

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

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

Expiration Date: Mar 13, 2026

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

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

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

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020
PRM	12367	APEX1099237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Jun 02, 2017
GMIS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Mar 15, 2019
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 07, 2022
NTRM	12060735	CC356192	2498 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Dec 14, 2026

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 APW1100391 CO	FTIR	Feb 06, 2018
Nicolet 6700 APW1100391 NO	FTIR	Feb 15, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Feb 16, 2018
Nicolet 6700 APW1100391 SO2	FTIR	Mar 01, 2018

Triad Data Available Upon Request

NOTES: NET WEIGHT: 10.43lbs

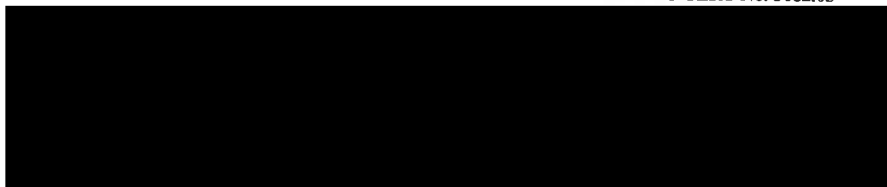
GROSS WEIGHT: 60.93lbs

PO# 5218000763

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



TESTING CERT No. 3082.05



ORIFICE TRANSFER STANDARD CERTIFICATION

WORKSHEET TE-5025A

ROOTSMETER S/N 0438320



TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVELAND, OH
44102
613.467.9000
877.283.7810 TOLL FREE
613.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

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

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

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9832	0.7337	1.4054	0.9957	0.7430	0.8911
0.9791	1.0296	1.9875	0.9915	1.0426	1.2603
0.9770	1.1481	2.2221	0.9894	1.1626	1.4090
0.9760	1.2006	2.3305	0.9884	1.2157	1.4778
0.9707	1.4510	2.8107	0.9830	1.4694	1.7823
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}

ANALYTICAL BALANCE (DU)

Model : XS205DU


Serial No. : 1126323724

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



Accuracy Calibration Certificate

Customer

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

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XS205DU Asset Number: LABE 05/1
Serial No.: 1126323724 Terminal Model: SAT
Building: Laboratory Terminal Serial No.: 1126323724
Floor: 1 Terminal Asset No.: N/A
Room: Analytical Balance

Range	Max. Capacity	Readability (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
METTLER TOLEDO Work Instruction: CP/W002/20
This calibration certificate contains measurements for As Found calibration. No As Left calibration was performed because the device was not modified after As Found calibration. Therefore, results for As Left correspond to As Found.
The sensitivity/span of the weighing instrument was adjusted before calibration with a built-in weight.
In accordance with EURAMET cg-18 (11/2015), the test loads were selected to reflect the specific use of the weighing device or to accommodate specific calibration conditions.

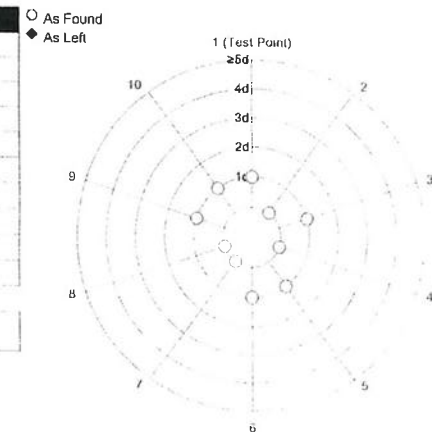
	Temperature		Humidity	
As Found	Start: 25.7 °C	End: 25.8 °C	Start: 50.9 %	End: 50.6 %

Measurement Results

Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00004 g	N/A
2	70.00005 g	N/A
3	70.00004 g	N/A
4	70.00005 g	N/A
5	70.00006 g	N/A
6	70.00004 g	N/A
7	70.00005 g	N/A
8	70.00005 g	N/A
9	70.00006 g	N/A
10	70.00006 g	N/A
Standard Deviation	0.000008 g	N/A



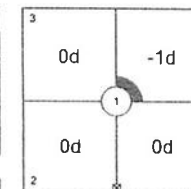
The "d" in the graph represents the readability of the range/interval in which the test was performed.

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

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	100.0000 g	N/A
Maximum Deviation	0.0001 g	N/A



As Found

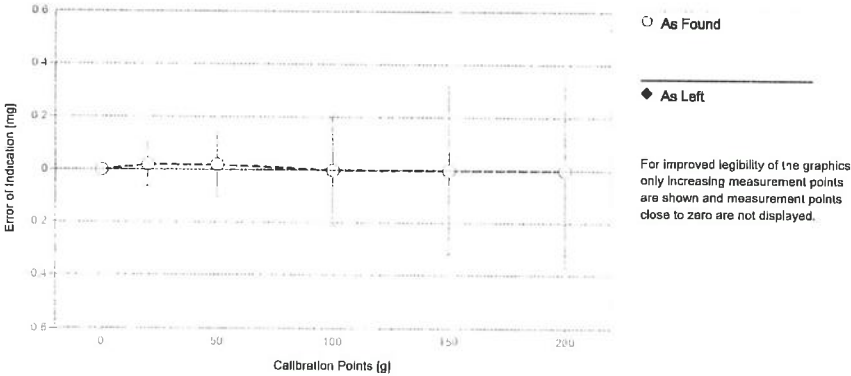
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.020 mg	2
3	0.10000 g	0.10000 g	0.00000 g	0.023 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg	2
5	4.99998 g	5.00000 g	0.00002 g	0.048 mg	2
6	10.00001 g	10.00001 g	0.00000 g	0.061 mg	2
7	19.99999 g	20.00001 g	0.00002 g	0.082 mg	2
8*	50.00003 g	50.00005 g	0.00002 g	0.12 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.21 mg	2
10	150.0000 g	150.0000 g	0.0000 g	0.32 mg	2
11	200.0000 g	200.0000 g	0.0000 g	0.37 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.



The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.
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.: WS37 Date of Issue: 17-Jun-2024
Certificate Number: 186753-1 Calibration Due Date: 20-Jan-2025

Weight Set 2: OIML E2

Weight Set No.: WS87 Date of Issue: 04-Jul-2023
Certificate Number: 186520 Calibration Due Date: 02-Jan-2025

Thermo Hygrometer

Equipment No.: IN279 Date of Issue: 19-Jun-2024
Certificate Number: SG-H-00577/67 Calibration Due Date: 17-Jun-2025

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: $1.5 \cdot 10^{-8} / K$

Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

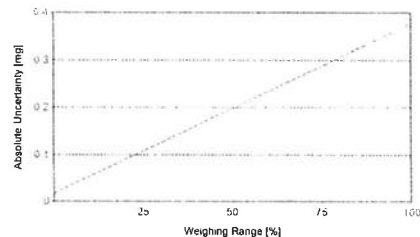
Linearization of Uncertainty Equation

Range		As Found	As Left
d	Max		
1 0.00001 g	81 g	$U_1 = 0.018 \text{ mg} + 0.00444 \text{ mg/g} \cdot R$	N/A
2 0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00439 \text{ mg/g} \cdot R$	N/A

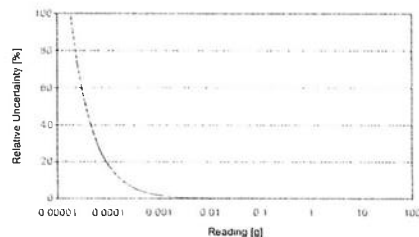
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.00220 g	0.018 mg	0.82%	N/A	N/A
0.02200 g	0.018 mg	0.082%	N/A	N/A
0.22000 g	0.019 mg	0.0086%	N/A	N/A
2.20000 g	0.028 mg	0.0013%	N/A	N/A
220.0000 g	1.0 mg	0.00047%	N/A	N/A



As Found



As Left

The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

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 ☒ No adjustments/modifications made. As Left results correspond to As Found.

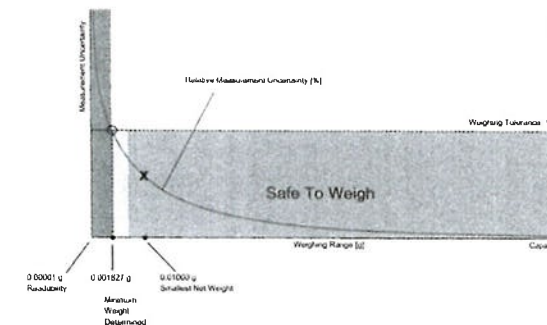
Process Requirements

Weighing Tolerance: 1%

Smallest Net Weight: 0.01000 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 method is not a substitute for a full uncertainty analysis.

Minimum Weight

As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036842 g	0.055511 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036842 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

The minimum weight table applies to the fine range of the weighing device.



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

As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036842 g	0.055511 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036842 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

The minimum weight table applies to the fine range of the weighing device.



