

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

ANALYTICAL BALANCE

Model : MS204TS/00

Serial No. : B904136539

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH-ServiceSupport@mtl.com



Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham
City: Sriracha
Zip / Postal: 20230
State / Province: Chonburi
Contact: Sathaporn N.
Order Number: 033298040

Weighing Device

Manufacturer: Mettler Toledo
Model: MS204TS00
Serial No.: B904136539
Building: Laboratory
Floor: 1
Room: Balance
Instrument Type: Weighing Instrument
Asset Number: LABE 05/4
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
Mettler Toledo Work Instruction: CP/W002720
This calibration certificate contains measurements for As Found and As Left calibrations.
The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

	Temperature		Humidity	
	Start	End	Start	End
As Found	23.4 °C	End: 23.4 °C	Start: 50.6 %	End: 50.6 %
As Left	Start: 23.8 °C	End: 23.4 °C	Start: 51.8 %	End: 51.2 %

As Found Calibration Date: 05-Feb-2024
As Left Calibration Date: 05-Feb-2024
Issue Date: 05-Feb-2024

Approved Signatory:

Technical Manager / Head of Calibration Center

Sathaporn T.
Sathaporn Tabson
Dilthut

Measurement Results

Repeatability

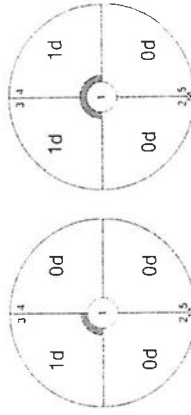
Test Load: 100 g		As Found	As Left
1	100.0001 g	99.9996 g	100.0001 g
2	100.0001 g	99.9997 g	100.0001 g
3	100.0000 g	99.9997 g	100.0000 g
4	100.0001 g	99.9996 g	100.0001 g
5	100.0001 g	99.9997 g	100.0001 g
6	100.0000 g	99.9996 g	100.0000 g
7	100.0001 g	99.9997 g	100.0001 g
8	100.0000 g	99.9996 g	100.0000 g
9	100.0001 g	99.9996 g	100.0001 g
10	100.0001 g	99.9996 g	100.0001 g
Standard Deviation		0.00005 g	0.00005 g

The "d" in the graph represents the readability of the range/interval in which the test was performed.
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g		As Found	As Left
1	100.0000 g	99.9996 g	100.0000 g
2	100.0000 g	99.9996 g	100.0000 g
3	100.0001 g	99.9997 g	100.0001 g
4	100.0001 g	99.9996 g	100.0001 g
5	100.0000 g	99.9996 g	100.0000 g
Maximum Deviation		0.0001 g	0.0001 g

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



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Error of Indication

As Found					
	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.12 mg	2
2	0.0100 g	0.0100 g	0.0000 g	0.13 mg	2
3	0.0500 g	0.0499 g	-0.0001 g	0.13 mg	2
4	0.1000 g	0.0999 g	-0.0001 g	0.13 mg	2
5	1.0000 g	0.9999 g	-0.0001 g	0.13 mg	2
6	5.0000 g	4.9999 g	-0.0001 g	0.14 mg	2
7	10.0000 g	9.9999 g	-0.0001 g	0.14 mg	2
8	50.0000 g	49.9997 g	-0.0003 g	0.16 mg	2
9	100.0000 g	99.9995 g	-0.0005 g	0.20 mg	2
10*	149.9999 g	149.9993 g	-0.0006 g	0.31 mg	2
11*	199.9998 g	199.9990 g	-0.0008 g	0.35 mg	2
As Left					
	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.11 mg	2
2	0.0100 g	0.0100 g	0.0000 g	0.13 mg	2
3	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
4	0.1000 g	0.1000 g	0.0000 g	0.13 mg	2
5	1.0000 g	1.0001 g	0.0001 g	0.13 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.13 mg	2
7	10.0000 g	10.0001 g	0.0001 g	0.14 mg	2
8	50.0000 g	50.0001 g	0.0001 g	0.15 mg	2
9*	100.0000 g	100.0001 g	0.0001 g	0.20 mg	2
10*	149.9999 g	150.0000 g	0.0001 g	0.31 mg	2
11*	199.9998 g	199.9999 g	0.0001 g	0.35 mg	2

*The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.

As Found

◆ As Left



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

Calibration Points [g]

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

The results of this calibration certificate relate only to the calibrated item.

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.: WS32
Certificate Number: 188109
Date of Issue: 25-Sep-2023
Calibration Due Date: 25-Mar-2025

Weight Set 2: OIML E2

Weight Set No.: WS85
Certificate Number: 188113
Date of Issue: 27-Sep-2023
Calibration Due Date: 26-Mar-2025

Thermo Baro Hygrometer

Equipment No.: IN74
Certificate Number: SG-H-00418/66
Date of Issue: 19-May-2023
Calibration Due Date: 18-May-2024

Remarks

FACT adjustment functionality activated

Equipment condition: Good

Next calibration according to customer's procedure

Calibration data not decide by calibration laboratory

End of Accredited Section

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

Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-6} / K$

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

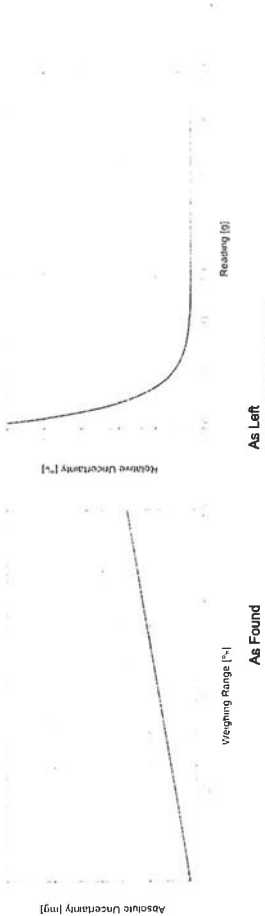
Linearization of Uncertainty Equation

1	Range		As Found	As Left
	d	Max		
1	0.0001 g	220 g	$U_1 = 0.13 \text{ mg} + 0.0101 \text{ mg/g} \cdot R$	$U_1 = 0.13 \text{ mg} + 0.00616 \text{ mg/g} \cdot R$

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

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

Net Indication	As Found		As Left	
0.0220 g	0.13 mg	0.59%	0.13 mg	0.59%
0.2200 g	0.13 mg	0.060%	0.13 mg	0.060%
2.2000 g	0.15 mg	0.0069%	0.14 mg	0.0065%
22.0000 g	0.35 mg	0.0016%	0.27 mg	0.0012%
220.0000 g	2.4 mg	0.0011%	1.5 mg	0.00068%



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GWP®
Certificate



As Found ✓ As Left ✓

The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed As Found As Left

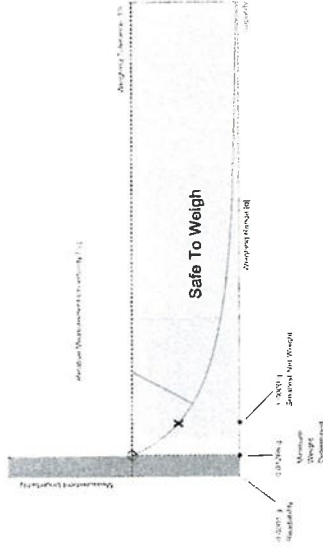
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 1.0000 g

Safety Factor: 2

Safe Weighing Range



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

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Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
Tolerance	1	2	3	5	10
0.1%	0.13300 g	0.26873 g	0.40728 g	0.69320 g	1.46405 g
0.2%	0.06616 g	0.13300 g	0.20051 g	0.33764 g	0.69320 g
0.5%	0.02638 g	0.05288 g	0.07947 g	0.13300 g	0.26873 g
1%	0.01318 g	0.02638 g	0.03962 g	0.06616 g	0.13300 g
2%	0.00659 g	0.01318 g	0.01978 g	0.03300 g	0.06616 g
5%	0.00283 g	0.00527 g	0.00790 g	0.01318 g	0.02638 g

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

As Left Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
Tolerance	1	2	3	5	10
0.1%	0.12728 g	0.25614 g	0.38662 g	0.65256 g	1.34797 g
0.2%	0.06344 g	0.12728 g	0.19151 g	0.32118 g	0.65256 g
0.5%	0.02533 g	0.05072 g	0.07618 g	0.12728 g	0.25614 g
1%	0.01266 g	0.02533 g	0.03802 g	0.06344 g	0.12728 g
2%	0.00633 g	0.01266 g	0.01899 g	0.03167 g	0.06344 g
5%	0.00253 g	0.00506 g	0.00759 g	0.01266 g	0.02533 g

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

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

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

Notes on minimum weight values in above table:

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

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Measurement Results

Results Summary

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

✓ = Passed
✗ = Failed
N/A = Safety Factor not met

Repeatability

Test Load: 100 g

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

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

Eccentricity

Test Load: 100 g

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

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

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As Found

Reference Value		Control limits for various weighing tolerances							
		0.1%	0.2%	0.5%	1%	2%	5%		
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A		
50.0000 g	-0.0003 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g		
100.0000 g	-0.0005 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g		
149.9999 g	-0.0006 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g		
199.9998 g	-0.0008 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g		
Result		✓	✓	✓	✓	✓	✓		

As Left

Reference Value		Control limits for various weighing tolerances							
		0.1%	0.2%	0.5%	1%	2%	5%		
0.0000 g	0.0000 g	N/A	N/A	N/A	N/A	N/A	N/A		
50.0000 g	0.0001 g	0.0250 g	0.0500 g	0.1250 g	0.2500 g	0.5000 g	1.2500 g		
100.0000 g	0.0001 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g		
149.9999 g	0.0001 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g		
199.9998 g	0.0001 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g		
Result		✓	✓	✓	✓	✓	✓		

