std}}{Counts_{r(Std)}}$$

## Calibration Train



## Calibration Graphs

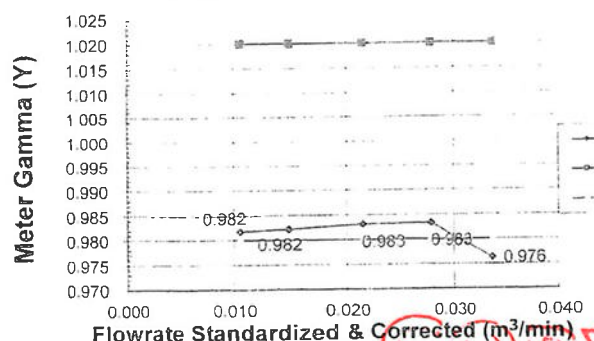
Meter Pressure vs Flowrate



Console Serial: 1007055

Console Model: MC-

Meter Gamma vs Flowrate



Console Serial: 1007055

Console Model: MC-572-V



WISDOM SCIENCE

# TEMPERATURE DISPLAY CALIBRATION

## Meter Console Information

Console Model	MC-572-V
Console serial	1007055
Temp Indicator Model	765-KF
Temp Indicator Serial	JC17852

## Calibration Conditions

Cal Date	04-Aug-24
Due Date	04-Aug-25
Cal Report No	WDS-SV8707001
Ambient Temp (°C)	25
Pressure (mm Hg)	758
Humidity (%)	60

## Reference Equipment

Temp Meter Model	Fuke 7-48
Serial No	60590035
Cal Date	07-Apr-24
Temp Meter Model	Fuke 179
Serial No	59620112
Cal Date	06-Feb-24

## Temperature Sensor Calibration

Reference Point #	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
1	-18.0	-18.0	0.0
2	38.0	38.0	0.0
3	93.0	94.0	-1.0
4	149.0	149.0	0.0
5	260.0	261.0	-1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	593.0	0.0
9	816.0	816.0	0.0
10	1038.0	1038.0	0.0
Maximum 1			1.0

## Note

1 For valid test results, the maximum difference between temperature readings should  $\leq 1.0^{\circ}\text{C}$  (EPA Method 5, Section 6.1.1.8).  
Perform all TC Channel calibrations. Except meter (DGM) channel

PASS

## DGM Out Temperature Sensor Calibration

Temperature point #	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
Ice	0.0	0.0	0.0
Ambient	28.9	27.0	-0.1
Heat	114.5	115.0	-0.5
Difference Rang			
Temp. Difference			$\pm 2^{\circ}\text{F}$ or $\pm 1.1^{\circ}\text{C}$

PASS

## Note

The temperatures of the thermocouple and reference thermometers shall agree to within  $\pm 2^{\circ}\text{F}$  (EPA Method 5, section 10.5)

Approved By :

Service Manager

**WISDOM SCIENCE**

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

**Flue gas Analyzer**

**Testo 350XL**

**Serial No. 01794619/002**



Certificate No: G 670415  
Date of issue : 25-Jun-24

Instrument description : Flue Gas Analyzer  
Instrument model : Testo 350XL  
Control unit serial no. : 01794619/002  
Instrument serial no. : 01807527/002  
ID no. or control no. : -  
Manufacturer : Testo SE & Co. KGaA  
Probe description : -  
Probe model : -  
Probe serial no. : -  
Customer name : Eastern Thal Consulting 1992 Company Limited  
Customer address : 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 2 Pages  
Receiving no. : L-242269  
Receiving date. : 19-Jun-24  
Parameter of calibration : Gas Calibration(Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.18,302,1001 ppm,  
Nitrogen Dioxide 30.34,81.32, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm,  
Sulphur Dioxide 50.36, 100.8, 600.8 ppm)  
Condition of UUC. : Used  
Ambient condition : All of the Measurement were carried out the stabilized labortary

Temperature : 23 ±5 °C  
Humidity : 55 ± 15 %RH  
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210  
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

*The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurment  
Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.  
This certificate is applied only to item under test Environmental condition.  
This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory.  
Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.  
This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).*

Date of calibration : 24-Jun-24



Calibration Technician

Technical Manager



FW-CL-09-C Rev.8

Page 1 of 2



Certificate No.: G 670415

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen ( O2 ) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen ( O2 ) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen ( O2 ) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide ( CO ) 80.18 ppm	CG-0002-24	Nimt	11-Jan-29
Carbon monoxide ( CO ) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide ( CO ) 1001 ppm	CG-0085-24	Nimt	22-May-29
Nitrogen Dioxide ( NO2 ) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide ( NO2 ) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide ( NO2 ) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide ( NO ) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide ( NO ) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide ( NO ) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide ( SO2 ) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide ( SO2 ) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 24.1 °C Humidity : 62.8 %RH Pressure : 1009.9 mbar

Calibration conditions

Gas Temperature : 24 °C Flow rate : 1,000 ml/min Gas pressure : 1014.7 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.48	-0.02	0.15
O2 (%Vol)	10.04	9.93	-0.11	0.20
O2 (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.18	81	0.82	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1001	1002	1	12
NO2 (ppm)	30.34	31.5	1.16	8.0
NO2 (ppm)	81.32	82.3	0.98	8.0
NO2 (ppm)	201.9	201.2	-0.7	12
NO (ppm)	30.01	32	1.99	8.0
NO (ppm)	151.5	155	3.5	8.0
NO (ppm)	322.5	327	4.5	12
SO2 (ppm)	50.36	49	-1.36	6.0
SO2 (ppm)	100.8	100	-0.8	6.0
SO2 (ppm)	600.8	602	1.2	13

Remark : 1 cmol/mol = 1 %vol. 1 μmol/mol = 1 ppm.