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:

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

Measurement Results

Results Summary

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

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 70 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.000005 g	0.000008 g	✗	0.000008 g	✗
0.2%	0.000010 g		✓		⚠
0.5%	0.000025 g		✓		✓
1%	0.000050 g		✓		✓
2%	0.000100 g		✓		✓
5%	0.000250 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	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

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

Error of Indication

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
19.99999 g	0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
50.00003 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0000 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
19.99999 g	0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
50.00003 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0000 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

Serial No. : N/A[S41020124]



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : BAROMETER
MANUFACTURER : BARIO
MODEL / TYPE : N/A
SERIAL NO. : N/A[S41020124]
CLID. NO. : 212500828
JOB CONTROL NO. : 250507051351
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : EASTERN THAI CONSULTING 1992 CO., LTD.
683 MOO 11, SUKHAPIBARN 8 RD,
NONGKHAM, SRIRACHA, CHONBURI 20230

DATE OF RECEIVED : 07 May 2025

DATE OF ISSUED : 09 May 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdec
Calibration Engineer

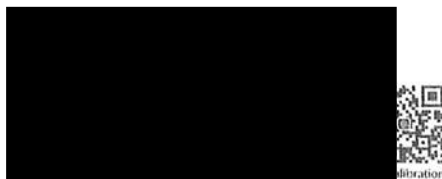
Approved By

Authorized Signatory
09 May 2025



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q25051351
F3-011-05/12-23



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : BAROMETER
MANUFACTURER : BARIO
MODEL / TYPE : N/A
SERIAL NO. : N/A[S41020124]
DATE OF CALIBRATION : 08 May 2025

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-08 according to DKD-R 6-1 as calibration guidelines.

The calibration was performed by direct measurement with Reference Pressure Monitor which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Reference Pressure Monitor, Fluke Model RPM3 S/N. 829.

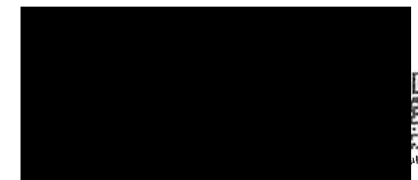
TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. MP-0245-24, Due Date 11 November 2025.

UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2$. It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q25051351
F3-011-05/12-23



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

Expiration Date: Oct 15, 2029

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

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

ANALYTICAL RESULTS

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

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%	May 15, 2025
NTRM	200602-06	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# 5221004861



DRY GAS METER XC-572-V

Serial No. : 1110070



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Certificate Of Calibration

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

Meter Console Information

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

Calibration Condition

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

Factors/Conversion

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

Reference Equipment

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

UUT Meter (DGM)

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

Reference Meter (WTM)

Standardized Data

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 _{m(std)} (m ³)	Q _{m(std)} m ³ /min	V _{w(std)} (m ³)	Q _{w(std)} m ³ /min	(Y)	(ΔY)	Q _{m(std)corr}	ΔH _g	ΔΔH _g	
0.157	0.010	0.155	0.010	0.991	-0.003	0.010	53.303	6.250	
0.154	0.015	0.152	0.015	0.989	-0.005	0.015	47.860	0.807	
0.176	0.022	0.175	0.022	0.993	-0.001	0.022	46.233	-0.820	
0.200	0.029	0.199	0.028	0.997	0.003	0.028	43.895	-3.158	
0.174	0.035	0.175	0.035	1.001	0.007	0.035	43.973	-3.080	

Calibration Results

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_g, 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:

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Date:

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Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Nomenclature

P_b - Barometric Pressure
DGM - Dry Gas Meter
K₁ - Constant based on standard temp and press
Θ - Run time, in minutes
P_m - ΔH (Meter Pressure, gauge)
V_m - Volume collected by test meter, corrected for STP
Q_{m(std)} - Calculated flow rate of test meter
K' - Critical orifice coefficient
P_w - Measured pressure of reference meter
t_w - Temperature measured in reference meter
t_m - Temperature measured in test meter
Y - Ratio of volume collected from test meter and orifice
sc - Scaling Factor
Counts_{std} - Number of pulse counts, standardized
C_{total} - Number of raw pulse counts of a calibration run

Equations

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

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

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

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

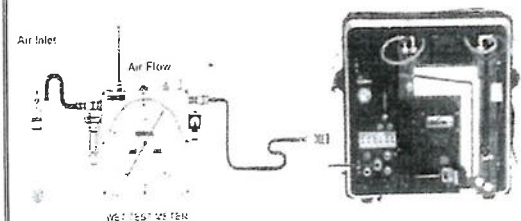
$$Y_{sc} = \frac{V_{w(std)}}{Counts_{std}}$$

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

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

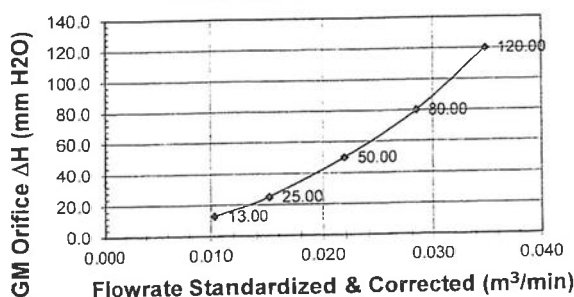
$$Metric \Delta H_g = \frac{P_w - (1.001136 * P_{std} + \frac{P_{m(std)}}{13.6})}{Y} \left(\frac{T_{std}}{T_{st} + \Theta} \right)$$

Calibration Train



Calibration Graphs

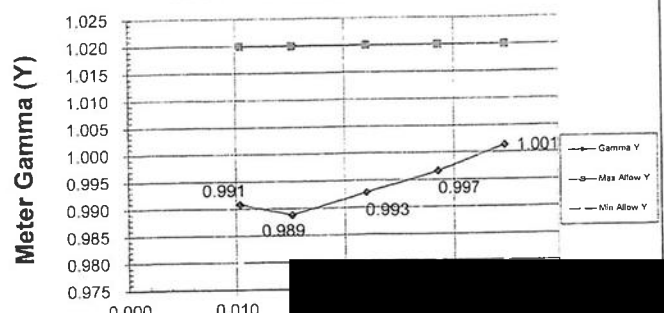
Meter Pressure vs Flowrate



Console Serial: 1110070

Console Model: XC-572-V

Meter Gamma vs Flowrate



Console Serial: 1110070

TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

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

Calibration Conditions

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

Reference Equipment

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

Temperature Sensor Calibration

Reference Point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	39.0	-1.0
3	93.0	94.0	-1.0
4	149.0	150.0	-1.0
5	260.0	261.0	-1.0
6	371.0	372.0	-1.0
7	482.0	483.0	-1.0
8	593.0	593.0	0.0
9	816.0	815.0	1.0
10	1038.0	1038.0	0.0
Maximum ¹			1.0

PASS

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

DGM Out Temperature Sensor Calibration

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

Difference Range

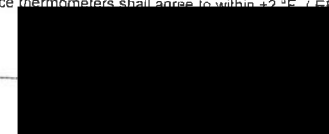
Temp. Difference $\pm 2^{\circ}\text{F}$ or $\pm 1.1^{\circ}\text{C}$

PASS

Note

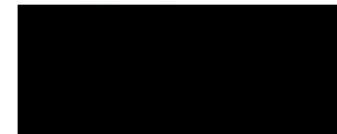
The temperatures of the thermocouple and reference thermometers shall agree to within $\pm 2^{\circ}\text{F}$ (EPA Method 5, section 10.5)

Approved By :



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DRY GAS METER MC-572-V

Serial No. : 1007055

Certificate Of Calibration

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

Meter Console Information

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

Calibration Condition

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

Factors/Conversion

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

Reference Equipment

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

UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
e	P _{avg}	V _{std}	V _{ref}	t _{in}	t _{out}	V _{std}	V _{ref}	t _{in}	t _{out}
15.00	13.0	107.7550	107.9221	29	30	68.41024	68.57350	28	27
10.00	25.0	107.9308	108.0876	30	30	68.58202	68.73488	27	27
8.00	50.0	108.1027	108.2822	30	30	68.74958	68.92516	27	27
7.00	80.0	108.3029	108.5061	30	30	68.94550	69.14488	27	27
5.00	120.0	108.5139	108.6908	30	30	69.15251	69.32550	27	27

Standardized Data

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

Pass/Fail Result: **Pass**

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

Note: For ΔH_{std}, 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 ±0.2 inches (5.1mm) H₂O

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Date: 04-Aug-24

Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Nomenclature

P_a - Barometric Pressure
 DGM - Dry Gas Meter
 K₁ - Constant based on standard temp and press
 t - Run time, in minutes
 P_m - ΔH (Meter Pressure, gauge)
 V_m - Volume collected by test meter, corrected for STP
 Q_{m(stp)} - Calculated flow rate of test meter
 K' - Critical orifice coefficient
 P_w - Measured pressure of reference meter
 t_w - Temperature measured in reference meter
 t_m - Temperature measured in test meter
 Y - Ratio of volume collected from test meter and orifice
 sc - Scaling Factor
 Counts_{std} - Number of pulse counts, standardized
 C_{total} - Number of raw pulse counts of a calibration run