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

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



CALIBRATION CERTIFICATE

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

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

Equipment : Analog Barometer

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

Calibrated by : Mr. Jann Khaothong

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

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



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Certificate No : L202305085-002

Environment Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

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

STD = Standard

UUC = Unit Under Calibration

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

Description of UUC :

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

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

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

End of Certificate

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CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03N199E15AC0U4
Cylinder Number: EB0145030
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CH4,PPN,BALN

Reference Number: 160-402242242-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 350
Certification Date: Oct 15, 2021
Expiration Date: Oct 15, 2029

Calibration performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 800/5-19/201. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. This uncertainty is based on the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

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

CALIBRATION STANDARDS			
Type	Lot ID	Cylinder No	Expiration Date
NTRM	08011503	K002564	May 15, 2025
NTRM	200602-06	6162660Y	Mar 17, 2027

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

Triad Data Available Upon Request

NOTES:

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



DO NOT COPY

Michael A. Markes

Approved for Release

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182



CERTIFICATE OF CALIBRATION

Certificate No. : 23-148804
Sample Code : 23-56200-006

Page 1 of 3

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapbarn 8 Rd., Nongkharn,

Siracha, Chonburi 20230

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

(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Model : UFE 500

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-P100)	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. Pisek Into

Scientist

Issue date

25 December 2023

Approved by

(Mr. Somchai Neampunt)

Signed for Director

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

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

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

361 Soi Ladprao 122, Ladprao Road, Phlabphla, Wang Thonglang, Bangkok 10310

TEL 02-516-2422 FAX 02-516-6949

Rev 01 Effective Date 15/10/21



REPORT OF CALIBRATION

Certificate No. : 23-148804
Sample Code : 23-56200-006

Page 2 of 3

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	Measured temperature at each positions (°C)										Uncertainty ± (°C)	Coverage factor k
		# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{Rev}	# 10		
104	103.5	104.11	103.914	103.84	103.93	103.97	103.64	103.91	103.91	104.21		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

Handwritten signature

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CONTACT@AMARC.CO.TH

TEL 02-516-2422

FAX 02-516-6949

Rev 09

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Phlabphla, Wang Thonglang, Bangkok 10310

FM CL-08

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FM CL-14



REPORT OF CALIBRATION

Page 3 of 3

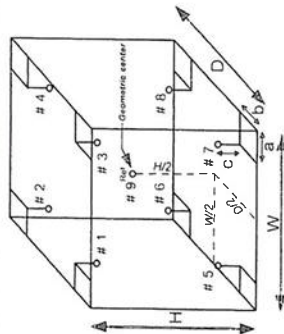
Certificate No. : 23-148804

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.

Figure: Example of sensor
Installation Positions

- End of Report -

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

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ORIFICE TRANSFER STANDARD CERTIFICATION

WORKSHEET TE-5025A

ROOTSMETER S/N 0438320



TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVELAND, OH
45002
513.467.9000
877.263.7810 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

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

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

DATA TABULATION

(x axis)		(y axis)	(x axis)		(y axis)
Vstd	Qstd		Va	Qa	
0.9832	0.7337	1.4054	0.9957	0.7430	0.8911
0.9791	1.0296	1.9875	0.9915	1.0426	1.2503
0.9770	1.1481	2.2821	0.9894	1.1626	1.4090
0.9760	1.2006	2.3305	0.9884	1.2157	1.4778
0.9707	1.4510	2.8107	0.9830	1.4694	1.7825
Qstd slope (m) = 1.96262			Qa slope (m) = 1.22896		
intercept (b) = -0.03249			intercept (b) = -0.02060		
coefficient (r) = 0.99993			coefficient (r) = 0.99993		
y axis = SQRT [H2O (Pa/760) (298/Ta)]			y axis = SQRT [H2O (Ta/Pa)]		

CALCULATIONS

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

$$Qstd = Vstd/Time$$

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

$$Qa = Va/Time$$

For subsequent flow rate calculations:

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

$$Qa = 1/m \{ [SQRT H2O(Ta/Pa)] - b \}$$

COPY

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737

NSC-TIS17025
CALIBRATION0152

Page 1 of 2

Certificate No. : 23-055203

Sample Code : 23-21440-001

CERTIFICATE OF CALIBRATION

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

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

Equipment : Digital thermo-hygrometer

Manufacturer : testo

Model : 608-H1

Serial No. : 45106737

ID No. : LABE 09/7

Date of Receipt : 25 May 2023

Date of Calibration : 29 May 2023

Condition of Calibration

1. Environment

1.1 Ambient temperature : 23.0 °C ± 3.0 °C

1.2 Relative humidity : 55.0 % ± 15.0 %

2. Calibration method

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

2.2 The calibration by comparison unit under calibration (UUC) to the thermometer standard / chilled mirror hygrometer in a chamber at the controlled temperature / relative humidity.

3. Reference standard instrument

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

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

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

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

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

6. Condition of calibration item : Normal

Calibrated by

Miss Pornsuda Lohabal

Scientist

Approved by

(Mr. Somchai Neampunt)

Signed for Director

Issue date

31 May 2023

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

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

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

361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

TEL 02-516-2422

FAX 02-516-6949

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/07/21

NSC-TIS17025
CALIBRATION0152

Page 2 of 2

Certificate No. : 23-055203

Sample Code : 23-21440-001

REPORT OF CALIBRATION

Results of Calibration

Temperature measurement

Resolution : 0.1 °C

Range : 0 °C to 50 °C

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

Humidity measurement

Resolution : 0.1 %RH

Range : 10 %RH to 95 %RH

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

Notes

Calibration results without adjustment.

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

- End of Report -

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TEL 02-516-2422

FAX 02-516-6949

361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

ANALYTICAL BALANCE (DU)

Model : XS205DU

Serial No. : 1126323724



Certificate No. : 23-148799

Sample Code : 23-56200-001

Page 1 of 4

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

Page 2 of 4

REPORT OF CALIBRATION

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

Result of Calibration

1. Test weight and repeatability of reading

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

Unit : g	Range : 80	<input 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

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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 : 80 200

Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	1.00748	0	1.0274
40	0.98753	100	0.9975
80	0.99751	200	0.9975

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.00000	0.00000	0.000012	2.05
0.01	0.0100025	0.01000	0.00000	0.000012	2.05
0.1	0.1000019	0.10001	-0.00001	0.000013	2.03
1	1.0000125	1.00001	0.00000	0.000015	2.02
5	5.0000208	5.00004	-0.00002	0.000021	2.00
10	10.000004	10.00008	-0.00008	0.000026	2.00
20	20.000030	20.00011	-0.00008	0.000036	2.00
50	50.000014	50.00014	-0.00013	0.000068	2.00
100	100.000042	100.0001	-0.0001	0.00016	2.00
150	150.000056	150.0001	0.0000	0.00022	2.00
200	200.000041	200.0002	-0.0002	0.00027	2.00

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

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Certificate No. : 23-148799

Sample Code : 23-56200-001

REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

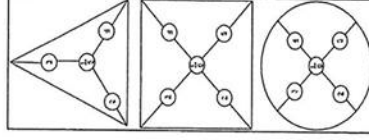
Deviation of the measurement value through off - center (eccentric) loading. The corner load increases with the weight of the load and its removal from the center of the pan support.

Weighing pan : ☐ Circle
: ☐ Triangular
: ☒ Rectangular

Test weight : 50 and 100

Unit : g

Range	Position	Reading of indicator	Reading of indicator
80	1	50.00015	100.0001
200	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

- Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibration item: Normal
- 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).
- Reference standard instrument :

Instrument : Class : ID No. : Certificate No. :
1) STANDARD WEIGHT 1 mg to 1 kg E2 LB-WE-79 23-105642

Dua Date : 10 September 2024

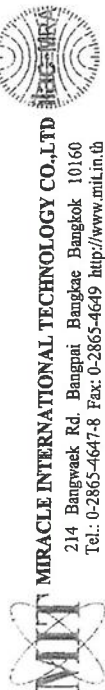
- End of Report -

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BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



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



CALIBRATION CERTIFICATE



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

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

Equipment : Analog Barometer

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

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used


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

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

Result of Calibration

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

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

Approved by: 
(Mr. Sarayuth Tochua)



Page 1 of 2

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Certificate No : L202305085-002

Environment Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

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

STD = Standard

UUC = Unit Under Calibration

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

Description of UUC :

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

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

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

End of Certificate

Page 2 of 2

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CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030



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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03NI99E15AC0U4
Cylinder Number: EB0145030
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CH4,PPN,BALN
Reference Number: 160-402242242-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 350
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-000/R-12/031, using the "4 procedures listed. Analytical Method used for analytical determination. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

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

Triad Data Available Upon Request

NOTES:

Gross Weight: 28.0 Kg
Net Weight: 4.9 Kg
PO# 522100461



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Michael A. Huber

Approved for Release

DRY GAS METER MC-572V

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 #: 0009854

Calibration Condition

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

Factors/Conversion

Std. Temp (°K): 298
 Std. Pressure (mm Hg): 760
 K₁ (K/mm Hg): 0.3857

Reference Equipment

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

Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	2.1249	2.2873	26	26	11.24924	11.40853	25	25
10.00	25.0	1.9384	2.0964	26	26	11.06645	11.22136	25	25
8.00	50.0	1.7294	1.9105	26	26	10.86093	11.03905	25	25
7.00	80.0	1.4887	1.6921	26	26	10.62322	10.82407	25	25
5.00	120.0	1.1950	1.3736	26	26	10.33100	10.50914	25	25