End of Report



**Hot Air Oven**

**Model : UFE 500**

**Serial No. : G511.0182**

NSC-TSI-TSI17025  
CALIBRATION 0152

## CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 23-148804

Sample Code : 23-56200-006

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.

(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Mammert Model : UFE 500

Serial No. : G511 0182 ID No. : LABE 17/4

Date of Receipt : 22 December 2023 Date of Calibration : 22 December 2023

## Condition of Calibration

1. Environment	1.1 Ambient temperature	: Maximum	30.9 °C	: Minimum	29.6 °C
	1.2 Relative humidity	: Maximum	54.5 %	: Minimum	46.8 %
	1.3 Line voltage supplied	: Maximum	227.6 VAC	: Minimum	224.2 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. Risak Into

Approved by

Scientist

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 recognised national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (AMARC)

361 Soi Ladprao 122, Ladprao Road, TEL: 02-516-2422

PHABPHIA, WANG THONGLANG, BANGKOK 10310 FAX 02-516-6949

Rev 01 Effective Date 15/10/21

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date 15/10/21

NSC-TSI-TSI17025  
CALIBRATION 0152

## REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 23-148804

Sample Code : 23-56200-006

## Results of Calibration

Resolution : 0.5 °C

## 1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)										Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 <sup>ref</sup>	# 10		
104	103.5	103.5	104.11	103.94	103.85	103.84	103.97	103.93	103.64	103.51	104.23	104.23	0.47	2.00

## 2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104	0.04	0.78	0.81

## Notes

UUC\* = Unit Under Calibration



## REPORT OF CALIBRATION

Page 3 of 3  
Certificate No. : 23-148804  
Sample Code : 23-56200-006

### 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 = 56 cm ; D = 40 cm ; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC\* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

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

- End of Report -

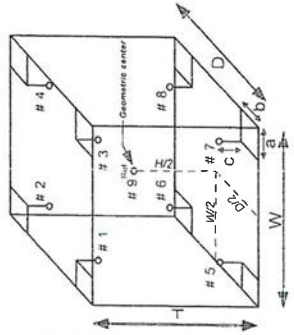


Figure: Example of sensor  
Installation Positions

**COPY**

**UV/VIS SPECTROPHOTOMETER**

**Model : UV-1800**

**Serial No. : A11635101643 CD**



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



# Certificate of Calibration

Number of Page(s)

1 of 3

Certificate No.

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, Sukkaphitbarn 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-JUV-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

Siray Light is traceable to certificate No. 116616

The above certificate are traceable to SI unit through Siama Scientific Ltd.

(UKAS accredited calibration laboratory NO. 06593)

Calibrated by

Mr. Poomjai Korsawatvorakul

Approved by

Service Manager

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 re-issued except in full, without written approval of the Bara Scientific Co., Ltd.



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



# Certificate of Calibration

Certificate No.

BSCC-UV-146/24

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	0.0000	0.0000	0.0075
	0.7415	0.7387	-0.0028	0.0075
257	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
313	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
350	0.0000	0.0000	0.0000	0.0075
	0.6406	0.6395	-0.0011	0.0075

\*CNR = Customer not request

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 re-issued except in full, without written approval of the Bara Scientific Co., Ltd.



**Bara Scientific**  
Sole agent of Success

**Bara Scientific Co., Ltd.**  
968 U Chu Liang Building Floor 7 Rama4 Road  
Silom Bangkok Bangkok Thailand 10500  
Tel : 02-6324300 Fax : 02-6376486-7  
www.barascientific.com



# 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 (±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
440.0	1.0987	1.1005	0.0018	0.0042
	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
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
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)	Absorbance (A)
201.33±0.11nm	200.80	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 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 except in full, without written approval of the Bara Scientific Co., Ltd

COPY

**SOUND LEVEL METER**

**MODEL : NL-42A**

**SERIAL No. : 00222592**

Calibration Certificate

Equipment : SOUND LEVEL METER  
Manufacturer : RUON  
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24  
Serial No.: 00222592 / 195904 / 15424  
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 : 29 APRIL 2024  
Calibration Date : 13-17 MAY 2024  
Date of Issue : 20 MAY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

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.

Cert. No. : ACL24132  
Pages : 1 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow 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.

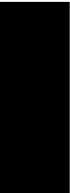
Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-4	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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).



Summary of Measurement Result :

Parameter	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		
Long - term stability	0.2	0.2
Level linearity on the reference level range	0.1	0.1
Level linearity including the level range control	0.2	0.3
Tone burst response	0.2	0.3
Peak C sound level	0.2	0.35
Overload indication	0.2	0.25
High level stability	0.1	0.1

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 )
14.4

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

Frequency Weighting	Measured value ( dB )
A - weight	12.5
C - weight	19.0
Flat	24.5

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	0.0	0.0	0.0
1000	-0.1	-0.1	-0.1
8000	1.4	1.5	1.5
Acceptance Limits			±1.5
			±1.0
			±5.0

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	-0.1	-0.1
125	0.0	0.0	0.0
250	0.0	0.0	-0.1
500	0.0	0.0	-0.1
1000	0.0	0.0	0.0
2000	0.0	0.0	0.0
4000	0.0	0.0	0.0
8000	0.0	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	94.0	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	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

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

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

**9. Tone burst response**

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

**10. Peak C sound level**

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (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

**11. Overload indication**

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.1	±1.5
89.5	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**

## **BAROMETER**

**Equipment : Analog Barometer**

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

CALIBRATION CERTIFICATE



Certificate No. : L202405022-0013  
Date Issued : 08-May-24

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 : 03-May-24  
Date Calibrated : 06-May-24

Calibrated by : Mr. Saruth Srichutikul

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: 