Equations

$$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_w}{1.315})}{T_w}$$

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

$$Counts_{std} = K_1 \frac{C_{total} * (P_{bar} - \frac{P_w}{1.315})}{T_m}$$

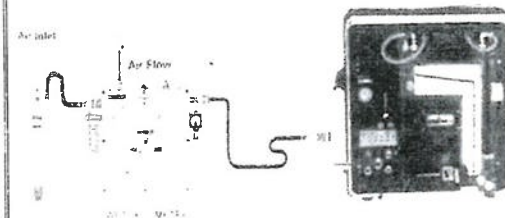
$$Q_{w(std)} = \frac{V_{w(std)}}{t}$$

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

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

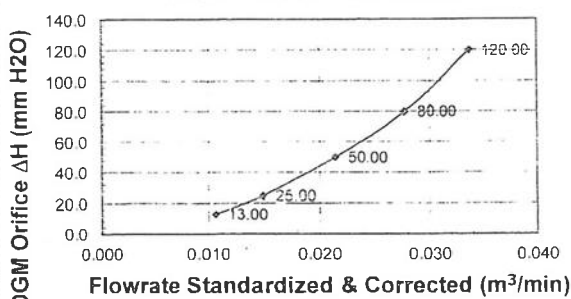
$$Metric \Delta H = \frac{P_w * 101.325}{P_{std} - P_w} * \left(\frac{T_w - T_{std}}{T_w} \right)$$

Calibration Train



Calibration Graphs

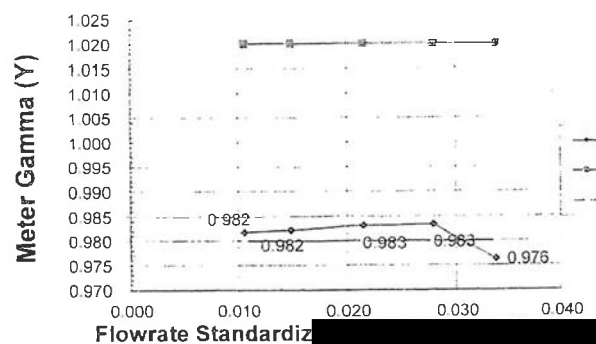
Meter Pressure vs Flowrate



Console Serial: 1007055

Console Model: MC-

Meter Gamma vs Flowrate



Console Serial: 1007055

TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model	MC-S72-V
Console Serial	1007055
Temp Indicator Model	765-KF
Temp Indicator Serial	JC17852

Calibration Conditions

Cal Date	04-Aug-24
Due Date	04-Aug-25
Cal Report No	WDS-SV6707001
Ambient Temp (°C)	25
Pressure (mm Hg)	750
Humidity (%)	60

Reference Equipment

Temp Meter Model	Fluke 714B
Serial No	60590035
Cal Date	07-Apr-24
Temp Meter Model	Fluke 179
Serial No	59620112
Cal Date	06-Feb-24

Temperature Sensor Calibration

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

PASS

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.

DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ice	0.0	0.0	0.0
Ambient	26.9	27.0	-0.1
Heat	114.5	115.0	-0.5

Difference Rang

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

PASS

Note

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

Approved By :

Patpasu Chaisana
(Patpasu Chaisana)
Service Manager

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED

DRY GAS METER XC-572-V

Serial No. : A2007510

Certificate Of Calibration

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

Meter Console Information

Console Model : XC-572-V
 Console serial : A2007510
 DGM Model #: SK25EX
 DGM Serial #: 00005115

Calibration Condition

Cal. Date: 30-Aug-24
 Due Date: 30-Aug-25
 Cal. Report No.: WDS-SV6708010
 Ambient Temp (°C): 25
 Pressure (mm Hg): 758
 Relative Humidity (%): 60

Factors/Conversion

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

Reference Equipment

WTM Model: W-NKoDa-5B WTM Cal. Due Date: Dec 2024
 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	814.2810	814.4438	26	26	77.39845	77.56182	28	27
10.00	25.0	814.4657	814.6233	26	27	77.58371	77.74136	27	27
8.00	50.0	814.6427	814.8218	27	27	77.76069	77.93943	27	27
7.00	80.0	815.2310	815.4323	28	28	78.34575	78.54534	29	28
5.00	120.0	815.4512	815.6222	28	28	78.58461	78.73859	28	28

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
$V_{m(std)}$ (m ³)	$Q_{m(std)}$ m ³ /min	$V_{w(std)}$ (m ³)	$Q_{w(std)}$ m ³ /min	(Y)	(ΔY)	$Q_{m(std)}$	ΔH_{sc}	$\Delta \Delta H_{sc}$
0.159	0.011	0.159	0.011	0.997	0.002	0.011	51.276	3.517
0.154	0.015	0.154	0.015	0.996	0.002	0.015	46.891	-0.868
0.175	0.022	0.174	0.022	0.994	-0.001	0.022	46.793	-0.966
0.197	0.028	0.193	0.028	0.982	-0.013	0.028	46.623	-1.136
0.168	0.034	0.169	0.034	1.005	0.010	0.034	47.211	-0.547
				0.995	= Y Avg.		47.759	= ΔH_{sc} 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

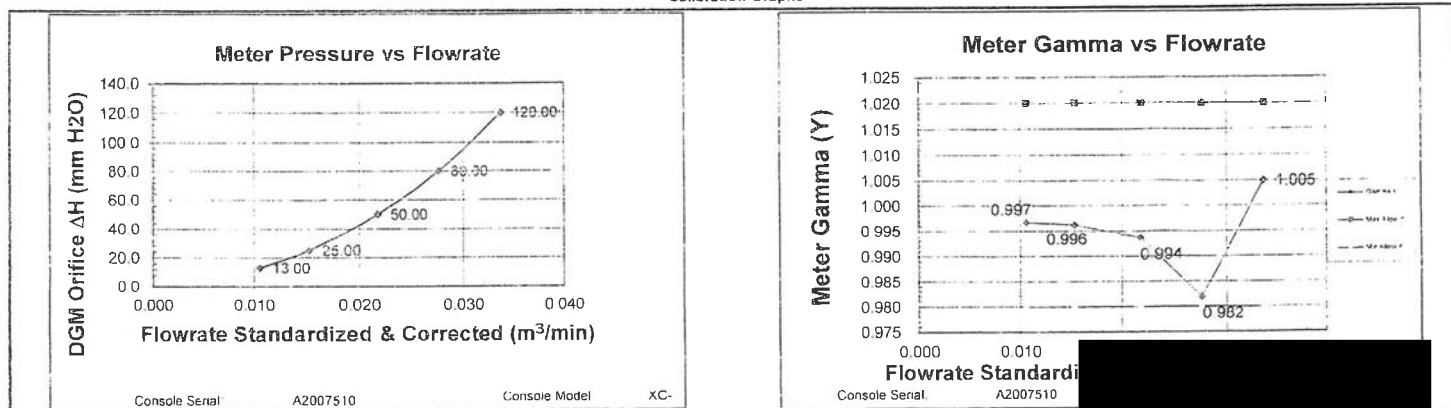
Note: For ΔH_{sc} , orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ± 2 inches (5.1mm) H₂O

Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Nomenclature	Equations	Calibration Train
<p>P_b - Barometric Pressure</p> <p>DGM - Dry Gas Meter</p> <p>K_1 - Constant based on standard temp and press</p> <p>Θ - Run time, in minutes</p> <p>P_m - ΔH (Meter Pressure, gauge)</p> <p>V_m - Volume collected by test meter, corrected for STP</p> <p>$Q_{m(std)}$ - Calculated flow rate of test meter</p> <p>K' - Critical orifice coefficient</p> <p>P_w - Measured pressure of reference meter</p> <p>T_w - Temperature measured in reference meter</p> <p>T_m - Temperature measured in test meter</p> <p>Y - Ratio of volume collected from test meter and orifice</p> <p>sc - Scaling Factor</p> <p>Counts_{std} - Number of pulse counts, standardized</p> <p>Counts_{total} - Number of raw pulse counts of a calibration run</p>	$V_{w(std)} = Y * K_1 \frac{V_w * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_w}$ $V_{m(std)} = Counts_{std} * Y_{sc(avg)}$ $Counts_{std} = K_1 \frac{Counts_{total} * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_m}$ $Q_{w(std)} = \frac{V_{w(std)}}{\Theta} \quad Y_{sc} = \frac{V_{w(std)}}{Counts_{std}}$ $K_1 = \frac{T_{std}}{P_{std}}$ $Metric \Delta H_{sc} = \frac{P_{bar} - 0.9811658 * (P_{bar} + \frac{P_{m(g)}}{13.6})}{T_w} * \left(\frac{T_w * \Theta}{V_w * P_{bar}} \right)^2$	

Calibration Graphs



TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model	XC-572-V
Console serial	A2007510
Temp Indicator Model	765-KF
Temp Indicator Serial	JC17819

Calibration Conditions

Cal Date	30-Aug-24
Due Date	30-Aug-25
Cal Report No	WDS-SV6708010
Ambient Temp (°C)	25
Pressure (mm Hg)	759
Humidity (%)	60

Reference Equipment

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

Temperature Sensor Calibration

Reference Point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-18.0	0.0
2	38.0	38.0	0.0
3	93.0	93.0	0.0
4	149.0	149.0	0.0
5	260.0	260.0	0.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	593.0	0.0
9	816.0	817.0	-1.0
10	1038.0	1039.0	-1.0
Maximum ¹			1.0

PASS

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

DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ice	0.0	0.0	0.0
Ambient	27.6	28.0	-0.4
Heat	116.3	116.0	0.3

Difference Range

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

PASS

Note

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

Approved By : _____

Flue gas Analyzer

Testo 350 New

Serial No. 63455616/0722



Certificate No: G 670713
Date of issue : 09-Oct-24

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 no. : -
Customer name : Eastern Thai Consulting 1992 Company Limited
Customer address : 683 Moo 11, Sukhapibarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 3 Pages
Receiving no. : L-243862
Receiving date. : 03-Oct-24
Parameter of calibration : Gas Calibration(Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.18,302,1007 ppm, Nitrogen Dioxide 30.68, 81.8, 201.9 ppm, Nitric Oxide 30.0, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