Standardized Data				Calibration Results				
Test Meter		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 _{test} (m ³)	Q _{test} m ³ /min	V _{ref} (m ³)	Q _{ref} m ³ /min	(Y)	(ΔY)	Q _{test@corr}	ΔH ₂	ΔΔH ₂
0.159	0.011	0.156	0.010	0.983	-0.001	0.010	52.990	5.531
0.155	0.015	0.152	0.015	0.981	-0.002	0.015	47.999	0.540
0.178	0.022	0.175	0.022	0.982	-0.002	0.022	46.696	-0.763
0.200	0.029	0.197	0.028	0.983	-0.001	0.028	45.249	-2.210
0.177	0.035	0.175	0.035	0.989	0.006	0.035	44.361	-3.098
				0.984	= Y Avg		47.459	= ΔH@ Avg

Pass/Fail Result: **Pass**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02
 Note: For ΔH₂, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O

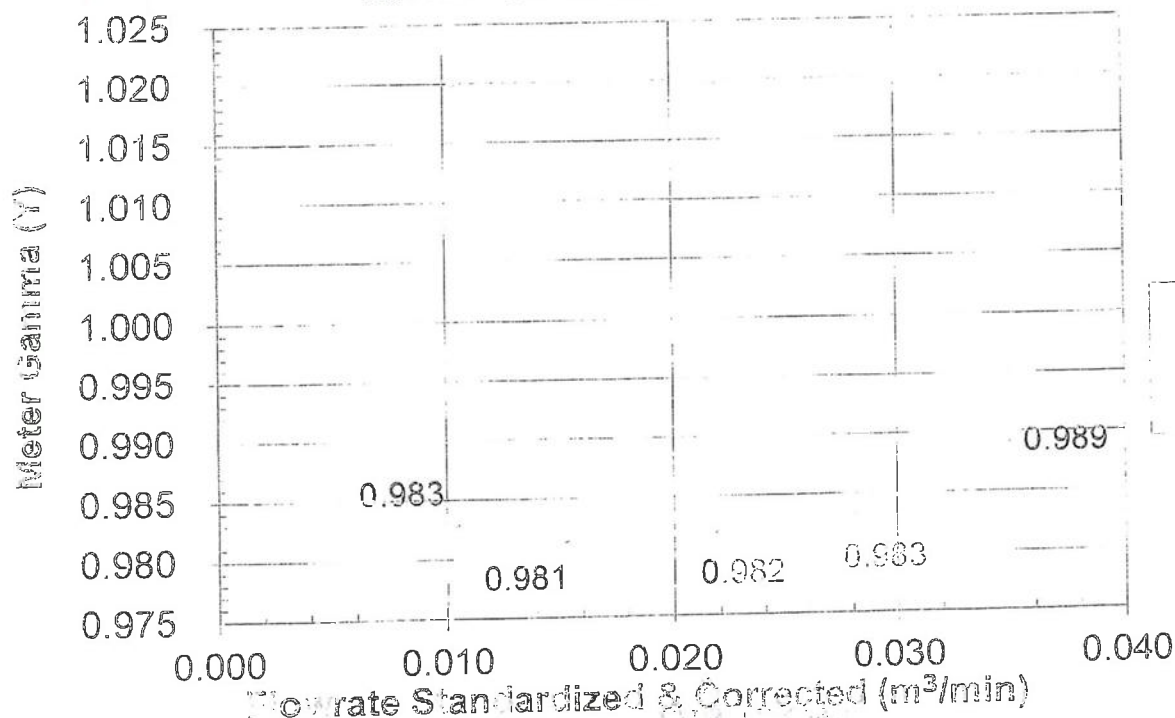
Approved By:

(Patpasu Chaisana)
 Service Manager

Date: 3-Apr-23

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Meter Gamma vs Flowrate



Console Serial: 0504003

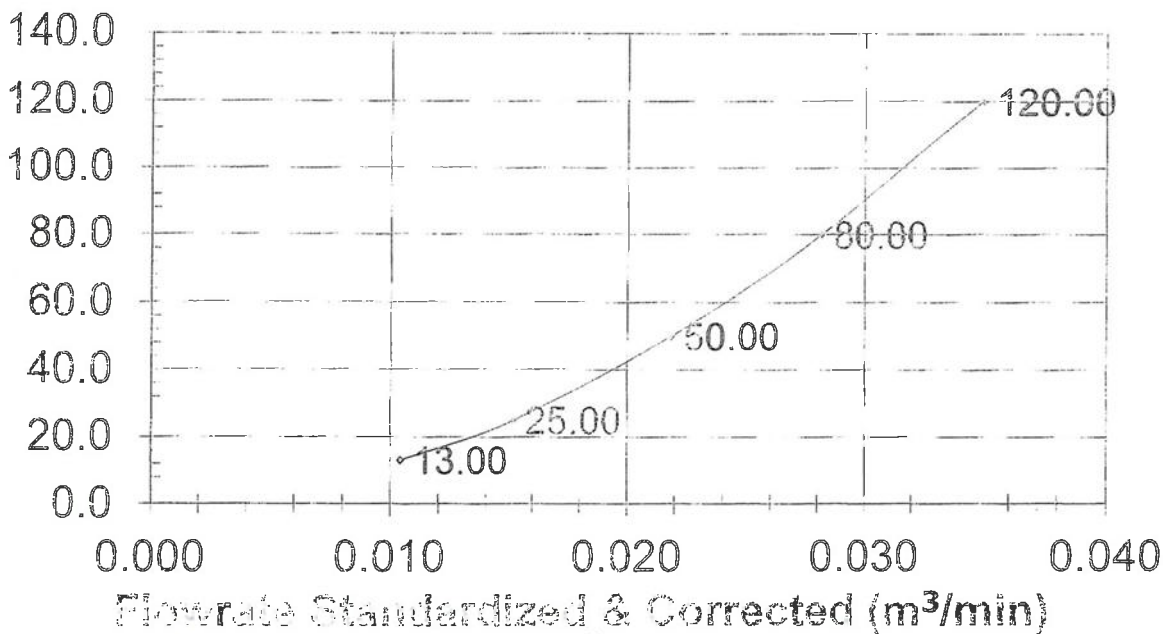
Console Model:

MC572V

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DGM Orifice ΔH (mm H₂O)

Meter Pressure vs Flowrate



Console Serial: 0504003

Console Model: MCS72V

บริษัท วิสโดม ไซนส์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information		Calibration Conditions		Reference Equipment	
Console Model :	MC572V	Cal. Date :	3-Apr-23	Temp. Simulator Model :	FLUKE 714B
Console Serial :	0504003	Issue Date :	3-Apr-23	Serial No :	60590035
Temp Indicator Model :	765-KF	Cal. Report No. :	WDS-SV660039		
Temp Indicator Serial :	JC17852	Ambient Temp. (°C) :	25		
		Pressure (mm Hg) :	758		
		Humidity (%) :	60		

Temperature Sensor Calibration

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

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. Temperature	Temperature (°C)	°C
#			
Ambient	26.5	26.0	0.5
Heat	100.5	102.0	-1.5

DGM Out Temp. Diff. $\pm 3^{\circ}\text{C}$

PASS

Approved By :

(P) : Chaiseng
Service Manager

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DRY GAS METER XC-572-OV

Serial No. : A2204323



WISDOM SCIENCE

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Certificate Of Calibration

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

Meter Console Information

Console Model : XC-572-OV
 Console serial : A2204323
 DGM Model #: SK25EX
 DGM Serial #: 00008284

Calibration Condition

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

Factors/Conversion

Std. Temp. (°K): 298
 Std. Pressure (mm Hg): 760
 K₁ (K/mm Hg): 0.3857

Reference Equipment

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

UUT Meter (DGM)

Reference Meter (WTM)

Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
e	P _{mid}	V _{mi}	V _{mf}	t _{mi}	t _{mf}	V _{wi}	V _{wf}	t _{wi}	t _{wf}
15.00	13.0	18.0685	18.2252	25	26	17.55844	17.71573	25	25
10.00	25.0	18.2477	18.3984	25	26	17.73837	17.88948	25	25
8.00	50.0	18.4339	18.6056	25	26	17.92517	18.09730	25	25
7.00	80.0	18.6458	18.8344	25	27	18.13775	18.32707	25	25
5.00	120.0	18.8839	19.0510	25	27	18.37705	18.54528	25	25

Standardized Data

Calibration Results

Test Meter		Reference Meter		Correction Factor		Flow Rate		ΔH@ (mm H ₂ O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation	
V _{std} (m ³)	Q _{std} (m ³ /min)	V _{ref} (m ³)	Q _{ref} (m ³ /min)	(Y)	(ΔY)	Q _{std} (m ³ /min)	ΔH _e	ΔΔH _e	
0.154	0.010	0.154	0.010	1.004	0.003	0.010	54.437	3.293	
0.148	0.015	0.148	0.015	1.002	0.001	0.015	50.528	-0.616	
0.169	0.021	0.169	0.021	0.999	-0.001	0.021	50.086	-1.058	
0.186	0.027	0.186	0.027	0.999	-0.001	0.027	50.928	-0.216	
0.165	0.033	0.165	0.033	0.999	-0.002	0.033	49.741	-1.403	
				1.001	= Y Avg.			51.144	= ΔH _e 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_e, orifice pressure differential that equates to 0.75scfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

Approved By:

(Palpasu Chaisana)
 Service Manager

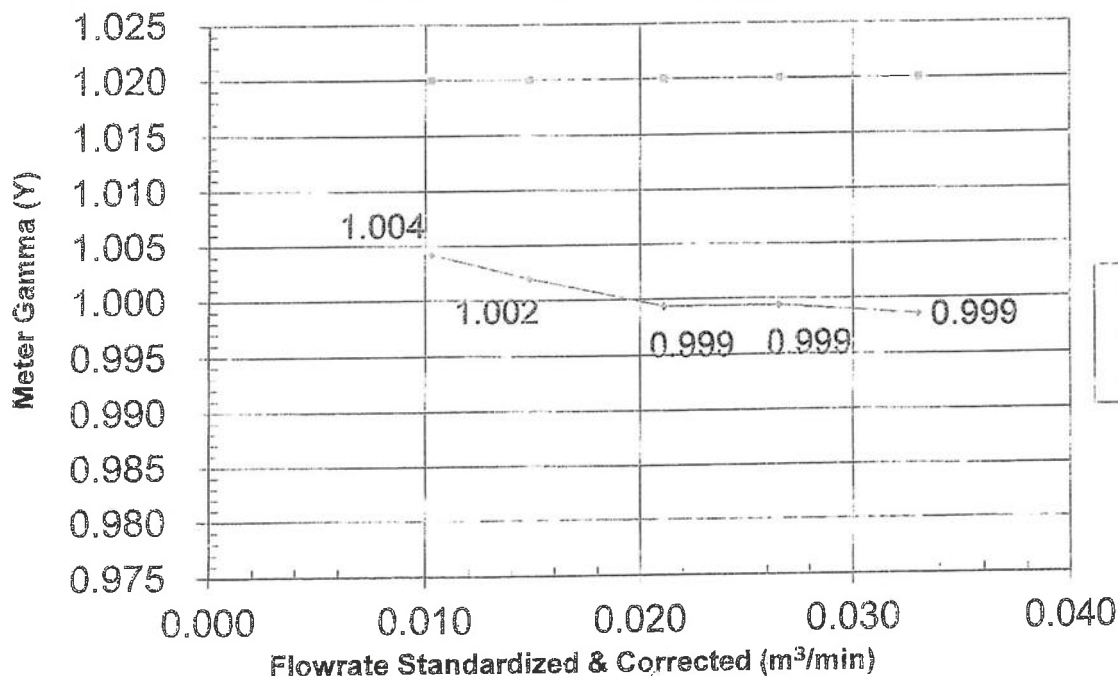
บริษัท วิสโดม ซายล์ แอนด์ เซอร์วิส กรุ๊ป จำกัด
 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

Date

2-May-2023

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Meter Gamma vs Flowrate



Console Serial:

A2204323

Console Model:

XC-572-OV

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

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

Calibration Conditions

Cal. Date: 2-May-2023
Due Date: 1-May-2024
Cal. Report No.: WDS-SV600066
Ambient Temp. (°C): 25
Pressure (mm Hg): 758
Humidity (%): 55

Reference Equipment

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

Temperature Sensor Calibration

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

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 AUX, STACK, PROBE, OVEN, FILTER, EXIT. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

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

Difference Rang

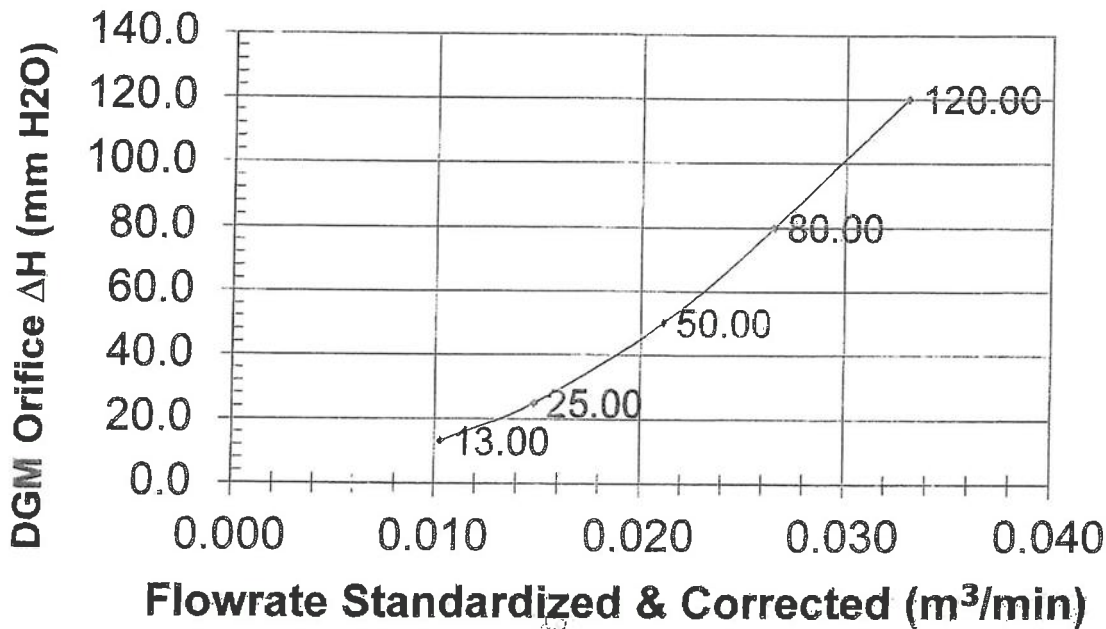
DGM Out Temp. Diff. $\pm 3^{\circ}\text{C}$

Approved By :

(W. Pongthong)
Service Manager

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
Address 9/115 Lumpini Town Ville Ratchaphruek-Phitlao Village, No. 4, Bang Kham, Bang Kruai, Nonthaburi 11130 Thailand

Meter Pressure vs Flowrate



Console Serial:

A2204323

WISDOM SCIENCE

Console Model:

XC-572-OV

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DRY GAS METER XC572V

Serial No. : 1110070

Certificate Of Calibration

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

Meter Console Information

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

Calibration Condition

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

Factors/Conversion

Std. Temp (°K) 298
 Std. Pressure (mm Hg) 760
 K₁ (K/mm Hg) 0.3857

Reference Equipment

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

UUT Meter (DGM)

Reference Meter (WTM)

Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	599.3828	599.5462	27	27	20.05690	20.22163	28	27
10.00	25.0	599.5689	599.7246	27	26	20.24425	20.39999	27	27
8.00	50.0	599.7405	599.9176	26	25	20.41592	20.59344	27	27
7.00	80.0	599.9333	600.1337	26	26	20.60920	20.81034	27	27
5.00	120.0	600.1559	600.3319	26	26	20.83271	21.00950	27	27

Standardized Data

Calibration Results

Test Meter		Reference Meter		Correction Factor		Flow Rate		ΔH@ (mm H ₂ O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation	
V _{test} (m ³)	Q _{test} m ³ /min	V _{ref} (m ³)	Q _{ref} m ³ /min	(Y)	(ΔY)	Q _{test} (m ³ /min)	ΔH _{test}	ΔH _{ref}	
0.159	0.011	0.160	0.011	1.005	0.010	0.011	50.181	2.747	
0.152	0.015	0.152	0.015	0.996	0.000	0.015	48.098	0.662	
0.174	0.022	0.173	0.022	0.995	-0.001	0.022	47.605	0.171	
0.197	0.028	0.196	0.028	0.993	-0.003	0.028	45.688	-1.747	
0.174	0.035	0.172	0.034	0.990	-0.006	0.034	45.602	-1.832	
				0.996	= Y Avg		47.434	= ΔH@ Avg	

Pass/Fail Result:

Pass

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02
 Note: For ΔH_{test}, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O

Approved By:

(Patpasu Chaisana)
 Service Manager

Date

3-Jul-23

WISDOM SCIENCE

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 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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TEMPERATURE DISPLAY CALIBRATION

Calibration Conditions		Reference Equipment	
Cal Date	3-Jul-23	Temp Simulator Model	FLUKE 714B
Due Date	2-Jul-24	Serial No.	60550035
Cal Report No.	WDS-SV660107		
Ambient Temp (°C)	25		
Pressure (mm Hg)	758		
Humidity (%)	60		

Temperature Sensor Calibration

Reference Point	Rel. 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	149.0	0.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1039.0	-1.0
		Maximum	1.0

PASS

Note

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

DGM Out Temperature Sensor Calibration

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

Difference Range

DGM Out Temp. Diff. ±3 °C

PASS

Approved By:

WISDOM SCIENCE

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 WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
 Address 9/115 Lumpini Town Vile Ratchapruk-Pinklao Village No. 4 Bang Kianun Bang Kruai Nonthaburi 11130 Thailand
 Tel 090-860 1392 084-598 1944 084-704-1620



ELAPSED TIMER CALIBRATION

Meter Console Information

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

Calibration Conditions

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

Reference Equipment

Calibration Standard : JS-307
Method Reference : Compare

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

Approved By

(Patpasu Chaisana)
Service Engineer

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Flue gas Analyzer

Testo 350 NEW

Serial No. 63455616/0722

Certificate No: G 660489
Date of issue : 17-Aug-23

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 63455616/0722
Control unit serial no. : 03600177/0722
ID no. or control no. : *
Manufacturer : Testo SE & Co. KGaA
Probe description : *
Probe model : *
Probe serial : *
Customer name : Eastern Thal Consulting 1992 Company Limited
Customer address : 683 Moo 11, Sukhapibam 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 2 Pages
Receiving no. : L-232625
Receiving date. : 10-Aug-23
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %Vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 80.96 ppm, Nitric Oxide 151.5 ppm, Sulphur Dioxide 100.8 ppm)

Condition of UUC. : Used
Ambient condition : All of the 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, Lakse, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration work instration no. WI-CL-2B-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 : 17-Aug-23

Kwanchoi K.