Certificate No : L202405022-0013

Environment Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading	UUC Reading (mbar)	UUC Reading (mbar)	UUC Error	Uncertainty	MPE	Pass / Fail
mbar	Before Adjusted	After Adjusted	mbar	± mbar	± mbar	with Guard Band
990.00	990	-	0.00	0.59	10.3	Pass
1000.00	1000	-	0.00	0.59	10.3	Pass
1010.00	1010	-	0.00	0.59	10.3	Pass
1020.00	1020	-	0.00	0.59	10.3	Pass
1030.00	1030	-	0.00	0.59	10.3	Pass

STD = Standard  
UUC = Unit Under Calibration  
MPE = Maximum Permissible Error

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

Description of UUC :	Range	950 - 1080	mbar Absolute
	Calibration Range	990 - 1030	mbar Absolute
	Scale Interval	1	mbar

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-P250097 for Reference Pressure Monitor Serial No. 1598, Due 09-Nov-24

End of Certificate



**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 0413

Installation Site Technical Room GC 11C

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

• Performer

Signature

Print

Title

Company

Date

15 / 08 / 2024

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

• Reviewer

Signature

Print

Title

Company

Date

15 / 08 / 2024

• Manager

Signature

Print

Title

Company

Date

15 / 08 / 2024

Operational Qualification

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 DF				
Serial Number (S/N)		LAB01 04 / 3		C 1 2 0 9 5 2 0 0 7 2 C				
No.	Item	Criteria			Results	Pass	Fail	
1	Display, LED test	Verify the display and LED operation.	All LEDs light.	LED	Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Screen contrast adjustment is possible.				<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	
3	Firmware version check	Verify the program version.	Version number and build number are displayed.	Ver.	Version: 4.1.060 Build No.: 207	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
			The version No. and build No. matches the controlled version number.	Controlled Ver. No.	Version: 2.060 Build No.: 207	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green.				<input checked="" type="checkbox"/>	<input type="checkbox"/>
			Displayed actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$ .	(Name)	Set value	Measured value		
			<input checked="" type="checkbox"/> COIL	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$		
			<input checked="" type="checkbox"/> IN1	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$		
			<input type="checkbox"/> IN2	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$		
			<input checked="" type="checkbox"/> DET1	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$		
			<input type="checkbox"/> DET2	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$		
			<input type="checkbox"/> AUX3	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$		
			<input type="checkbox"/> AUX4	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$		
			<input type="checkbox"/> AUX5	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$	50.0 $^{\circ}\text{C}$		
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Inspection pressure gauge reading		Pressure gauge correction value	0.0 kPa		
			<input checked="" type="checkbox"/> 10.0 $\pm$ 3.0 kPa		Pressure gauge reading	9.3 kPa		
			Post-correction reading		Post-correction reading	9.3 kPa		
			Inspection pressure gauge reading		Pressure gauge correction value	0.4 kPa		
			<input checked="" type="checkbox"/> 200.0 $\pm$ 20.0 kPa		Pressure gauge reading	197.2 kPa		
			Post-correction reading		Post-correction reading	197.2 kPa		
			Inspection pressure gauge reading		Pressure gauge correction value	0.3 kPa		
			<input checked="" type="checkbox"/> 500.0 $\pm$ 35.0 kPa		Pressure gauge reading	497.1 kPa		
			Post-correction reading		Post-correction reading	497.1 kPa		

Performer (signature): \_\_\_\_\_ Date: 15 / 08 / 2024  
Reviewer (signature): \_\_\_\_\_ Date: 15 / 08 / 2024

## Operational Qualification

## Operational Qualification Record

No.	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Monitored pressure 6 minutes after start 250.0 ± 5.0 kPa	250.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa	250.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate 3.01 L/min/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Verify the accuracy of the full-flow and septum purging.	Total 10.0136 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Verify the accuracy of the full-flow and septum purging.	Split vent 10.0136 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Verify the accuracy of the full-flow and septum purging.	Total 10.0136 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Verify the accuracy of the full-flow and septum purging.	Split vent 10.0136 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Verify the accuracy of the full-flow and septum purging.	Total 10.0136 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Inspect temperature sensor displayed value 50.041.2°C	Temp. correction value 5.210°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Inspect temperature sensor displayed value 50.041.2°C	Temp. correction value 5.210°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Inspect temperature sensor displayed value 50.041.2°C	Temp. correction value 5.210°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Inspect temperature sensor displayed value 50.041.2°C	Temp. correction value 5.210°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Inspect temperature sensor displayed value 50.041.2°C	Temp. correction value 5.210°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Monitored temperature 6 minutes after start 200 ± 1°C	200.0°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Inspect temperature reading 8 minutes after start 200.0 ± 4.7°C	200.0°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Using a temperature sensor with 1°C minimum display increment 200 ± 3°C	200.0°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	FID <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> Not Applicable Calculated S value 10.0 × 10 <sup>3</sup> C/g min.	C <sub>10</sub> AREA value 47787	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Make-up gas: N <sub>2</sub> 10.0 × 10 <sup>3</sup> C/g min.	Calculated S value 1.30 × 10 <sup>3</sup> C/g	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Make-up gas: He 7.00 × 10 <sup>3</sup> C/g min.	C <sub>10</sub> AREA value	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		FID <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> Not Applicable Calculated S value 10.0 × 10 <sup>3</sup> C/g min.	Flowrate at vent 1.30 × 10 <sup>3</sup> C/g	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Calculated S value 10.0 × 10 <sup>3</sup> C/g min.	Calculated S value	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 15 / 08 / 2024

Reviewer (signature):

Date: 15 / 08 / 2024

## Operational Qualification

## Operational Qualification Record

## 3-2 AOC-20i Auto Injector

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

Model Name		AOC-20i	
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 2 0 9	
No.	Item	Criteria	Results
1	Display, LED test	Verify the display and LED operation.	<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display: 000
3	Firmware version check	Verify the version number is displayed.	3.4
4	Basic operation test	Verify that the auto injector basic operation is correct.	3.4