Condition of UUC. : Used
Ambient condition : All of the Measurment were caried out the stabilized labotary
Temperature : 23 ±5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210 THAILAND

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition. This Calibration Certificate may not be 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 tracebility to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 09-Oct-24



Certificate No.: G 670713

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.18 ppm	CG-0002-24	Nimt	11-Jan-29
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1007 ppm	1870/24	Linde	17-Jun-26
Nitrogen Dioxide (NO2) 30.68 ppm	2832/24	Linde	08-Sep-24
Nitrogen Dioxide (NO2) 81.8 ppm	2330/24	Linde	01-Aug-26
Nitrogen Dioxide (NO2) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.0 ppm	CG-0065-24	Nimt	06-May-26
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.9 °C Humidity : 66.4 %RH Pressure : 1011.5 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,300 ml/min Gas pressure : 1014.8 mbar

Calibration Results (Befor adjustment) (Table 2)

Parameter of Standard	Standard	Mean of		Error	Uncertainty
	Values	UUC			
O2 (%Vol)	2.50	2.43	-0.07		0.15
O2 (%Vol)	10.04	9.92	-0.12		0.20
O2 (%Vol)	21.02	21.11	0.09		0.30
CO (ppm)	80.18	74	-6.18		3.0
CO (ppm)	302	295	-7		6.0
CO (ppm)	1007	996	-11		12
NO2 (ppm)	30.68	32.2	1.52		8.0
NO2 (ppm)	81.8	81.5	-0.3		8.0
NO2 (ppm)	201.9	204.3	2.4		12
NO (ppm)	30.0	27	-3.0		8.0
NO (ppm)	151.5	146	-5.5		8.0
NO (ppm)	322.5	305	-17.5		12
SO2 (ppm)	50.36	48	-2.36		6.0
SO2 (ppm)	100.8	97	-3.8		6.0
SO2 (ppm)	600.8	591	-9.8		13

Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.43	-0.70	0.15
O2 (%Vol)	10.04	9.92	-0.12	0.20
O2 (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.18	80	-0.18	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1007	1008	1	12
NO2 (ppm)	30.68	32.2	1.52	8.0
NO2 (ppm)	81.8	81.5	-0.3	8.0
NO2 (ppm)	201.9	204.3	2.4	12
NO (ppm)	30.0	31	1.0	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	321	-1.5	12
SO2 (ppm)	50.36	51	0.64	6.0
SO2 (ppm)	100.8	102	1.2	6.0
SO2 (ppm)	600.8	604	3.2	13

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

End of Report

เรื่อง อายุการใช้งานโดยประมาณของ Gas Sensor

เรียน ท่านผู้ใช้งานฝ่ายจัดซื้อทราบ

เนื่องจากเครื่องมือวัด/วิเคราะห์แก๊สที่ทางบริษัท เอ็นเทค อินดัสเทรียล โซลูชั่น จำกัด ได้จำหน่ายให้แก่ท่านประกอบไปด้วย Sensor ที่มีโครงสร้างจาก Electrochemical หรือ วัสดุที่มีการเสื่อมอายุได้ ดังนั้น Sensor ที่ติดตั้งในเครื่อง จึงสามารถเสื่อมสภาพ ตามอายุการใช้งานได้

บริษัทฯ ได้ตระหนักถึงความสำคัญ ในการใช้งานเครื่องมือของท่าน ซึ่งจำเป็นต้องใช้อย่างต่อเนื่องและต้องการความถูกต้องแม่นยำตลอดเวลา บริษัทฯ จึงได้จัดทำตารางสำหรับตรวจสอบอายุการใช้งานและระยะเวลา ที่จะเปลี่ยน Sensor ครั้งต่อไปให้กับท่าน เพื่อความสะดวกในการดูแลรักษาและสั่งซื้อ Spare Sensor ก่อนที่ Sensor จะหมดอายุการใช้งาน ดังนี้

ใบรายงานอายุการใช้งานของ Gas Sensor									
อ้างอิงเอกสารเลขที่				AI-SV-RP-2407044		ชื่อลูกค้า		บริษัท อีสเทิร์น ไทยคอนซัลติง 1992 จำกัด	
ชื่อเครื่องมือ				Testo 350NEW		S/N		63455616/0722	
ส่วนที่ 1 : ตารางอายุการใช้งาน Sensor					ส่วนที่ 2 : Sensor ที่ติดตั้งในเครื่องของท่าน				
ข้อ	ชื่อ Sensor	ใช้สำหรับ	อายุ Sensor (เดือน)	การรับประกัน (เดือน)	Sensor (Part number)	วันที่สิ้นสุดการรับประกัน	วันที่หมดอายุตามปกติ	วันที่แนะนำให้สั่งซื้อครั้งต่อไป	หมายเหตุ
1	All sensor	Testo 3xx	24-36	12					
2	O2 (0390 0070)	Testo 200,335,350 M/XL	18-24	18					
3	O2,CO	Testo 327-I/-2, 320, 310	30	24					
4	O2 (0393 0000)	Testo 340/ 350, 2010	18-24	18					
5	O2,CO	Testo 330 L.L., L.L., 2010	48-60	48					
6	NO,NO ₂ low	Testo 330 L.L., L.L., 2010	36-48	24					
7	CO2 IR	Testo 350 M/XL, 350, 2010	48-60	24					
8	O2 (0393 0000)	Testo 340,350, 2010	18-24	18					
หมายเหตุ					รายละเอียดอื่น ๆ				
อายุการใช้งานของ Sensor อาจเสื่อมสภาพช้าหรือเร็วกว่ากำหนด ขึ้นอยู่กับเงื่อนไขการใช้งาน ปริมาณความเข้มข้นแก๊ส จำนวนครั้ง และปัจจัยอื่น ๆ ในการใช้งานด้วย					เนื่องจาก CO sensor วัดค่าได้ไม่เกิน 10,000 ppm หากวัดค่าเกินถือว่าอยู่นอกเหนือการรับประกัน				

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182

NSC-TISI-TIS17025
CALIBRATION 0152

Page 1 of 3

CERTIFICATE OF CALIBRATION

Certificate No. : 24-164691

Sample Code : 24-67405-001

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

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

Date of Receipt : 19 December 2024 Date of Calibration : 19 December 2024

Condition of Calibration

1. Environment
- | | |
|---------------------------|---|
| 1.1 Ambient temperature | : Maximum 32.0 °C ; Minimum 31.0 °C |
| 1.2 Relative humidity | : Maximum 48.5 % ; Minimum 43.5 % |
| 1.3 Line voltage supplied | : Maximum 226.3 VAC ; Minimum 222.0 VAC |

2. Calibration method

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

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-11 (RTD-138 to RTD-146)	24-040191	07 April 2025

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

NSC-TISI-TIS17025
CALIBRATION 0152

Page 2 of 3

REPORT OF CALIBRATION

Certificate No. : 24-164691

Sample Code : 24-67405-001

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor <i>k</i>
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{fixed}		
104	103.5	103.5	104.14	104.15	103.80	104.15	104.09	104.19	103.85	103.65	104.22	0.47	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
104	0.07	0.63	0.69

Notes

- UUC* = Unit Under Calibration

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

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

NSC-TISI-TIS17025
CALIBRATION 0152

Page 3 of 3

REPORT OF CALIBRATION

Certificate No. : 24-164691

Sample Code : 24-67405-001

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

3. Air valve or fresh air level : Off

4. Fan level : Open

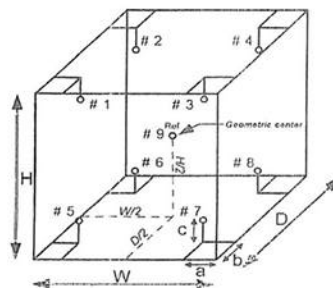
5. The quoted uncertainty includes "Stability of chamber and loading effect
in chamber at 20% of uniformity".6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference
location which are observed at the same time.

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.

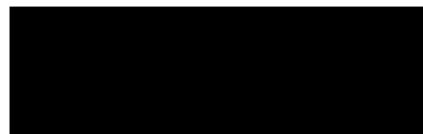
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.

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 -



UV/VIS SPECTROPHOTOMETER

Model : UV-1800

Serial No. : A11635101643 CD



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



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-153/25
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11635101643 CD
ID No. LABE 03/2
Date of receipt 21 April 2025
Date of calibration 21 April 2025
Date of issue 25 April 2025

Customer name Eastern Thai Consulting 1992 Co., Ltd.