Mr. Kwanchai Khamdoung
Calibration Technician

D. Wongsittetee

Mrs. Nongluck Wongsittetee
Technical Manager

COPY

Certificate No.: G 660489

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.498 % Vol	4219/21	Linde	30-Sep-25
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2583/22	Linde	09-Aug-24
Nitrogen Dioxide (NO2) 80.96 ppm	3240/21	Linde	26-Jun-24
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24

Measured room conditions

Temperature : 23.8 °C Humidity : 62.1 %RH Pressure : 1008.9 mbar

Calibration conditions

Gas Temperature : 24 °C Flow rate : 1,300 ml/min Gas pressure : 1016.8 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard		Mean of		Uncertainty (±)
	Values	UUC	Error		
O2 (%Vol)	2.498	2.55	0.052		0.15
O2 (%Vol)	10.04	10.11	0.07		0.20
O2 (%Vol)	21.02	21.14	0.12		0.30
CO (ppm)	80.14	80	-0.14		3.0
CO (ppm)	302	302	0		6.0
CO (ppm)	1003	999	-4		12
*NO2 (ppm)	80.96	81.5	0.54		8.0
*NO (ppm)	151.5	150	-1.5		8.0
*SO2 (ppm)	100.8	100	-0.8		6.0

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

* Calibrations marked Not TISI Accredited "in this Certificate have been included for completeness."

End of Report

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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 LABF 04/3	
Installation Site Instrument Room GC/IC	
The undersigned performer reports that the Operational Qualification Protocol has been successfully completed for the system stated above.	
• Performer	
Signature	Jhi
Print	Thavornal Pungkha
Title	Service Engineer
Company	Parascentific Co., Ltd
The undersigned reviewer and manager report that the performer has completed the Operational Qualification Protocol successfully.	
• Reviewer	
Signature	Pong Pong
Print	Panupong Bumrungron
Title	Scientist
Company	Eastern Than Consulting 1992 Co., Ltd
• Manager	
Signature	HS
Print	Nuanapha Bakhunlod
Title	HS
Company	Eastern Than Consulting 1992 Co., Ltd

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Operational Qualification Definitions

1-2 Scope

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

(Address):	692 Moo 11 Sukhaphiban 3 Rd Nongkhun Siachet (Nongkhun 20110)
(Company):	Eastern Than Consulting 1992 Co., Ltd
(Department):	
(Installation Site):	Instrument Room GC/IC
(Equipment ID No.):	Gas Chromatograph LABF 04/3
(Product Model Name):	GC-2010Plus / AOC-201 / AOC-203

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

Operational Qualification

Operational Qualification Record

3. Operational Qualification Record

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

3-1 Gas Chromatograph GC-2010Plus

Model Name: GC-2010Plus AF

Component ID	Serial Number (SN)	Model Name	GC-2010Plus AF	Pass	Fail
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	All LEDs light. Screen contrast adjustment is possible.	LED Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Standard self-diagnostic test	"Good" displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Version: 2.10.00 Build No.: 20090926	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green. Displayed actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Pressure gauge reading: 0.1 kPa Pressure gauge correction value: 0.4 kPa Pressure gauge reading: 0.5 kPa Pressure gauge correction value: 0.4 kPa Pressure gauge reading: 0.4 kPa Pressure gauge correction value: 0.4 kPa Pressure gauge reading: 0.4 kPa Pressure gauge correction value: 0.4 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): [Signature] Date: 16 / 07 / 2024
Reviewer (signature): [Signature] Date: 18 / 8 / 2024

Operational Qualification

Operational Qualification Record

No.	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Verify that the pressure program operates normally.	Monitored pressure 6 minutes after start: 250.0 ± 5.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Inspection: pressure gauge reading 8 minutes after start: 250.0 ± 20.0 kPa Septum purge: 3.0 ± 1.0 mL/min Split vent: 2.0 ± 0.2 mL/min Total: 5.0 ± 1.2 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature.	Temp. correction value: -1.0°C Temp. sensor reading: $5.0 \pm 0.1^{\circ}\text{C}$ Corrected temp. value: $5.0 \pm 0.1^{\circ}\text{C}$ Temp. correction value: -0.4°C Temp. sensor reading: $1.4 \pm 0.2^{\circ}\text{C}$ Corrected temp. value: $1.4 \pm 0.1^{\circ}\text{C}$ Temp. correction value: -1.1°C Temp. sensor reading: $2.2 \pm 0.4^{\circ}\text{C}$ Corrected temp. value: $2.2 \pm 0.2^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify that the temperature program operates normally.	Monitored temperature 6 minutes after start: $200 \pm 1^{\circ}\text{C}$ Inspection: temperature reading 8 minutes after start: $200.0 \pm 4.7^{\circ}\text{C}$ Using a temperature sensor with 1°C minimum display increment: $200 \pm 3^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity.	Calculated S value: 1.4×10^{-3} C/g min. Calculated S value: 1.4×10^{-3} C/g min. Calculated S value: 1.4×10^{-3} C/g min. Calculated S value: 1.4×10^{-3} C/g min.	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): [Signature] Date: 16 / 07 / 2024
Reviewer (signature): [Signature] Date: 18 / 8 / 2024

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

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

Component ID		Model Name		AOC-20i	
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 8 0 9			
No.	Item	Criteria		Results	Pass/Fail
1	Display, LED test.	Verify the display and LED operation.		Display: 000	<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	All LEDs light, except decimal point.			<input checked="" type="checkbox"/>
3	Firmware version check	Verify that ROM and RAM memory operates normally.	Display shows "000"		<input checked="" type="checkbox"/>
		Verify the program version.	Version number is displayed.		<input checked="" type="checkbox"/>
		The version number matches the controlled version number.	Version No. Controlled Ver. No.		<input checked="" type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct.	Sample injected into the GC and GC operation starts		<input checked="" type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

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

Performer (signature):

Date: 16 / 07 / 2022

Reviewer (signature):

Date: 18 / 8 / 2022

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

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

Performer (signature):

Date: 16 / 08 / 2022

Reviewer (signature):

Date: 18 / 8 / 2022

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182

NSC-TSI-TS17025
CALIBRATION 0152

Page 1 of 3

Certificate No. : 23-148804

Sample Code : 23-56200-006

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.

(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Model : UFE 500

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. Pisek Into
Scientist

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

Issue date : 25 December 2023

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

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

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TEL 02-516-2422
FAX 02-516-6949
Rev. 01

Effective Date 15/10/21

NSC-TSI-TS17025
CALIBRATION 0152

Page 2 of 3

Certificate No. : 23-148804

Sample Code : 23-56200-006

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)/reading (°C)	Measured temperature at each positions (°C)										Uncertainty z (°C)	Coverage factor k
		# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10		
104	103.5	104.11	103.91	103.84	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

COPY

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REPORT OF CALIBRATION

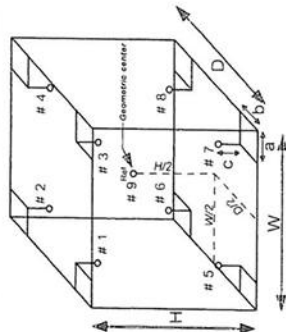
Certificate No. : 23-148804

Sample Code : 23-56200-006

Result 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.

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

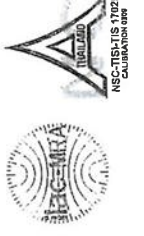
- End of Report -

COPY

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

Bara Scientific
Division of Success

Certificate of Calibration

2 of 3

Number of Page(s)

Certificate No.

BSCC-UV-152/23

Calibration Results:

1. Wavelength Accuracy

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

2. Photometric Accuracy (UV)

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

*CNR = Customer not request

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1 of 3

Number of Page(s)

BSCC-UV-152/23

UV/VIS Spectrophotometer

UV-1800

Shimadzu

A11635101643 CD

N/A

25 April 2023

25 April 2023

27 April 2023

Eastern Thai Consulting 1992 Co., Ltd

683 Moo 11, Sukkaphibam 8 Rd., Nongkham, Sriracha, Chonburi 20230

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

Good Operation

Analysis Department

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

Wavelength Accuracy is traceable to certificate No. 94780 and 94775

Photometric Accuracy is traceable to certificate No. 94808 and 100147

Stray Light is traceable to certificate No. 94791

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

(UKAS accredited calibration laboratory NO. 0659)

Mr. Pannaphong Phannmekul

Approved by

Mr. Kanchit Choothep
Technical Manager

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3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

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

*CNR = Customer not request

4. Stray Light*

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

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

The measurement uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%
End of Certificate

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SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645



Calibration Certificate

Equipment : SOUND CALIBRATOR

Manufacturer : RION

Model : NC-75

Serial No.: 34802645

ID No.:

Condition As Found :

GOOD

Customer :

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

Location :

Ambient Temperature : (23.0 ± 3) °C

Pressure : (101.3 ± 3) kPa

Relative Humidity : (50.0 ± 20) %

Received Date :

06 SEPTEMBER 2023

Calibration Date :

12 OCTOBER 2023

Date of Issue :

16 OCTOBER 2023

Calibrated by :

Natthakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

COPY

Continuation of Calibration Certificate

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

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T. Petchurai

Continuation of Calibration Certificate

Cert. No. : ACC23037
Job No. : VC66AC0097
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Acceptance limit (dB)
94	93.94	-0.06	0.14	0.40

2. Frequency

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

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.24	0.10	3.0

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

_____ End of Calibration Certificate _____

COPY

Y. Petcha

SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230989

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

CALIBRATION CERTIFICATE

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

Instrument Calibrated :
Description : Sound Level Meter
Manufacturer : Rion
Model : NL-52A
Serial No. : 00230989
Microphone : UC-59 No.22337
Preamplifier : NH-25 No.22425
Standards used :

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

Date of Receipt : 27 Feb. 2023

Date of Calibration : 24 Mar. 2023

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.93	114.0	113.9	0.0	0.7	0.30	N/A

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 113.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
16.2	0.10	N/A

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

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

Date of Calibration : 24 Mar. 2023

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3. Acoustical signal test of frequency weightings

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

4. Electrical signal test of frequency weightings

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

Date of Calibration : 24 Mar. 2023

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5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