☒ Not Applicable ☐ Dual system, sub injector

Model Name		AOC-20i	
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 2 0 9	
No.	Item	Criteria	Results
1	Display, LED test	Verify the display and LED operation.	<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display: 000
3	Firmware version check	Verify the version number is displayed.	3.4
4	Basic operation test	Verify that the auto injector basic operation is correct.	3.4

Performer (signature):

Date: 15 / 08 / 2024

Reviewer (signature):

Date: 15 / 08 / 2024

## Operational Qualification


### 3-3 AOC-20s Auto Sampler

☐ Applicable ☒ Not Applicable

Model Name				AOC-20S			
Component ID		L A O E		Q4 P			
Serial No. (S/N)		C 1 2 1 3 4 0 5 6 1 0					
No	Item	Criteria		Results	Pass	Fail	
1	In-fld operation test	Verify that the auto sampler basic operation is correct.		LED lights green, not red.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2	Firmware version check	Verify the program version.	Version number is displayed.	Version No. Contolled Ver. No.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Performer (signature):	[Redacted]	Date:	15	08	2024
Reviewer (signature):	[Redacted]	Date:	18	08	2024

Component ID		Model Name		SPL-2010IPlus																																															
Serial No. (S/N)																																																			
No.	Item	Criteria	Results	Pass	Fail																																														
1	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	<table border="1"> <tr> <td>Inspection pressure gauge reading <math>\square 10.0 \pm 3.0 \text{ kPa}</math></td> <td>Pressure gauge correction value</td> </tr> <tr> <td>Inspection pressure gauge reading <math>\square 200.0 \pm 20.0 \text{ kPa}</math></td> <td>Pressure gauge correction value</td> </tr> <tr> <td>Inspection pressure gauge reading <math>\square 500.0 \pm 50.0 \text{ kPa}</math></td> <td>Pressure gauge correction value</td> </tr> </table>	Inspection pressure gauge reading $\square 10.0 \pm 3.0 \text{ kPa}$	Pressure gauge correction value	Inspection pressure gauge reading $\square 200.0 \pm 20.0 \text{ kPa}$	Pressure gauge correction value	Inspection pressure gauge reading $\square 500.0 \pm 50.0 \text{ kPa}$	Pressure gauge correction value	<table border="1"> <tr> <td>kPa</td> <td>kPa</td> </tr> <tr> <td>kPa</td> <td>kPa</td> </tr> <tr> <td>kPa</td> <td>kPa</td> </tr> </table>	kPa	kPa	kPa	kPa	kPa	kPa	<input type="checkbox"/>	<input type="checkbox"/>																																	
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Pressure program test	Verify that the pressure program operates normally.	<table border="1"> <tr> <td>Monitored pressure 6 minutes after start <math>250.0 \pm 50.0 \text{ kPa}</math></td> <td>Post-correction reading</td> </tr> <tr> <td>Inspection pressure gauge reading 8 minutes after start <math>250.0 \pm 20.0 \text{ kPa}</math></td> <td>Post-correction reading</td> </tr> </table>	Monitored pressure 6 minutes after start $250.0 \pm 50.0 \text{ kPa}$	Post-correction reading	Inspection pressure gauge reading 8 minutes after start $250.0 \pm 20.0 \text{ kPa}$	Post-correction reading	<table border="1"> <tr> <td>kPa</td> <td>kPa</td> </tr> <tr> <td>kPa</td> <td>kPa</td> </tr> </table>	kPa	kPa	kPa	kPa	<input type="checkbox"/>	<input type="checkbox"/>																																						
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kPa	kPa																																																		
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Flowrate test	Verify the accuracy of the full-flow and septum purging.	<table border="1"> <tr> <td>Septum purge vent measured flow rate <math>3.0 \pm 1.0 \text{ mL/min}</math></td> <td>Septum purge</td> </tr> <tr> <td> <table border="1"> <tr> <td>Total of septum purge and split vent flow rate values <math>10.0 \pm 3.0 \text{ mL/min}</math></td> <td>Split vent</td> </tr> <tr> <td>Total of septum purge and split vent flow rate values <math>200.0 \pm 20.0 \text{ mL/min}</math></td> <td>Split vent</td> </tr> </table> </td> <td> <table border="1"> <tr> <td>mL/min</td> <td>mL/min</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table> </td> </tr> <tr> <td></td> <td></td> <td> <table border="1"> <tr> <td>Septum purge</td> <td>Split vent</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table> </td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td></td> <td></td> <td> <table border="1"> <tr> <td>Septum purge</td> <td>Split vent</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table> </td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td> <table border="1"> <tr> <td>Septum purge</td> <td>Split vent</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table> </td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td></td> <td></td> <td> <table border="1"> <tr> <td>Septum purge</td> <td>Split vent</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table> </td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>	Septum purge vent measured flow rate $3.0 \pm 1.0 \text{ mL/min}$	Septum purge	<table border="1"> <tr> <td>Total of septum purge and split vent flow rate values <math>10.0 \pm 3.0 \text{ mL/min}</math></td> <td>Split vent</td> </tr> <tr> <td>Total of septum purge and split vent flow rate values <math>200.0 \pm 20.0 \text{ mL/min}</math></td> <td>Split vent</td> </tr> </table>	Total of septum purge and split vent flow rate values $10.0 \pm 3.0 \text{ mL/min}$	Split vent	Total of septum purge and split vent flow rate values $200.0 \pm 20.0 \text{ mL/min}$	Split vent	<table border="1"> <tr> <td>mL/min</td> <td>mL/min</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table>	mL/min	mL/min	mL/min	mL/min			<table border="1"> <tr> <td>Septum purge</td> <td>Split vent</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table>	Septum purge	Split vent	mL/min	mL/min	<input type="checkbox"/>	<input type="checkbox"/>			<table border="1"> <tr> <td>Septum purge</td> <td>Split vent</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table>	Septum purge	Split vent	mL/min	mL/min	<input type="checkbox"/>	<input type="checkbox"/>	2			<table border="1"> <tr> <td>Septum purge</td> <td>Split vent</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table>	Septum purge	Split vent	mL/min	mL/min	<input type="checkbox"/>	<input type="checkbox"/>			<table border="1"> <tr> <td>Septum purge</td> <td>Split vent</td> </tr> <tr> <td>mL/min</td> <td>mL/min</td> </tr> </table>	Septum purge	Split vent	mL/min	mL/min	<input type="checkbox"/>	<input type="checkbox"/>
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mL/min	mL/min																																																		