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

Temperature (24.7-26.8) °C (On site)
Humidity (36.9-46.2) %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. 114485 and 114511
Photometric Accuracy is traceable to certificate No. 119612 and 114653
Stray Light is traceable to certificate No. 114484
The above certificate are traceable to SI unit through Sarna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Phongpak Sonbunchu

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 Floor7 Rama4 Road
Silom Bangrak Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6375496-7
www.barascientific.com



Certificate of Calibration

Certificate No. BSCC-UV-153/25

Number of Page(s) 2 of 3

Calibration Results:

1.Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (±nm)
287.71	287.70	-0.01	0.18
445.82	445.87	0.05	0.18
536.52	536.52	0.00	0.18
741.02	741.05	0.03	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 0.7404	-0.0001 0.7416	-0.0001 0.0012	0.0075 0.0075
257	CNR CNR	CNR CNR	CNR CNR	CNR CNR
313	CNR CNR	CNR CNR	CNR CNR	CNR CNR
350	0.0000 0.6397	0.0000 0.6398	0.0000 0.0001	0.0075 0.0075

*CNR = Customer not request

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Silom Bangrak Bangkok Thailand 10500
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Certificate of Calibration

Certificate No. BSCC-UV-153/25

Number of Page(s)

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Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty ($\pm A$)
420.0	0.0000	0.0001	0.0001	0.0042
	0.5733	0.5712	-0.0021	0.0042
	0.7113	0.7097	-0.0016	0.0042
	1.0164	1.0150	-0.0014	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5581	0.5559	-0.0022	0.0042
	0.6996	0.6975	-0.0021	0.0042
	1.0000	0.9984	-0.0016	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
	0.5217	0.5202	-0.0015	0.0042
	0.6970	0.6947	-0.0023	0.0042
	0.9982	0.9969	-0.0013	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
	0.5630	0.5620	-0.0010	0.0042
	0.7615	0.7594	-0.0021	0.0042
	1.0953	1.0943	-0.0010	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)		
	Wavelength (nm)	Transmission (%T)	Absorbance (A)
201.10 \pm 0.11nm	200.85	0.9740	2.0116

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

*Stray Light not NSC-ONSC Accredited.

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

The above results are valid exclusively for the purpose of
Advertising the report / Certificate and
except in full, without written approval of the Bara Scientific Co., Ltd.

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645

Cert. No. : ACC24043

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No.: 34802645
ID No.: -

Condition As Found : GOOD

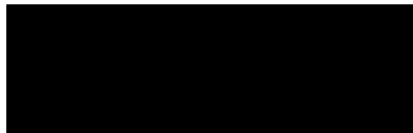
Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

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

Received Date : 09 SEPTEMBER 2024
Calibration Date : 26 SEPTEMBER 2024
Date of Issue : 26 SEPTEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :



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

Cert. No. : ACC24043

Job No. : VC67AC0150

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by follow 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 :

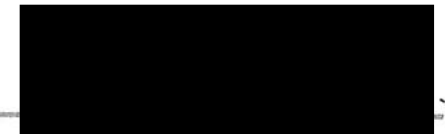
Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	33461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25
Audio Analyzer	AVR-3360A	V744B6069	EF-0009-24	09-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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



SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com

SITHIPORN
associates



Cert. No. : ACC24043
Job No. : VC67AC0150
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	93.97	-0.03	0.14	0.40

2. Frequency

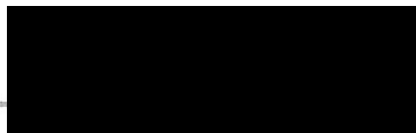
Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.15	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 -----



SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00222594



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

CALIBRATION CERTIFICATE

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

Instrument Calibrated :**Ambient Environment**

Description	: Sound Level Meter	Temperature	: $(23 \pm 3) ^\circ\text{C}$
Manufacturer	: Rion	Relative Humidity	: $(50 \pm 15) \%$
Model	: NL-42A	Ambient Pressure	: $(101.325 \pm 1.5) \text{ kPa}$
Serial No.	: 00222594		
Microphone	: UC-52 No.195906		
Preamplifier	: NH-24 No.15426		

Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
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 : 5 Feb. 2024**Date of Calibration** : 1 Mar. 2024

The results relate only to the items tested/calibrated or value
 Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written

FM.BL.MTC.002 Rev

Head Office
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

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

Calibration Procedure :

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

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

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

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

Date of Calibration : 1 Mar. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.92	114.1	113.9	0.0	1.0	0.30	N/A

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

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
25.1	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	11.6	0.10	N/A
C-Weight	17.2	0.10	N/A
Flat	22.7	0.10	N/A

Date of Calibration : 1 Mar. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.3	0.4	0.4	1.5	0.45	0.6
1 000	-0.1	-0.1	-0.1	1.0	0.45	0.6
8 000	0.3	0.4	0.2	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve (dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	0.0	0.0	2.0	0.20	0.6
125	0.0	0.1	0.0	1.5	0.20	0.6
250	0.0	0.1	0.0	1.5	0.20	0.6
500	0.0	0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.2	-0.1	-0.1	2.0	0.20	0.6
4 000	-0.3	-0.3	-0.3	3.0	0.20	0.6
8 000	0.0	0.0	-0.1	5.0	0.20	0.7

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

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

Date of Calibration : 1 Mar. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 10/0267

7. Level linearity on the reference level range

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
137	137.1	0.1	1.1	0.30	0.3
136	136.1	0.1	1.1	0.30	0.3
135	135.1	0.1	1.1	0.30	0.3
134	134.1	0.1	1.1	0.30	0.3
129	129.1	0.1	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.1	0.1	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.1	0.1	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.1	0.1	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	69.0	0.0	1.1	0.30	0.3
64	64.0	0.0	1.1	0.30	0.3

Date of Calibration : 1 Mar. 2024

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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 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
59	59.0	0.0	1.1	0.30	0.3
54	54.0	0.0	1.1	0.30	0.3
49	49.0	0.0	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3
39	39.0	0.0	1.1	0.30	0.3
34	34.0	0.0	1.1	0.30	0.3
29	29.0	0.0	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	26.9	-0.1	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	24.9	-0.1	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
30-130	94.0	94.0	0.0	1.1	0.30	0.3

Date of Calibration : 1 Mar. 2024

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FMBL.MTC.002 Rev.1

8. Level linearity including the level range control

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

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
30-130	35	35.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighling	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Fast	200	126.0	0.0	\pm 1.0	0.20	0.3
	2	108.9	-0.1	+1.0; -2.5	0.20	0.3
	0.25	99.9	-0.1	+1.5; -5.0	0.20	0.3
Slow	200	119.5	-0.1	\pm 1.0	0.20	0.3
	2	99.9	-0.1	+1.0; -5.0	0.20	0.3
SEL	200	120.0	0.0	\pm 1.0	0.20	0.3
	2	100.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	90.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 1 Mar. 2024

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FMBL.MTC.002 Rev.1



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL, BP, 10/0267

10. Peak C sound level

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

11. Overload indication

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

12. High-level stability

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

Approved by

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 1 Mar. 2024

Date of Issue : 4 Mar. 2024

End of Certificate

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FM.BL.MTC.002 Rev.1

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ANALYTICAL BALANCE (DU)

Model : XS205DU


Serial No. : 1126323724

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5846/4 - 846/5 Lasalle Rd., Bangna Tai
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham
City: Sriracha Contact: Sasiporn Nakin
Zip / Postal: 20230
State / Province: Chonburi
Order Number: 
0 3 3 3 3 1 9 6 1 9

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XS205DU Asset Number: LABE 05/1
Serial No.: 1126323724 Terminal Model: SAT
Building: Laboratory Terminal Serial No.: 1126323724
Floor: 1 Terminal Asset No.: N/A
Room: Analytical Balance

Range	Max. Capacity	Readability (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

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

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

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

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

As Found	Temperature		Humidity	
	Start: 25.7 °C	End: 25.8 °C	Start: 50.9 %	End: 50.6 %

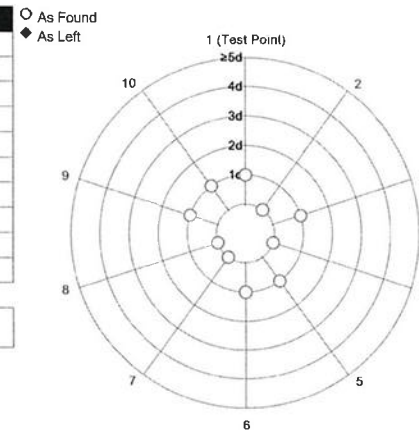
Measurement Results

Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00004 g	N/A
2	70.00005 g	N/A
3	70.00004 g	N/A
4	70.00005 g	N/A
5	70.00006 g	N/A
6	70.00004 g	N/A
7	70.00005 g	N/A
8	70.00005 g	N/A
9	70.00006 g	N/A
10	70.00006 g	N/A

Standard Deviation	0.000008 g	N/A
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

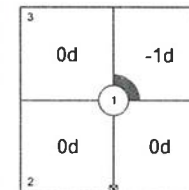
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	100.0000 g	N/A

Maximum Deviation	0.0001 g	N/A
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As Found

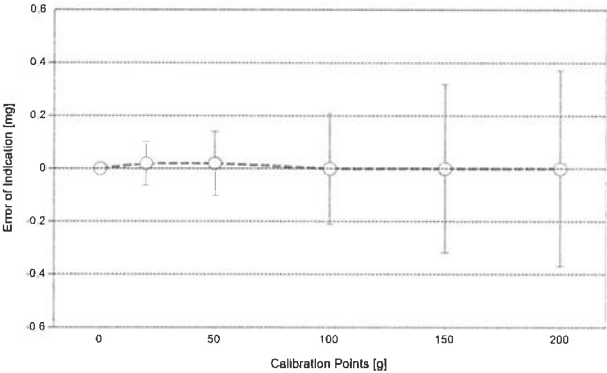
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.020 mg	2
3	0.10000 g	0.10000 g	0.00000 g	0.023 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg	2
5	4.99998 g	5.00000 g	0.00002 g	0.048 mg	2
6	10.00001 g	10.00001 g	0.00000 g	0.061 mg	2
7	19.99999 g	20.00001 g	0.00002 g	0.082 mg	2
8 *	50.00003 g	50.00005 g	0.00002 g	0.12 mg	2
9	100.00000 g	100.00000 g	0.00000 g	0.21 mg	2
10	150.00000 g	150.00000 g	0.00000 g	0.32 mg	2
11	200.00000 g	200.00000 g	0.00000 g	0.37 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.