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

6.2 Time weightings at 1 kHz

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

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7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
137	137.0	0.0	0.8	0.30	0.3
136	136.0	0.0	0.8	0.30	0.3
135	135.0	0.0	0.8	0.30	0.3
134	134.0	0.0	0.8	0.30	0.3
133	133.0	0.0	0.8	0.30	0.3
132	132.0	0.0	0.8	0.30	0.3
131	131.0	0.0	0.8	0.30	0.3
130	130.0	0.0	0.8	0.30	0.3
129	129.0	0.0	0.8	0.30	0.3
124	124.0	0.0	0.8	0.30	0.3
119	119.0	0.0	0.8	0.30	0.3
114	114.0	0.0	0.8	0.30	0.3
109	109.0	0.0	0.8	0.30	0.3
104	104.0	0.0	0.8	0.30	0.3
99	99.0	0.0	0.8	0.30	0.3
94	94.0	0.0	0.8	0.30	0.3
89	89.0	0.0	0.8	0.30	0.3
84	84.0	0.0	0.8	0.30	0.3
79	79.0	0.0	0.8	0.30	0.3
74	74.0	0.0	0.8	0.30	0.3

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

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
69	69.0	0.0	0.8	0.30	0.3
64	63.9	-0.1	0.8	0.30	0.3
59	59.0	0.0	0.8	0.30	0.3
54	53.9	-0.1	0.8	0.30	0.3
49	49.0	0.0	0.8	0.30	0.3
44	44.1	0.1	0.8	0.30	0.3
39	39.5	0.5	0.8	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

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

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8. Level linearity including the level range control

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

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

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 1 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	126.0	0.0	±0.5	0.20	0.3
	2	108.9	-0.1	+1.0; -1.5	0.20	0.3
	0.25	99.9	-0.1	+1.0; -3.0	0.20	0.3
Slow	200	119.5	-0.1	±0.5	0.20	0.3
	2	99.9	-0.1	+1.0; -3.0	0.20	0.3
SEL	200	120.0	0.0	±0.5	0.20	0.3
	2	100.0	0.0	+1.0; -1.5	0.20	0.3
	0.25	90.8	-0.2	+1.0; -3.0	0.20	0.3

Date of Calibration : 24 Mar. 2023

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FM.BLMTC.002 Rev.4

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E-mail : rumpal@tistr.or.th Website:www.tistr.or.th

Office/Laboratory
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mt@tistr.or.th

Office
196 Phahonyothin Road, Chaturachak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

Request No. 21-66/0343

10. Peak C sound level

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

11. Overload indication

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

12. High-level stability

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

Calibrated by :

Wittawat Supanich

(Mr. Wittawat Supanich)

Approved by :

Mr. Prawate Kiatyapa
Director
(Mr. Prawate Kiatyapa)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24 Mar. 2023

Date of Issue : 24 Mar. 2023

Ref: 2011266022700825005

End of Certificate

9/5

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

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

FM.BL.MTC.002 Rev

Head Office
15 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpa@tistr.or.th Website: www.tistr.or.th

Office/Laboratory
Sri 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office
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Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

ANALYTICAL BALANCE (DU)

Model : XS205DU

Serial No. : 1126323724



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

CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 22 December 2023

Date of Calibration : 22 December 2023

Calibrated by : Mr. Somwang Sangdee
Scientist
Approved by : (Mr. Somchai Neampunt)
Signed for Director

Issue date : 25 December 2023

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

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

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	40.000026 80.000037 40.000017 80.000017	
	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

Page 3 of 4

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.

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Certificate No. : 23-148799

Sample Code : 23-56200-001

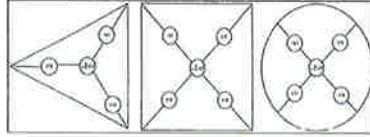
REPORT OF CALIBRATION

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	
		80	
		200	
Position	Reading of indicator	Reading of indicator	Reading of indicator
1	50.00015	100.0001	100.0001
2	50.00022	100.0001	100.0001
3	50.00008	100.0001	100.0001
4	50.00002	100.0000	100.0000
5	50.00016	100.0002	100.0002
6	50.00014	100.0001	100.0001
Maximum difference	0.00013	0.0001	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

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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	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	99.9998 199.9998 100.0000 200.0000	
	Standard deviation	0.00006 0.00007 0.00003 0.00007	

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



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.

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Certificate No. : 23-148800

Sample Code : 23-56200-002

REPORT OF CALIBRATION

Result of Calibration :

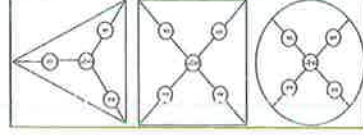
4. Eccentric or off-centre loading

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
2. This result of calibration was found accurate as shown on date and place of calibration only.
3. Condition of Calibration item: Norma
4. This certification is traceable to the International System of Unit maintained at : *

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

Company Limited (Instrument number 1)

5. Reference standard instrument :

Instrument

1) STANDARD WEIGHT 1 mg to 1 kg

Class ID No.
E2 LB-WF-79

Certificate No.
23-105642

Due Date
10 September 2024

End of Report -

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BOD INCUBATOR

Model : TC445S

Serial No. : 0223/007275

SK

S K SALES AND SERVICE CO.,LTD.
194/56, 194/57 Thakham Rd. 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. Suphachai Saksi ☐ 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 %

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Certificate No. : S2309-3014

Page 2 of 2

Table1 General Information

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

Table2 Chamber Performance

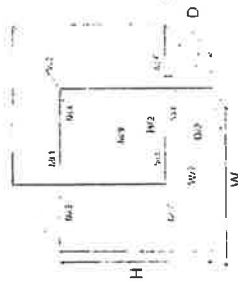
Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (± °C)	Measured Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.37	0.64	0.98

Table3 Temperature Distribution

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

Resolution : 0.1 (°C)

* Probe No. 9 is Reference Probe



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

** End of Calibration Report **

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[Signature]

BOD INCUBATOR

ID No. : LABE 19/5

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	UUC*	Measured temperature at each positions (°C)										Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{o-1}			
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



REPORT OF CALIBRATION

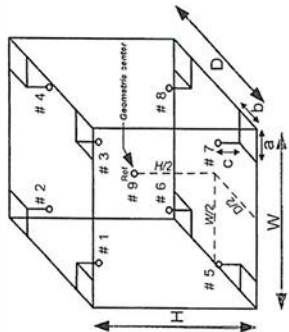
Certificate No. : 24-046203

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 cm ; D = 56 cm ; H = 146 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.

Figure: Example of sensor
Installation Positions

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

- End of Report -

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Hot Air Oven

Model : UM 400

Serial No. : 900982

NSC-TS1-TS17025
CALIBRATION 0152

Page 1 of 3

CERTIFICATE OF CALIBRATION

Certificate No. : 24-001944
Sample Code : 24-00963-001Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapibarn 8 Rd., Nongkhram,
Siracha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Hot Lab)Equipment : Temperature controlled enclosures (Hot air oven)
Manufacturer : Memmert
Model : UM 400
Serial No. : 900982
ID No. : LABE 17/1
Date of Receipt : 09 January 2024
Date of Calibration : 09 January 2024

Condition of Calibration

1. Environment
1.1 Ambient temperature : Maximum 30.6 °C ; Minimum 29.2 °C
1.2 Relative humidity : Maximum 57.5 % ; Minimum 46.4 %
1.3 Line voltage supplied : Maximum 229.5 VAC ; Minimum 222.5 VAC

2. Calibration method

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

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-10 (RTD-257 to RTD-265)	23-066256	29 June 2024

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

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

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Sarawoot Thammo

Approved by

(Mr. Somchai Neampunt)

Issue date

09 January 2024

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

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

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

361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

FM CL 114

TEL 02-516-2422

FAX 02-516-6949

Rev 01

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21

NSC-TS1-TS17025
CALIBRATION 0152

Page 2 of 3

REPORT OF CALIBRATION

Certificate No. : 24-001944
Sample Code : 24-00963-001

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)								Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{Rev}	
60	60.0	60.0	60.04	59.90	59.81	59.84	59.47	59.91	60.08	59.98	59.87	2.00
85	85.0	85.0	86.07	85.75	85.58	85.62	84.69	85.83	86.28	85.94	85.77	2.00

2. Characterization results

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

Notes

UUC* = Unit Under Calibration

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361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

FM CL 108

TEL 02-516-2422

FAX 02-516-6949

Rev.09

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21

NSC-TISI-TIS17025
CALIBRATION 0152

REPORT OF CALIBRATION

Page 3 of 3

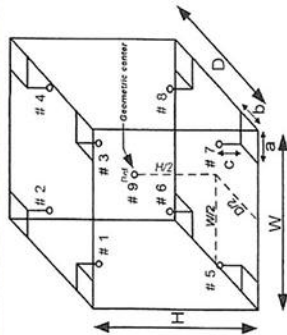
Certificate No. : 24-001944

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 -

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LIQUID IN GLASS THERMOMETER

Model : Total Immersion

Serial No. : 43560



QUALITY CALIBRATION CO.,LTD.

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



CERTIFICATE No : 23T10864
REFERENCE No : 71117-1

PAGE : 1 OF 2

Certificate of Calibration

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

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

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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

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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		Lot 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

(Mr. Somchai Neampunt)

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 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.