Performer (signature):  Date: 15 / 03 / 2024  
Reviewer (signature): Date: 15 / 03 / 2024

**Primary Flow Calibrator**

**Serial No. : 110619 , 207510**

Certificate of Calibration

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

**Name** : Eastern Thai Consulting 1992 Co., Ltd.

**Address** : 683 Moo 11, Sukhapibam 8 Rd., Nongkham, Srinachul Chonburi 20210

**Certificate No** : 24-AFM-023

**Request No** : Req-2024-0095

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	0.0058
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 :

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

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

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

**Name** : Eastern Thai Consulting 1992 Co., Ltd.

**Address** : 683 Moo 11, Sukhapibam 8 Rd., Nongkham, Srinachul Chonburi 20210

**Certificate No** : 24-AFM-023

**Request No** : Req-2024-0095

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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 :

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

where Q Flow Rate P = Absolute Pressure T = Absolute Temperature  
Meas = Measurement Condition ref = Standard Condition

\* Indicates non accredited

End of Certificate

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	08000057	Qreborn	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** : 

**Service Calibration Engineer**

**Approved By** : 

**Calibration Engineer Supervisor**

**Issue Date** : 30 January 2024



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.

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.



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CA8886**

CERTIFICATE OF CALIBRATION

ISSUED BY  
Cirrus Research plc

DATE OF ISSUE  
19 January 2024

CERTIFICATE NUMBER  
206869

Cirrus Research plc

Acoustic House

Bridlington Road

Hummanby


North Yorkshire

YO14 0PH

United Kingdom

Page 1 of 2

Approved signatory  
N Smith

Electronically signed:  


Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc

Model: CR:110A

Serial number: CA8886

Firmware version: 5.4

Notes: Eastern Thai Consulting 1992 Co.,Ltd.  
683 Moo.11, Sukaphibai 8 Rd., Nongkham,  
Sriacha, 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	SIGLENT	SDG 1032X	SDG1XDDQ6F6309
Attenuator	Cirrus Research	ZE:952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

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%.



Environmental conditions

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

Before

Pressure: 100.96 kPa

Temperature: 21.5 °C

Humidity: 35.2 %

After

Pressure: 100.96 kPa

Temperature: 21.6 °C

Humidity: 33.4 %

Test results summary

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



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CA8887**

CERTIFICATE OF CALIBRATION

ISSUED BY

Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206883



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  
Model: CR-110A  
Serial number: CA8887  
Firmware version: 5.4  
Notes: Eastern Thai Consulting 1992 Co., Ltd.  
683 Moo.11, Sukaphibai 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	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

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COPY

206883

CERTIFICATE OF CALIBRATION

Certificate Number:

206883

Page

2 of 2

Environmental conditions

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

Before Pressure: 100.93 kPa Temperature: 21.6 °C Humidity: 35.4 %  
After Pressure: 100.92 kPa Temperature: 21.6 °C Humidity: 36.4 %

Test results summary

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

**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CA8888**

CERTIFICATE OF CALIBRATION

ISSUED BY

Cirrus Research plc

DATE OF ISSUE

19 January 2024

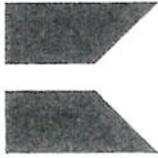
CERTIFICATE NUMBER

206880

CERTIFICATE OF CALIBRATION

Certificate Number:  
206880

Page 2 of 2



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  
Model: CR-110A  
Serial number: CA8888  
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	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

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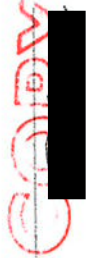
Environmental conditions

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

Before Pressure: 100.93 kPa Temperature: 21.4 °C Humidity: 34.6 %  
After Pressure: 100.92 kPa Temperature: 21.6 °C Humidity: 35.3 %

Test results summary

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



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CA8889**

CERTIFICATE OF CALIBRATION

ISSUED BY

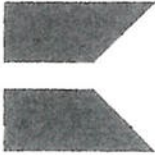
Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206918



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

Page 1 of 2

Approved signatory

N.Smith

Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:

Cirrus Research plc

Model:

CR-110A

Serial number:

CA8889

Firmware version:

5.4

Notes:

Eastern Thai Consulting 1992 Co.,Ltd.  
683 Moo.11, Sukaphibai 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

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CERTIFICATE OF CALIBRATION

Certificate Number:

206918

Page

2 of 2

Environmental conditions

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

Before

Pressure: 100.96 kPa

Temperature: 21.6 °C

Humidity: 34.6 %

After

Pressure: 100.94 kPa

Temperature: 21.5 °C

Humidity: 34.4 %

Test results summary

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

COPY

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**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0640**



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, Sukaphilai 8 Rd., Nongkham,
Serial number:	CB0640	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	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

**Notes**

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**COPY**

**Environmental conditions**

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

<b>Before</b>	Pressure: 99.84 kPa	Temperature: 21.4 °C	Humidity: 32.5 %
<b>After</b>	Pressure: 99.87 kPa	Temperature: 21.7 °C	Humidity: 33.5 %

**Test results summary**

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

**COPY**

**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0641**

CERTIFICATE OF CALIBRATION

ISSUED BY

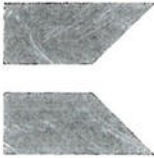
Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206878



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

Model:

CR:110A

Serial number:

CB0641

Firmware version:

5.4

Notes:

Eastern Thai Consulting 1992 Co., Ltd.  
683 Moo. 11, Sukaphibai 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.