The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.
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.: WS37 Date of Issue: 17-Jun-2024
Certificate Number: 186753-1 Calibration Due Date: 20-Jan-2025

Weight Set 2: OIML E2

Weight Set No.: WS87 Date of Issue: 04-Jul-2023
Certificate Number: 186520 Calibration Due Date: 02-Jan-2025

Thermo Hygrometer

Equipment No.: IN279 Date of Issue: 19-Jun-2024
Certificate Number: SG-H-00577/67 Calibration Due Date: 17-Jun-2025

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 · 10⁻⁸ / K
Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

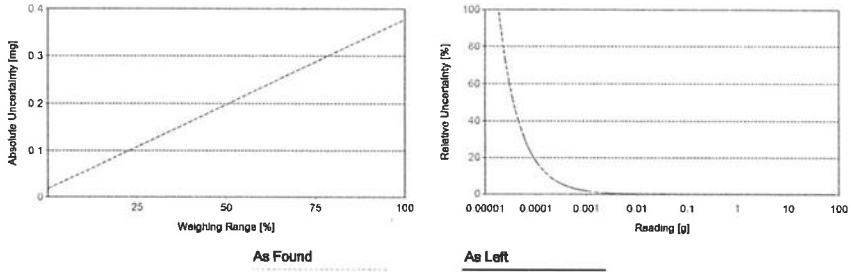
Linearization of Uncertainty Equation

Range		As Found		As Left
d	Max			
1	0.00001 g	81 g	U ₁ = 0.018 mg + 0.00444 mg/g · R	N/A
2	0.0001 g	220 g	U ₂ = 0.06 mg + 0.00439 mg/g · R	N/A

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

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

Net Indication	As Found		As Left	
0.00220 g	0.018 mg	0.82%	N/A	N/A
0.02200 g	0.018 mg	0.082%	N/A	N/A
0.22000 g	0.019 mg	0.0086%	N/A	N/A
2.20000 g	0.028 mg	0.0013%	N/A	N/A
220.0000 g	1.0 mg	0.00047%	N/A	N/A



The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

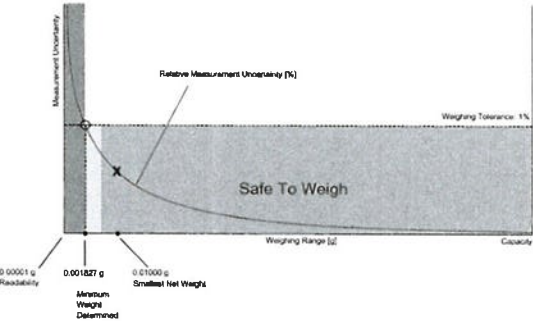
The weighing device meets the given process requirements.

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

Process Requirements

Weighing Tolerance: 1% | Smallest Net Weight: 0.01000 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 of the uncertainty as it was performed.

Minimum Weight

As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036842 g	0.055511 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036842 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

The minimum weight table applies to the fine range of the weighing device.

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

As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036842 g	0.055511 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036842 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

The minimum weight table applies to the fine range of the weighing device.

✓ 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.

Measurement Results

Results Summary

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

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 70 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.000005 g	0.000008 g	✗	0.000008 g	✗
0.2%	0.000010 g		✓		⚠
0.5%	0.000025 g		✓		✓
1%	0.000050 g		✓		✓
2%	0.000100 g		✓		✓
5%	0.000250 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	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

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

Error of Indication

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
19.99999 g	0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
50.00003 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0000 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
19.99999 g	0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
50.00003 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0000 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.

ANALYTICAL BALANCE

Model : SECURA224-1S

Serial No. : 0036707137

Certificate No. : 24-164695
Sample Code : 24-67405-005

CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 19 December 2024

Date of Calibration : 19 December 2024

Calibrated by Mr. Thanadol Pholthep
Scientist

Approved by

Issue date 20 December 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 of calibration.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Measurement Capability Development Center (TLCDC) to 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. : 24-164695
Sample Code : 24-67405-005

REPORT OF CALIBRATION

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

Result of Calibration

1. Test weight and repeatability of reading

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

Unit : g	Range : 220	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input checked="" type="checkbox"/> No adjustment	Nominal value	100	200
<input type="checkbox"/> Adjustment	Standard weight	100.000016	200.000028
	Average reading of indicator	100.0000	200.0000
	Standard deviation	0.00005	0.00005
Unit : -	Range : -	<input type="checkbox"/> Before adjustment	<input type="checkbox"/> After adjustment
<input type="checkbox"/> No adjustment	Nominal value	-	-
<input type="checkbox"/> Adjustment	Standard weight	-	-
	Average reading of indicator	-	-
	Standard deviation	-	-

Certificate No. : 24-164695
Sample Code : 24-67405-005

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 : 220

Range :

Test Point	Sensitivity, S	Test Point	Sensitivity, S
0	0.9998	-	-
100	0.9998	-	-
200	0.8998	-	-

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	0.000094	2.01
0.01	0.0100015	0.0100	0.0000	0.000094	2.01
0.1	0.1000064	0.1000	0.0000	0.000094	2.01
1	1.0000017	1.0000	0.0000	0.000095	2.01
2	2.0000049	2.0000	0.0000	0.000095	2.01
5	5.0000012	5.0000	0.0000	0.000096	2.01
10	9.999992	10.0000	0.0000	0.000097	2.01
20	20.000042	20.0000	0.0000	0.00010	2.01
50	50.000046	50.0000	0.0000	0.00012	2.01
100	100.000016	100.0000	0.0000	0.00016	2.00
200	200.000028	200.0000	0.0000	0.00028	2.00

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of UKAS M3003.

Certificate No. : 24-164695
Sample Code : 24-67405-005

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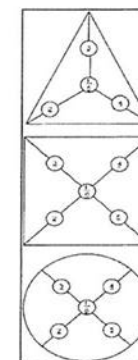
REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-center loading

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

Weighing pan	<input checked="" type="radio"/> Circle <input type="radio"/> Triangular <input type="radio"/> Rectangular	Test weight : 100 Unit : g
Range	220	
Position	Reading of indicator	Reading of indicator
1	99.9999	-
2	100.0001	-
3	99.9999	-
4	99.9998	-
5	99.9999	-
6	99.9999	-
Maximum difference	0.0002	-



Condition of Calibration

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

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

3. Condition of Calibration item: Normal

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

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

5. Reference standard instrument :

Instrument	Class	ID No.	Certificate No.	Due Date
1) STANDARD WEIGHT 1 mg to 1 kg	E2	LB-WE-78	24-097116	02 August 2025

- End of Report -

6. Ambient conditions	Min	Max
Temperature (°C)	25.0	25.4
Relative Humidity (%Rh)	39.8	41.0
Air pressure (hPa)	1011.0	1012.1

BOD INCUBATOR

Model : LABE 19/3



Page 1 of 3

CERTIFICATE OF CALIBRATION

Certificate No. : 24-089291

Sample Code : 24-35676-001

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

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

Equipment : Temperature controlled enclosures (Incubator)

Manufacturer : ผู้ผลิตเครื่องเรือน Model : N/A

Serial No. : S43020027 ID No. : LABE 19/3

Date of Receipt : 16 July 2024 Date of Calibration : 16 July 2024

Condition of Calibration

1. Environment
- | | | | | | | |
|---------------------------|---|---------|-----------|---|---------|-----------|
| 1.1 Ambient temperature | : | Maximum | 30.6 °C | : | Minimum | 28.9 °C |
| 1.2 Relative humidity | : | Maximum | 76.9 % | : | Minimum | 69.4 % |
| 1.3 Line voltage supplied | : | Maximum | 219.8 VAC | : | Minimum | 217.1 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-P1100)	LB-DA-12 (RTD-168 to RTD-176)	24-045389	28 April 2025

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. Pattanapong Pulngern

Scientist

Approved by

Issue date 17 July 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

This Certificate is Issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation

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



Page 2 of 3

REPORT OF CALIBRATION

Certificate No. : 24-089291

Sample Code : 24-35676-001

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor <i>k</i>
			#1	#2	#3	#4	#5	#6	#7	#8	#9 ^{Rev}		
20	20.0	20.0	20.56	20.45	20.01	19.85	20.21	20.25	20.17	20.05	20.11	0.24	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.08	0.50	0.87

Notes

- UUC* = Unit Under Calibration

Calibrated by Mr. Pattanapong Pulngern

Scientist

Approved by

Issue date 17 July 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

This Certificate is Issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation

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

REPORT OF CALIBRATION

Certificate No. : 24-089291

Sample Code : 24-35676-001

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 = 70 cm ; D = 55 cm ; H = 140 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.