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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 -

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STANDARD WEIGHT 50 g



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

Page 1 of 3

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist
Approved by : (Mr. Somchai Neampunt)
Signed for Director

Issue date : 31 May 2022

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

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

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



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

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

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

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Certificate No. : 22-052238

Sample Code : 22-19150-003

Page 3 of 3

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$, Relative humidity $50\% \pm 10\%$ and air density 1.20 kg/m^3
2. Calibration Method : Direct comparison weighing according to OIML R111-1 : 2004(E)
3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-078366	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 -

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STANDARD WEIGHT 100 g



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

Page 1 of 3

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

Issue date : 31 May 2022

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

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

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



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

Page 2 of 3

REPORT OF CALIBRATION

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Result of Calibration : ☒ Without adjustment ☐ Adjustment

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

Description	Deviation	Conventional	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 multiplied by the coverage factor $k = 2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

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NSC-TS-1517025
CALIBRATION 0152

Certificate No. : 22-052239

Sample Code : 22-19150-004

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/m³

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 (ρ_{ref}) of 8000 kg.m⁻³ which it balances in air of a reference density (ρ_0) of 1.2 kg.m⁻³

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

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

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Certificate No. : 22-052237

Sample Code : 22-19150-002

Page 3 of 3

REPORT OF CALIBRATION

Condition of Calibration

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

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

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

- End of Report -

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UV/VIS SPECTROPHOTOMETER

Model : UV - 1800

Serial No. : A11635101643 CD



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

Certificate of Calibration

2 of 3

Number of Page(s)

Certificate No. BSCC-UV-152/23

Calibration Results:

1. Wavelength Accuracy

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

2. Photometric Accuracy (UV)

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

*CNR = Customer not request

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968 U Chu Liang Building Floor 7 Rama4 Road
Silom Bangkok Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com

1 of 3

Number of Page(s)

Certificate No. BSCC-UV-152/23
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11635101643 CD
ID No. N/A
Date of receipt 25 April 2023
Date of calibration 25 April 2023
Date of issue 27 April 2023
Customer name Eastern Thai Consulting 1992 Co., Ltd
Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Temperature (22.4-23.1) °C (On site)
Humidity (44.5-45.2) %RH (On site)
Equipment condition Good Operation
Calibration Location Analysis Department
Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01
Traceability Wavelength Accuracy is traceable to certificate No. 94780 and 94775
Photometric Accuracy is traceable to certificate No. 94808 and 100147
Stray Light is traceable to certificate No. 94791
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)
Calibrated by Mr. Pannaphong Phannmekakul

Approved by

Signature

Mr. Kanchit Choothep
Technical Manager

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Certificate of Calibration

Certificate No.

BSCC-UV-152/23

Number of Page(s)

3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

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

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.75 \pm 0.1 nm	200.72	2.0164

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

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. Adversing the report / Certificate and publicity of the results are prohibited and also shall not be reproduced except in full, without written approval of the Bara Scientific Co., Ltd.

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UV/VIS SPECTROPHOTOMETER

Model : UV-1800

Serial No. : A11635101643 CD



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor 7 Ramak 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, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

Temperature (22.9-24.1) °C (On site)
Humidity (41.7-46.9) %RH (On site)

Equipment condition Good Operation

Calibration Location Analysis Department

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

Traceability
Wavelength Accuracy is traceable to certificate No. 116614 and 116613
Photometric Accuracy is traceable to certificate No. 116210 and 116224
Sray Light is traceable to certificate No. 116616
The above certificate are traceable to SI unit through Stama Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Poomjai Korsawatvorakul

Approved by

Mr.Sonthi Temboonsakdi
Service Manager

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



Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor 7 Ramak 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
Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

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

2.Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	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

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Certificate of Calibration

Certificate No.

BSCC-UV-146124

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
	1.0687	1.1005	0.0018	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5561	0.5578	0.0017	0.0042
	0.6968	0.6969	0.0001	0.0042
	1.0757	1.0774	0.0017	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5193	0.5213	0.0020	0.0042
	0.6937	0.6940	0.0003	0.0042
	1.0411	1.0428	0.0017	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5605	0.5624	0.0019	0.0042
	0.7579	0.7583	0.0004	0.0042
	1.1131	1.1136	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 based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

End of Certificate

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

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SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322756



451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com
NSC-TIS-17025
CALIBRATION 0394
Cert. No. : ACL23169
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00322756 / 196480 / 15488
ID No.:

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)
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Continuation of Calibration Certificate

Cert. No. : ACL23169
Job No. : VC66AC0058
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

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

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

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

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Continuation of Calibration Certificate

Cert. No. : ACL23169
Job No. : VC66AC0058
Pages : 3 of 8

Summary of Measurement Result :

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

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

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Continuation of Calibration Certificate

Cert. No. : ACL23169
Job No. : VC66AC0058
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	16.6
Flat	22.5

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	0.3	0.4	0.3
1000	-0.1	-0.1	-0.1
8000	0.0	0.0	0.0
			Acceptance Limits
			± 1.5
			± 1.0
			± 5.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23169
Job No. : VC66AC0058
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	107.9	-0.1	1.5 ; -5.0
	200	800	127.6	127.5	-0.1	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

Continuation of Calibration Certificate

Cert. No. : ACL23169
Job No. : VC66AC0058
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle			
89.6	89.5	-0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322750



Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00322750 / 196473 / 15482
ID No.:

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : 
(Thanakul Petchurai)

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

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Calibration Procedure : CP-AC-01

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :

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

Continuation of Calibration Certificate

Summary of Measurement Result :

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

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

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Continuation of Calibration Certificate

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.3
Flat	23.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
125	0.2	0.2	± 1.5
1000	0.0	0.0	± 1.0
8000	0.3	0.4	±5.0

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Continuation of Calibration Certificate

Cert. No. : ACL23168
Job No. : VC66AC0058
Pages : 5 of 8Cert. No. : ACL23168
Job No. : VC66AC0058
Pages : 6 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
63	0.0	-0.1	0.0
125	0.0	0.0	0.0
250	0.0	0.0	0.0
500	0.0	0.0	0.0
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	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 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	25.1	0.1	± 1.1

Continuation of Calibration Certificate

Cert. No. : ACL23168
Job No. : VC66AC0058
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

COPY

Continuation of Calibration Certificate

Cert. No. : ACL23168
Job No. : VC66AC0058
Pages : 8 of 8

11. Overload indication

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

COPY

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34302326

Calibration Certificate

Equipment : SOUND CALIBRATOR

Manufacturer : RION

Model : NC-75

Serial No.: 34302326

ID No.:

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : 
(Thanakul Petchurai)

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

COPY

~ 2 7 ~

Continuation of Calibration Certificate

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

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

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

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

End of Calibration Certificate

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0640

CERTIFICATE OF CALIBRATION

ISSUED BY
Citrus Research plc

DATE OF ISSUE
19 January 2024

CERTIFICATE NUMBER 206879

CERTIFICATE OF CALIBRATION

Certificate Number:
206879

Page 2 of 2

Citrus 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:
Model:
Serial number:
Firmware version:

Citrus Research plc
CR:110A
CB0640
5.4

Notes:
Eastern Thai Consulting 1992 Co.Ltd.
683 Moo.11, Sukapitbai 8 Rd., Nongkham,
Siracha, 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	Citrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Citrus 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%.



Environmental conditions

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

Before

Pressure: 99.84 kPa

Temperature: 21.4 °C

Humidity: 32.5 %

After


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



NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1365

CERTIFICATE OF CALIBRATION

ISSUED BY
Cirrus Research plc

DATE OF ISSUE
19 January 2024

CERTIFICATE NUMBER
206870

Certificate Number:
206870

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:
CB1365

Firmware version:
5.4

Notes:

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

Test summary

Date of calibration:
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	Cornel	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:	99.92 kPa	Temperature:	21.7 °C	Humidity:	33.2 %
After	Pressure:	99.96 kPa	Temperature:	21.8 °C	Humidity:	34.2 %

Test results summary

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

COPY

COPY

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

Certificate Number:

206868

Page

2 of 2

CERTIFICATE OF CALIBRATION

Environmental conditions

The following conditions were recorded at the time of the test

Before

Pressure: 100.13 kPa

Temperature: 22.0 °C

Humidity: 37.0 %

After

Pressure: 100.15 kPa

Temperature: 21.9 °C

Humidity: 35.4 %



Cirrus Research plc

Acoustic House

Bridlington Road

Hummerby

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 Thai Consulting 1992 Co., Ltd.
663 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	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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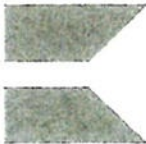
NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1498

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 19 January 2024 CERTIFICATE NUMBER 206877



Cirrus Research plc
Acoustic House
Bridlington Road
Hummerby
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: CB1498
Firmware version: 5.4
Notes: Eastern Thal Consulting 1992 Co., Ltd.
883 Moo.11, Sukaphibai 8 Rd., Nongkham,
Sripracha, 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

Environmental conditions

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

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

Test results summary

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

Certificate Number:
206877
Page 2 of 2

COPY

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1499

CERTIFICATE OF CALIBRATION

ISSUED BY

Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206881

CERTIFICATE OF CALIBRATION

Certificate Number

206877

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:



Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:

Cirrus Research plc

Model

CR:110A

Serial number:

CB1499

Firmware version:

5.4

Notes:

Eastern Thai Consulting 1992 Co., Ltd.
683 Moo.11, Sukaphibal 8 Rd., Nongkham,
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	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE-952	93692
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

Notes

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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

CERTIFICATE OF CALIBRATION

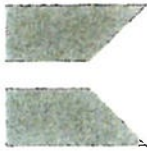
Certificate Number:
206866

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



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 Thal Consulting 1992 Co.Ltd. 663 Moo.11, Sukaphibai 8 Rd., Nongkham, Sriacha, Chonburi 20230
Model:	CR-110A		
Serial number:	CB1500		
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	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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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, Sukhapiabarn 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: 
 (Mr. Sarayuth Tothua)

Page 1 of 2

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Certificate No. : L202405022-0013

Environment Ambient Temperature : (25 ± 2)°C

Relative Humidity : (50 ± 15)%RH

STD Reading mbar	UUC Reading (mbar) Before Adjusted	UUC Reading (mbar) After Adjusted	UUC Error mbar	Uncertainty ± mbar	MPE ± mbar	Pass / Fail 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 Pass = [error] + [uncertainty] ≤ [MPE]