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

Certificate Number:

206878

Page

2 of 2

Environmental conditions

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

Before

Pressure: 100.96 kPa

Temperature: 21.6 °C

Humidity: 33.5 %

After

Pressure: 100.96 kPa

Temperature: 21.5 °C

Humidity: 34.9 %

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



**NOISE DOSI METER**

**MODEL : CR:110A**

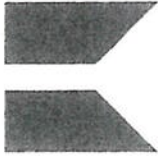
**SERIAL No. : CB0642**

CERTIFICATE OF CALIBRATION

ISSUED BY  
Cirrus Research plc

DATE OF ISSUE  
19 January 2024

CERTIFICATE NUMBER  
206920



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  
Model: CR-110A  
Serial number: CB0642  
Firmware version: 5.4

Notes: Eastern Thai Consulting 1992 Co.,Ltd.  
683 Moo.11, Sukaphibai 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	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:  
206920

Page 2 of 2

Environmental conditions

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

Before Pressure: 100.02 kPa Temperature: 21.9 °C Humidity: 34.6 %  
After Pressure: 100.03 kPa Temperature: 21.8 °C Humidity: 36.1 %

Test results summary

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



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0643**

CERTIFICATE OF CALIBRATION

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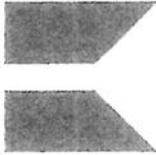
Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206871



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

Model:

CR-110A

Serial number:

CB0643

Firmware version:

5.4

Notes:

Eastern Thai Consulting 1992 Co., Ltd.  
683 Moo.11, Sukaphibai 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	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE-952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	40088

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:

206871

Page

2 of 2

Environmental conditions

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

Before

Pressure: 100.93 kPa

Temperature: 21.6 °C

Humidity: 36.1 %

After

Pressure: 100.92 kPa

Temperature: 21.5 °C

Humidity: 35.5 %

Test results summary

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

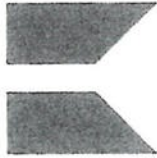
COPY

COPY

**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0644**



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  
Model: CR-110A  
Serial number: CB0644  
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	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

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Environmental conditions

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

Before Pressure: 100.90 kPa Temperature: 21.4 °C Humidity: 33.0 %  
After Pressure: 100.93 kPa Temperature: 21.6 °C Humidity: 32.2 %

Test results summary

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



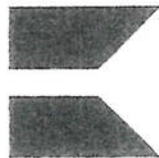
**NOISE DOSI METER**

**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

Page 1 of 2
Approved signatory N Smith
Electronically signed: 

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:      Cirrus Research plc      Notes:      Eastern Thai Consulting 1992 Co.,Ltd.  
Model:      CR:110A      683 Moo.11, Sukaphibal 8 Rd., Nongkham,  
Serial number:      CB0954      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	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:      100.03 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



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0955**

CERTIFICATE OF CALIBRATION

ISSUED BY  
Cirrus Research plc

DATE OF ISSUE  
19 January 2024

CERTIFICATE NUMBER  
206865



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:  
Model:  
Serial number:  
Firmware version:

Cirrus Research plc  
CR:110A  
CB0955  
5.4

Notes:  
Eastern Thai Consulting 1992 Co.,Ltd.  
683 Moo.11, Sukaphibai 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	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE-952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

**Notes**

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CERTIFICATE OF CALIBRATION

Certificate Number:  
206865

Page 2 of 2

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

<b>Before</b>	Pressure: 100.95 kPa	Temperature: 21.5 °C	Humidity: 35.2 %
<b>After</b>	Pressure: 100.93 kPa	Temperature: 21.7 °C	Humidity: 35.7 %

**Test results summary**

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



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0956**

CERTIFICATE OF CALIBRATION

ISSUED BY

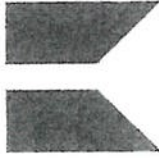
Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206875



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

Page 1 of 2
Approved signatory N Smith
Electronically signed: 

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc  
Model: CR:110A  
Serial number: C80956  
Firmware version: 5.4

Notes: Eastern Thai Consulting 1992 Co.,Ltd.  
683 Moo.11, Sukaphibai 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	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE:952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:

206875

Page

2 of 2

Environmental conditions

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

Before Pressure: 100.92 kPa Temperature: 21.7 °C Humidity: 36.0 %  
After Pressure: 100.93 kPa Temperature: 21.5 °C Humidity: 35.9 %

Test results summary

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



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB0957**

CERTIFICATE OF CALIBRATION

ISSUED BY  
Cirrus Research plc

DATE OF ISSUE  
19 January 2024

CERTIFICATE NUMBER  
206874

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:  
Model:  
Serial number:  
Firmware version:

Cirrus Research plc  
CR:110A  
CB0957  
5.4

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

Test summary

Date of calibration:  
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%.

CERTIFICATE OF CALIBRATION

Certificate Number:  
206874

Page 2 of 2

Environmental conditions

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

Before  
After

Pressure: 100.86 kPa  
Pressure: 100.89 kPa

Temperature: 20.9 °C  
Temperature: 20.7 °C

Humidity: 28.6 %  
Humidity: 29.0 %

Test results summary

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



**NOISE DOSI METER**

**MODEL : CR:110A**

**SERIAL No. : CB1497**

CERTIFICATE OF CALIBRATION

ISSUED BY

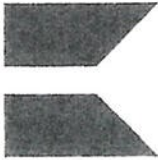
Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206868



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

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

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

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

Notes: Eastern Thal 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	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%.