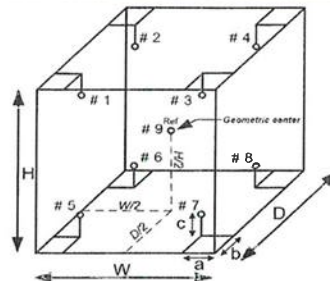


Figure: Example of sensor
installation Positions

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 M3000.

- End of Report -

BOD INCUBATOR

Model : LABE 19/5

CERTIFICATE OF CALIBRATION

Certificate No. : 25-042561
Sample Code : 25-18090-002Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapibarn 8 Rd., Nongkham,
Sriracha, Chonburi 20230Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(Laboratory)

Equipment : Temperature controlled enclosures (Incubator)

Manufacturer : Lovibond Model : TC 445 S

Serial No. : 0520/005227 ID No. : LABE 19/5

Date of Receipt : 20 March 2025 Date of Calibration : 20 March 2025

Condition of Calibration

1. Environment
- | | |
|---------------------------|---|
| 1.1 Ambient temperature | : Maximum 29.9 °C ; Minimum 27.5 °C |
| 1.2 Relative humidity | : Maximum 51.9 % ; Minimum 43.4 % |
| 1.3 Line voltage supplied | : Maximum 239.4 VAC ; Minimum 232.8 VAC |

2. Calibration method

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

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-11 (RTD-148 to RTD-155, RTD-227)	24-040190	03 April 2025

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. Pattanapong Pulngern
Scientist

Approved by

Issue date 24 March 2025

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.

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

REPORT OF CALIBRATION

Certificate No. : 25-042561

Sample Code : 25-18090-002

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{Ref}		
20	20.5	20.5	19.91	19.78	19.82	19.86	19.78	19.85	19.93	19.63	19.79	0.38	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
20	0.28	0.25	0.83

Notes

- UUC* = Unit Under Calibration

NSC-TISI-TIS17025
CALIBRATION 0152

Page 3 of 3

REPORT OF CALIBRATION

Certificate No. : 25-042561

Sample Code : 25-18090-002

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.

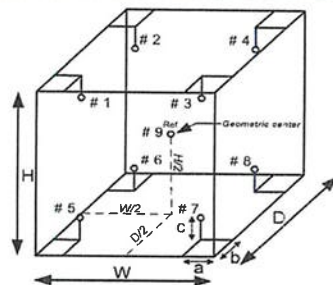


Figure: Example of sensor
Installation Positions

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 M3000.

- End of Report -

Hot Air Oven

Model : UM 400

Serial No. : 900982



Page 1 of 3

CERTIFICATE OF CALIBRATION

Certificate No. : 24-164692

Sample Code : 24-67405-002

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

Location of Calibration : EASTERN THAI CONSULTING 1992 CO., LTD.
(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 : 19 December 2024 Date of Calibration : 19 December 2024

Condition of Calibration

1. Environment
- | | |
|---------------------------|---|
| 1.1 Ambient temperature | : Maximum 32.1 °C ; Minimum 30.4 °C |
| 1.2 Relative humidity | : Maximum 48.9 % ; Minimum 42.4 % |
| 1.3 Line voltage supplied | : Maximum 226.3 VAC ; Minimum 221.0 VAC |

2. Calibration method

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

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-11 (RTD-148 to RTD-155, RTD-227)	24-040190	03 April 2025

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. Nophanon Anusak
Scientist

Approved by

Issue date 20 December 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).



Page 2 of 3

REPORT OF CALIBRATION

Certificate No. : 24-164692

Sample Code : 24-67405-002

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{ref}		
85	85.0	85.0	85.33	85.28	84.83	85.01	85.15	85.18	85.32	85.12	85.23	0.25	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.10	0.43	0.69

Notes

- UUC* = Unit Under Calibration

REPORT OF CALIBRATION

Certificate No. : 24-164692

Sample Code : 24-67405-002

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm ($a \times b \times c$) 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.

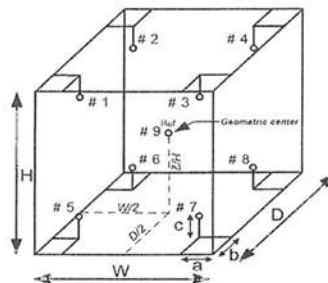


Figure: Example of sensor
installation Positions

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 -

LIQUID IN GLASS THERMOMETER

Model / Type : 0-100 °C

Serial No. : 43560



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : LIQUID IN GLASS THERMOMETER
MANUFACTURER : AA PRECISION
MODEL / TYPE : 0-100 °C
SERIAL NO. : 43560[LABE 16/1]
CLID. NO. : 232403905
JOB CONTROL NO. : 241031116258
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

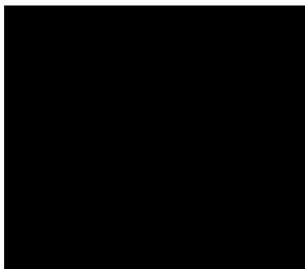
CUSTOMER : EASTERN THAI CONSULTING 1992 CO., LTD.
683 MOO 11, SUKHAPIBARN 8 RD,
NONGKHAM, SRIRACHA, CHONBURI 20230

DATE OF RECEIVED : 31 October 2024

DATE OF ISSUED : 05 November 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



05 November 2024

Approved By :



This Calibration Certificate documents the traceability to national standards, which realize the units
according to the International System of Units (SI)

Certificate No. Q24116258

F3-011-05/12-23



@clccalibration



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : LIQUID IN GLASS THERMOMETER
MANUFACTURER : AA PRECISION
MODEL / TYPE : 0-100 °C
SERIAL NO. : 43560[LABE 16/1]
DATE OF CALIBRATION : 04 November 2024

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPH-02 based on ASTM E 77-07 as calibration guidelines.
The calibration was performed by comparison with Calibration Bath, Precision Thermometer and IPRT
which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Calibration Bath, Kambic Model OB-22/2 ULT,OB-22/2 S/N. 17115653,17115654.
2. Precision Thermometer, ASL Model F200-A-8 S/N. 014433/03 with IPRT S/N. L0193A-1-1,PO106346-1-18.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q23136342,Q23126517. Due Date 20 December 2024,20 November 2024.
2. The measurements are traceable to International System of Units (SI), through Thailand Institute of Scientific and Technological Research (TISTR) and National Institute of Metrology (Thailand).
Certificate No. PSL-T 0203/67,TT-0136-23,TT-0110-24. Due Date 07 December 2024,12 December 2024,06 August 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied
by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement"

Certificate No. Q24116258

F3-011-05/12-23



@clccalibration



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukil 29 Yaek 4, Prasert Manukil Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC Reading were recorded and the means value were reported of four times measurement in the table below.

CALIBRATION DATA

CORRECTION OF TEMPERATURE

STD Reading (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty \pm (°C)
0.039	0.00	+0.039	0.065
25.003	25.00	+0.003	
50.008	50.00	+0.008	
100.013	100.00	+0.013	

Range : 0 °C to 100 °C

Graduation : 0.1 °C

Immersion Type : Total Immersion.

Correction of Reference Temperature (0 °C) = 0.039 °C

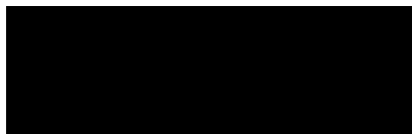
Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 56 of 67

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q24116258

F3-011-05/12-23



page 3 of 3



@dcalibration

pH Meter

Model : SevenCompact S220

Serial No. : B835349235

Certificate Number CCP-2401-24

Calibration Certificate SevenCompact™ pH/Ion Meter S220

Customer

Company EASTERN THAI CONSULTING 1992 CO., LTD.
Address 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham, Sriracha
Chonburi 20230
Customer ID number 301608441
Customer representative Sasiporn Nakin

Instrument

Type SevenCompact™ S220 Instrument serial number B835349235
Internal identification LABE 11/6 Firmware version 2.01.03

Technical Specifications

Measuring range -2000.0 ... 2000.0 mV -2.000 ... 20.000 pH
Resolution 0.1 mV 0.001 pH
Limit of error ± 0.2 mV; ± 0.1 mV in range -1000 ... 1000 mV ± 0.002 pH

Temperature range MTC -30.0 ... 130.0 °C
Temperature range ATC -5.0 ... 130.0 °C
Resolution 0.1 °C
Limit of error ± 0.1 °C

Procedure Statement

METTLER TOLEDO Certification SOP (Doc. No. 30027577) is used as referring documentation to adjust and certify the instrument indicated in the "Type" and "Serial number" section. The measurement results of this certification were obtained at ambient conditions.