UUC = Unit Under Calibration Fail = [error] + [uncertainty] > [MPE]

MPE = Maximum Permissible Error

Calibrated condition : Pressure Medium Air : Density = 1.19 kg/m³ @ 20°C, 1 bar

Mounting Position Vertical

Reference Level at center of its dial

Conversion Factor Multiply by 1.0 E+02 - Pa unit

Description of UUC :	Range	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-P230097 for Reference Pressure Monitor Serial No. L598. Due 09-Nov-24

End of Certificate



COPY

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 LABF 04/3	
Installation Site Instrument Room GC/IC	
The undersigned performer reports that the Operational Qualification Protocol has been successfully completed for the system stated above.	
• Performer	
Signature	Jm
Date	16 / 02 / 2023
Title	Service Engineer
Company	Parascientific Co., Ltd
The undersigned reviewer and manager report that the performer has completed the Operational Qualification Protocol successfully.	
• Reviewer	
Signature	Prayong Bumsungvor
Date	16 / 02 / 2023
Title	Scientist
Company	Eastern Thai Consulting 1992 Co., Ltd
• Manager	
Signature	Nyannaphol Bothunhod
Date	16 / 02 / 2023
Title	HS
Company	Eastern Thai Consulting 1992 Co., Ltd

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Operational Qualification Definitions

1-2 Scope

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

(Address):	69 Moo 11 Sukhaphan 3 Rd Nongkham, Si Sakhe, (November 2010)
(Company):	Eastern Thai Consulting 1992 Co., Ltd
(Department):	
(Installation Site):	Instrument Room GC/IC
(Equipment ID No.):	Gas Chromatograph LABF 04/3
(Product Model Name):	GC-2010 Plus / AOC-201 / AOC-205

COPY

Performer (signature):	Jm	Date:	16 / 02 / 2023
Reviewer (signature):	Prayong Bumsungvor	Date:	16 / 02 / 2023

Operational Qualification

Operational Qualification Record

3. Operational Qualification Record

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

Component ID		Model Name		GC-2010Plus AF	
Serial Number (SN)		LA06 0413		C 1 2 0 9 5 2 0 0 9 3 6	
No	Item	Criteria	Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation. Screen contrast adjustment is possible.	LED Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Standard self-diagnostic test	"Good" displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Ver. 2.10.00 Build No.: 20100404 Build No.: 20100404	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Temperature test	Verify that temperature control is normal. TEMP LED lights green. Displayed temperature agree to the set values within $\pm 1.0^{\circ}\text{C}$.	Temperature controller (Name) COL Set value 50.0 $^{\circ}\text{C}$ Measured value 50.0 $^{\circ}\text{C}$ IN1 50.0 $^{\circ}\text{C}$ IN2 50.0 $^{\circ}\text{C}$ DET1 50.0 $^{\circ}\text{C}$ DET2 50.0 $^{\circ}\text{C}$ AUX3 50.0 $^{\circ}\text{C}$ AUX4 50.0 $^{\circ}\text{C}$ AUX5 50.0 $^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure. Inspection pressure gauge reading 10.01.30kPa Pressure gauge correction value 0.1 kPa Inspection pressure gauge reading 20.0kPa Pressure gauge correction value 0.4 kPa Inspection pressure gauge reading 35.0kPa Pressure gauge correction value 0.3 kPa	Pressure gauge correction value 0.1 kPa Pressure gauge reading 4.4 kPa Post-correction reading 4.5 kPa Pressure gauge correction value 0.4 kPa Pressure gauge reading 14.7 kPa Post-correction reading 15.1 kPa Pressure gauge correction value 0.3 kPa Pressure gauge reading 41.4 kPa Post-correction reading 41.7 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): DM Date: 16 / 07 / 2024
Reviewer (signature): DM Date: 18 / 8 / 2024

Operational Qualification

Operational Qualification Record

No	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Verify that the pressure program operates normally. Monitored pressure 6 minutes after start 250.0 \pm 5.0 kPa Inspection pressure gauge reading 8 minutes after start 250.0 \pm 20.0 kPa	250.0 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 3.0 \pm 1.0 mL/min Total of septum purge and split vent flow rate values 10.0 \pm 3.0 mL/min Total of septum purge and split vent flow rate values 200 \pm 20 mL/min	Septum purge 1.0 mL/min Split vent 1.0 mL/min Total 2.0 mL/min Septum purge 1.0 mL/min Split vent 1.0 mL/min Total 2.0 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature. Inspection temperature sensor displayed value 50.0 \pm 0.2 $^{\circ}\text{C}$ Inspection temperature sensor displayed value 50.0 \pm 0.2 $^{\circ}\text{C}$ Inspection temperature sensor displayed value 50.0 \pm 0.2 $^{\circ}\text{C}$ Inspection temperature sensor displayed value 50.0 \pm 0.2 $^{\circ}\text{C}$	Temp. correction value -1.0 $^{\circ}\text{C}$ Temp. sensor reading 50.0 $^{\circ}\text{C}$ Corrected temp. value 51.0 $^{\circ}\text{C}$ Temp. correction value -0.9 $^{\circ}\text{C}$ Temp. sensor reading 50.0 $^{\circ}\text{C}$ Corrected temp. value 50.9 $^{\circ}\text{C}$ Temp. correction value -1.1 $^{\circ}\text{C}$ Temp. sensor reading 50.0 $^{\circ}\text{C}$ Corrected temp. value 48.9 $^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify that the column temperature program operates normally. Monitored temperature 6 minutes after start 200 \pm 1 $^{\circ}\text{C}$ Inspection temperature reading 8 minutes after start 200.0 \pm 4.7 $^{\circ}\text{C}$ Using a temperature sensor with 1 $^{\circ}\text{C}$ minimum display increment 200 \pm 3 $^{\circ}\text{C}$	200.0 $^{\circ}\text{C}$ 200.0 $^{\circ}\text{C}$ 200.0 $^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity. FID () Applicable Not Applicable Calculated S value Inj. unit () Make-up gas: N ₂ 10.0 \times 10 ⁻³ C/g min. 7.00 \times 10 ⁻³ C/g min. ICD () Applicable Not Applicable Calculated S value Inj. unit () 4.00 \times 10 ⁻³ mV \cdot mL/mg min.	C16AREA value 4698 Calculated S value 1.45 \times 10 ⁻³ C/g C16AREA value Flowrate at vent Calculated S value	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature): DM Date: 16 / 07 / 2024
Reviewer (signature): DM Date: 18 / 8 / 2024

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

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

Component ID		Model Name		AOC-20i	
Serial No. (S/N)		C 1 2 1 2 4 1 0 2 0 9			
No.	Item	Criteria		Results	Pass Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		Display: 000	<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display: 000	<input checked="" type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No. 3.40	<input checked="" type="checkbox"/>
		Verify that the auto controlled version number.	Controlled Ver. No.	3.40	<input checked="" type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct.		Sample injected into the GC and GC operation starts.	<input checked="" type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

Component ID		Model Name		AOC-20i	
Serial No. (S/N)					
No.	Item	Criteria		Results	Pass Fail
1	Display, LED test	Verify the display and LED All LEDs light, except decimal point.		Display	<input checked="" type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.		Display shows "000".	<input checked="" type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No. 3.40	<input checked="" type="checkbox"/>
		Verify that the auto controlled version number.	Controlled Ver. No.	3.40	<input checked="" type="checkbox"/>
4	Basic operation test	Verify that the auto injector basic operation is correct.		Sample No.1 transferred to the main injector, sample No. 2 transferred to the sub-injector. Sub-injector injects into the GC simultaneously with the main AOC.	<input checked="" type="checkbox"/>

Performer (signature):

Date: 16 / 02 / 2024

Reviewer (signature):

Date: 17 / 02 / 2024

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 9 1 0			
No.	Item	Criteria		Results	Pass Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.		LED lights green, not red.	<input checked="" type="checkbox"/>
2	Firmware version check	Verify the program version.	Version number is displayed.	Version No. 3.40	<input checked="" type="checkbox"/>
		Verify that the auto controlled version number.	Controlled Ver. No.	3.40	<input checked="" type="checkbox"/>

Performer (signature):

Date: 16 / 02 / 2024

Reviewer (signature):

Date: 18 / 02 / 2024

Primary Flow Calibrator

Serial No. : 110619 , 207510

Certificate of Calibration

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

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator
Manufacturer : Bios
Model : Defender 510-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 CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	4100KDU651882	TPA	9 November 2024

Traceability :

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

Note :

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

Calibration By : Mr. Noppadon Luangrit
Service Calibration Engineer
Approved By : Mr. Paet Mathavorn
Calibration Engineer Supervisor
Issue Date : 30 January 2024

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
24.80	101.23	0	0.00	0.0000	0.0058
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 :

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

where Q : Flow Rate

P : Absolute Pressure

T : Absolute Temperature

Meas = Measurement Condition

ref = Standard Condition

* Indicates non accredited

End of Certificate

COPY

COPY

Certificate No : 24-AFM-022

Request No : Req-2024-0094

Result of Calibration : Without Adjustment					
Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
24.80	101.23	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 :

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

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

Meas = Measurement Condition ref Standard Condition

* Indicates non accredited

End of Certificate



Certificate of Calibration

Certificate No : 24-AFM-022

Request No : Req-2024-0094

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.

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

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : MesaLabs

Model : Defender 510-M

Serial Number : 207510

ID : -

Sensor Model : -

Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 11 January 2024

Calibration Date : 30 January 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator			
Reference Standard	Model	Serial Number	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	12 July 2024
Temperature meter	GT 11	08000057	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	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 :

Approved By :

Mr. Noppadon Luangart

Mr. Pechit Mahavorn

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 30 January 2024