CERTIFICATE OF CALIBRATION

Certificate Number:

206868

Page

2 of 2

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

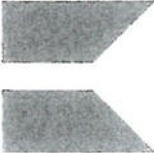
**NOISE DOSI METER**

**MODEL : CR:110A**


**SERIAL No. : CB1500**

CERTIFICATE OF CALIBRATION

ISSUED BY                      Cirrus Research plc  
DATE OF ISSUE            19 January 2024      CERTIFICATE NUMBER   206866



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, Sukaphibal 8 Rd., Nongkham,  
Serial number:                      CB1500    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	SIGLENT	SDG1XDDQ6R6309	
Attenuator	Cirrus Research	ZE:952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

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

Environmental conditions

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

Before    Pressure: 100.96 kPa    Temperature: 21.6 °C    Humidity: 34.1 %  
After      Pressure: 100.95 kPa    Temperature: 21.6 °C    Humidity: 34.7 %

Test results summary

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

Certificate Number:  
206866

Page 2 of 2





**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

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. : 23-148799  
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	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	40 80 40 80	
<input checked="" type="checkbox"/> Adjustment	Standard weight	40.000054 80.000048 40.000054 80.000048	
	Average reading of indicator	40.00026 80.00037 40.00017 80.00017	
	Standard deviation	0.000015 0.000016 0.000008 0.000009	

Unit : g	Range : 200	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100 200 100 200	
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000042 200.000041 100.000042 200.000041	
	Average reading of indicator	100.00003 200.00004 100.00001 200.00001	
	Standard deviation	0.000005 0.000005 0.000003 0.000005	





Certificate No. : 23-148799

Sample Code : 23-56200-001

## 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	10.0000004	10.00008	-0.00008	0.000026	2.00
20	20.0000030	20.00011	-0.00008	0.000036	2.00
50	50.000014	50.00014	-0.00013	0.000088	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

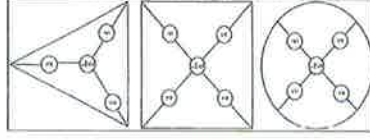
## REPORT OF CALIBRATION

## Result of Calibration :

## 4. Eccentric or off-centre loading

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

Weighing pan		Test weight : 50 and 100	
		Unit : g	
Range	Position	Reading of indicator	Reading of indicator
80	1	50.00015	100.0001
	2	50.00022	100.0001
	3	50.00008	100.0001
200	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 : W1-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 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 kg to 1 kg	E2	LB-WE-79	23-105642	10 September 2024

End of Report



**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,  
Sriacha, 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

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



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 : 23-56200-002

## REPORT OF CALIBRATION

## Result of Calibration :

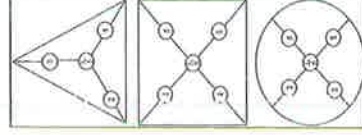
## 4. Eccentric or off-centre loading

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.

Range	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	-	-

Weighting pan : ☒ Circle  
☐ Triangular  
☐ Rectangular

Test weight : 100  
Unit : g



## Condition of Calibration

1. Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019	Ambient conditions	Min	Max
2. This result of calibration was found accurate as shown on date and place of calibration only.	Temperature (°C)	24.4	24.8
3. Condition of Calibration item: Norma	Relative Humidity (%Rh)	39.9	41.1
4. This certification is traceable to the International System of Unit maintained at : *	Air pressure (hPa)	1012.2	1012.8

Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public

Company Limited (Instrument number : 1)

5. Reference standard instrument :

Instrument

1) STANDARD WEIGHT 1 mg to 1 kg

Class : E2

ID No. : LB-WE-79

Certificate No. : 23-105642

Due Date : 10 September 2024

End of Report -



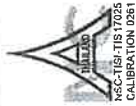
**BOD INCUBATOR**

**Model : TC445S**

**Serial No. : 0223/007275**

**SK**

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



## Certificate of Calibration

Reference No. : C03190/2309-025  
Customer : Eastern Thai Consulting 1992 Co., Ltd.  
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

- 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
- This result of calibration was found accurate as shown on date and place of calibration only
- This certificate can be traceable to International System of Unit :
  - Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by :

☒ Mr. Phayak Toolit ☐ Miss Tantaraporn Petpong

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 %

This certificate may not be reproduced other than in full except with the prior written approval of the S K Sales And Service Company Ltd.

Certificate No. : S2309-3014

Page 2 of 2

Table1 General Information

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

Table2 Chamber Performance

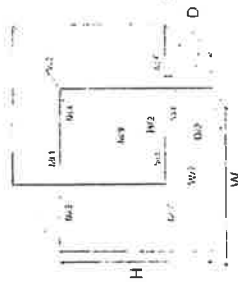
Setting Temperature ( °C )	Average Indicating Temperature ( °C )	Measured Stability ( ± °C )	Measured Uniformity ( °C )	Overall Variation ( °C )
20.0	20.0	0.37	0.64	0.98

Table3 Temperature Distribution

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

Resolution : 0.1 ( °C )

\* Probe No. 9 is Reference Probe



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

\*\* End of Calibration Report \*\*

**COPY**

**COPY**

**BOD INCUBATOR**

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

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. : LABE19/5

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 LB-DA-08 (RTD-248 to RTD-256) 23-084070 06 August 2024

(RTD-Pt100)

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 Approved by

Scientist

Issue date 19 April 2024

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

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

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

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

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

REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 24-046203

Sample Code : 24-18906-002

Resolution : 0.1 °C

1. Reporting of Temperature

Results of Calibration

Calibration point (°C) UUC\* UUC\* setting (°C) reading (°C) Measured temperature at each positions (°C) Uncertainty ± (°C) Coverage factor k

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

361 Soi Ladprao 122, Ladprao Road,  
Phlebapha, Wang Thonglang, Bangkok 10310  
Rev.09

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



## REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 24-046203

Sample Code : 24-18906-002

## Results of Calibration

## Notes

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

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

- End of Report -

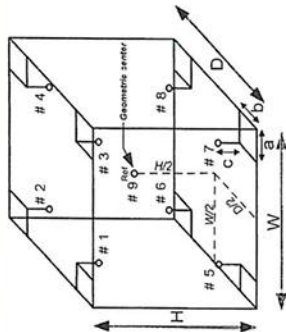


Figure: Example of sensor  
Installation Positions

COPY

**Hot Air Oven**

**Model : UM 400**

**Serial No. : 900982**



NSC-TISI-TIS17025  
CALIBRATION 0152

## REPORT OF CALIBRATION

Page 3 of 3

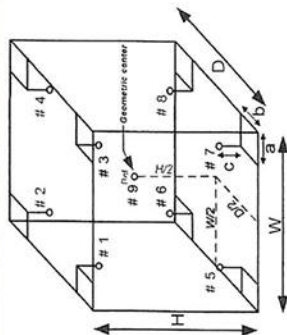
Certificate No. : 24-001944

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 -

COPY

**LIQUID IN GLASS THERMOMETER**

**Model : Total Immersion**

**Serial No. : 43560**



QUALITY CALIBRATION CO.,LTD.


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



CERTIFICATE No : 23T10864  
REFERENCE No : 71117-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT	: LIQUID IN GLASS THERMOMETER
MANUFACTURER	: PRECISION
MODEL	: 0 °C TO 100 °C
SERIAL No	: 43560
ID No	: LABE 16/1
RESOLUTION	: 0.1 °C
TYPE	: TOTAL IMMERSION
CONDITION AS RECEIVED	: USED ITEM
SUBMITTED BY	: EASTERN THAI CONSULTING 1992 CO., LTD. 683 MOO 11, SUKHAPIBAN 8 ROAD, NONGKHAM, SRIRACHA, CHONBURI 20230
CALIBRATED BY	: CHARUKIT L.
CALIBRATION DATE	: 09-Nov-23
APPROVED BY	: 
ISSUED DATE	: 09-Nov-23
RECEIVED DATE	: 02-Nov-23

THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF  
QUALITY CALIBRATION CO., LTD.

**COPY**



QUALITY CALIBRATION CO.,LTD.

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

CERTIFICATE No : 23T10864

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

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	23T3927	08-Mar-24
2) SPRT PROBE	5614	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
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

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

UUC\* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

**COPY**

**pH Meter**

**Model : SevenCompact S220**

**Serial No. : B448305208**

NSC-TIS-1517025  
CALIBRATION0152

## CERTIFICATE OF CALIBRATION

Page 1 of 3

Supersedes 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 20230

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

Equipment : pH Meter  
Manufacturer : METTLER TOLEDO  
Serial No. : B448305208  
Date of Receipt : 09 January 2024  
Model : SevenCompact S220  
ID No. : LABE 11/4  
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		Ref No.	Expire Date
3.3 Buffer Solution pH 4.008	919273	PH216.L5	24 September 2025
3.4 Buffer Solution pH 6.886	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 ReIN HARNED CELL LoIN 61275737; CPA ReIN HARNED CELL LoIN 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  
Scientist

Approved by

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 this 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-TIS-1517025  
CALIBRATION0152

## REPORT OF CALIBRATION

Page 2 of 3

Supersedes to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

Equipment : pH Meter  
Manufacturer : METTLER TOLEDO  
Serial No. : B448305208  
Range : -2,000 pH to 20,000 pH ; ±2000.0 mV ; -5.0°C to 130.0°C  
Resolution : 0.01 pH ; 0.1 mV ; 0.1 °C  
Model : SevenCompact S220  
ID No. : LABE 11/4

## Results of Calibration

Part 1. DC Voltage measurement  
pH Meter Serial No. : B448305208

Nominal Value	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor k
		mV	pH		
0	414.113	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 pH (@ 25 °C)	Average indicator reading		Error Value pH	Uncertainty pH	Coverage factor k
	pH	mV			
4.008	4.01	182.1	0.002	± 0.010	2.00
6.886	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



**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

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.
	(mg)	Mass	Uncertainty	Permissible Error	
			(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 multiplied by the coverage factor  $k=2.0$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

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

## REPORT OF CALIBRATION

### Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.20 kg/m<sup>3</sup>
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	21-078366	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 -

**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,  
Siriracha, Chonburi 20230

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

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee  
Scientist

Issue date : 31 May 2022

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 ( $\rho_a$ ) 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 M3005



Certificate No. : 22-052239

Sample Code : 22-19150-004

## REPORT OF CALIBRATION

## Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m<sup>3</sup>

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-78	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 -

COPY

**STANDARD WEIGHT 50 g**



Certificate No. : 22-052237

Sample Code : 22-19150-002

## CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

689 Moo 11, Sukhapiban 8 Rd., Nongkham,

Siracha, Chonburi 20230

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee  
Scientist

Issue date : 31 May 2022

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

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

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



Certificate No. : 22-052237

Sample Code : 22-19150-002

## REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

## Result of Calibration :

☒ Without adjustment☐ Adjustment

Conventional value of the result of weighing in air. For a weight taken at a reference temperature ( $t_{ref}$ ) of 20°C, the conventional mass is the mass of a reference weight of a density ( $\rho_{ref}$ ) 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  (mg)	Conventional		Expanded  Uncertainty  (mg)	Maximum  Permissible Error  $\pm$ (mg)		ID No.
		Mass					
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 multiplied by the coverage factor  $k=2.0$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003



Certificate No. : 22-052237

Sample Code : 22-19150-002

Page 3 of 3

## REPORT OF CALIBRATION

## Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m<sup>3</sup>
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 -



## REPORT OF CALIBRATION

Page 3 of 3

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. : B44B305208 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		
25	25.000	120	25.0	± 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 M0003

- End of report -