Certificate Number CCP-2401-24

Certification Tools

Certified digital voltmeter Manufacturer Keysight Technologies Serial number MY60051376
Type 34401A Certificate number E1U2303781
Date of certification December 10, 2023

Certified temperature resistors Manufacturer METTLER-TOLEDO Serial number A425
Type 51302410 Certificate number 71447
Date of certification September 26, 2023

Designation	Nominal value	Certified value
NTC 30 kΩ, 0 °C	94.980 kΩ	94.941 kΩ
NTC 30 kΩ, 25 °C	30.000 kΩ	29.992 kΩ
NTC 30 kΩ, 50 °C	10.969 kΩ	10.975 kΩ
NTC 30 kΩ, 75 °C	4.528 kΩ	4.528 kΩ
NTC 30 kΩ, 100 °C	2.070 kΩ	2.069 kΩ
Pt1000, 0 °C	1.0000 kΩ	1.0001 kΩ
Pt1000, 25 °C	1.0974 kΩ	1.0974 kΩ
Pt1000, 50 °C	1.1940 kΩ	1.1940 kΩ
Pt1000, 75 °C	1.2899 kΩ	1.2900 kΩ
Pt1000, 100 °C	1.3851 kΩ	1.3852 kΩ

Certificate Number CCP-2401-24

Certification Measurements

pH/mV sensor Input

Designation	Certified value	Measured value	Max. tolerance	Passed / Failed
-1900 mV	-1900.0 mV	-1899.9 mV	0.2 mV	Passed
-1000 mV	-1000.0 mV	-999.9 mV	0.1 mV	Passed
-500 mV	-500.0 mV	-500.0 mV	0.1 mV	Passed
-180 mV	-180.0 mV	-180.0 mV	0.1 mV	Passed
0 mV	0.0 mV	0.0 mV	0.1 mV	Passed
180 mV	180.0 mV	179.9 mV	0.1 mV	Passed
500 mV	500.0 mV	499.9 mV	0.1 mV	Passed
1000 mV	1000.0 mV	999.9 mV	0.1 mV	Passed
1900 mV	1900.0 mV	1899.9 mV	0.2 mV	Passed

pH/mV sensor Input
at high Impedance

Designation	Measured low imp.	Measured high imp.	Max. difference	Passed / Failed
1900 mV	1899.9 mV	1899.9 mV	0.6 mV	Passed

Temperature sensor Input

Designation	Nominal value	Measured value	Max. tolerance	Passed / Failed
NTC 30 k Ω , 0 °C	0.0 °C	0.0 °C	0.1 °C	Passed
NTC 30 k Ω , 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
NTC 30 k Ω , 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
NTC 30 k Ω , 75 °C	75.0 °C	75.0 °C	0.1 °C	Passed
NTC 30 k Ω , 100 °C	100.0 °C	100.0 °C	0.1 °C	Passed
PT1000, 0 °C	0.0 °C	0.0 °C	0.1 °C	Passed
PT1000, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
PT1000, 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
PT1000, 75 °C	75.0 °C	75.0 °C	0.1 °C	Passed
PT1000, 100 °C	100.0 °C	100.0 °C	0.1 °C	Passed

Digital sensor Input with
pH sensor

Sensor recognition	The sensor was recognized correctly by the meter	Passed
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Summary of Certification

Certification of instrument

Passed

The instrument referred to in this certificate has fulfilled the criteria of the certification. This is indicated by the notation Passed above.

Remarks

Service Assignment ID : 0332980040-001

Certification of the instrument was performed by

Performance Test

Attachment to Certificate No. CCP-2401-24

pH Electrode

Type: InLab® Expert Pro-ISM

S/N: 2463982

Certified standards used

Standard 1:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: 7/Jul/2025
	Nominal value: pH (25.00 °C):	4.01	Lot No.: 1J188G
Standard 2:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: 10/Jul/2025
	Nominal value: pH (25.00 °C):	7.00	Lot No.: 1J191H
Standard 3:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: 23/Nov/2024
	Nominal value: pH (25.00 °C):	10.01	Lot No.: 1H327A
Standard 4:	Type: Redox Solution	Manufacturer: METTLER TOLEDO	Exp. date: -
	Nominal value: pH (25.00 °C):	-	Lot No.: -

Adjustment

Set Calibration Buffer	B1 (25 °C) 1.68, 4.01, 7.00, 10.01							
Select Calibration Mode Segment	3-Point calibration			2-Point calibration			2-Point calibration	
3-Point Calibration	°C	pH		°C	pH		°C	pH
Cal 1	ATC	27.1	4.01	ATC	-	-	ATC	-
Cal 2	ATC	27.0	7.00	ATC	-	-	ATC	-
Offset (mV)	6.1			-			-	
Slope % (or mV/pH)	98.5			-			-	
Cal 3	ATC	27.1	10.01					
Offset (mV)	6.1							
Slope % (or mV/pH)	98.1							

Measurements

Resolution: 2 Decimal places

As Found					As Left				
Buffer Values	Measured		Difference		Buffer Values	Measured		Difference	
pH	°C	pH	pH		pH	°C	pH	pH	
4.01	27.0	ATC	4.03	0.02	4.01	27.0	ATC	4.02	0.01
7.00	27.1	ATC	7.04	0.04	7.00	26.8	ATC	7.01	0.01
9.99	27.1	ATC	9.98	-0.01	9.99	27.1	ATC	10.01	0.02

Redox Measurement Result = - mV

Note: The difference result of calibrated electrode should be within +/- 0.05 pH

Remarks:

STANDARD WEIGHT 50 g

Certificate No. : 24-062445
Sample Code : 24-25551-001

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 23 May 2024

Date of Calibration : 03 June 2024

Calibrated by Mr. Somwang Sangdee
Scientist

Approved by

Issue date 04 June 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).

Certificate No. : 24-062445
Sample Code : 24-25551-001

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 Mass	Expanded Uncertainty	Maximum Permissible Error	ID No.
	(mg)		(mg)	± (mg)	
50 g	-0.343	49.999657 g	0.10	0.30	LABE 10/1

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3000.



Certificate No. : 24-062445

Sample Code : 24-25551-001

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 1.19 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-83	24-001894	11 January 2025

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

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

- End of Report -

STANDARD WEIGHT 100 g

Certificate No. : 24-079772
Sample Code : 24-31841-002

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 25 June 2024

Date of Calibration : 30 June 2024

Calibrated by Mr. Nawa Sisuwan
Scientist
Issue date 03 July 2024

Approved by

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

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. : 24-079772
Sample Code : 24-31841-002

REPORT OF CALIBRATION

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

Result of Calibration : ☒ Without adjustment ☐ Adjustment

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

Description	Deviation	Conventional Mass	Expanded Uncertainty	Maximum Permissible Error	ID No.
	(mg)		(mg)	± (mg)	
100 g	-0.173	99.999827 g	0.16	0.50	LABE 10/2

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



Certificate No. : 24-079772

Sample Code : 24-31841-002

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature $20^{\circ}\text{C} \pm 1.5^{\circ}\text{C}$, Relative humidity $50\% \pm 10\%$ and air density 1.19 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-83	24-001894	11 January 2025

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 -

STANDARD WEIGHT 50 g



Certificate No. : 24-079773
Sample Code : 24-31841-003

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 25 June 2024

Date of Calibration : 30 June 2024

Calibrated by Mr. Nawa Sisuwan
Scientist

Approved by

Issue date 03 July 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

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. : 24-079773
Sample Code : 24-31841-003

REPORT OF CALIBRATION

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

Result of Calibration : ☒ Without adjustment ☐ Adjustment

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

Description	Deviation	Conventional Mass	Expanded Uncertainty	Maximum Permissible Error	ID No.
	(mg)		(mg)	± (mg)	
50 g	-0.176	49.999824 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

Certificate No. : 24-079773

Sample Code : 24-31841-003

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 1.19 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-83	24-001894	11 January 2025

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 -

ANALYTICAL BALANCE (DU)

Model : XS205DU


Serial No. : 1126323724

Mettler-Toledo (Thailand) Ltd.
846/4 - 846/5846/4 - 846/5 Lasalle Rd., Bangna Tai
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

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

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XS205DU Asset Number: LABE 05/1
Serial No.: 1126323724 Terminal Model: SAT
Building: Laboratory Terminal Serial No.: 1126323724
Floor: 1 Terminal Asset No.: N/A
Room: Analytical Balance

Range	Max. Capacity	Readability (d)
1	81 g	0.00001 g
2	220 g	0.0001 g

Procedure

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

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

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

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

	Temperature		Humidity	
As Found	Start: 25.7 °C	End: 25.8 °C	Start: 50.9 %	End: 50.6 %

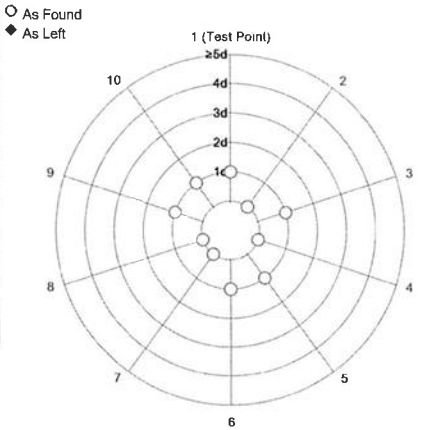
Measurement Results

Repeatability

Test Load: 70 g

	As Found	As Left
1	70.00004 g	N/A
2	70.00005 g	N/A
3	70.00004 g	N/A
4	70.00005 g	N/A
5	70.00006 g	N/A
6	70.00004 g	N/A
7	70.00005 g	N/A
8	70.00005 g	N/A
9	70.00006 g	N/A
10	70.00006 g	N/A

Standard Deviation	0.000008 g	N/A
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The "d" in the graph represents the readability of the range/interval in which the test was performed.

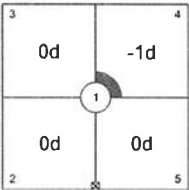
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

Position	As Found	As Left
1	100.0000 g	N/A
2	100.0000 g	N/A
3	100.0000 g	N/A
4	99.9999 g	N/A
5	100.0000 g	N/A

Maximum Deviation	0.0001 g	N/A
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As Found

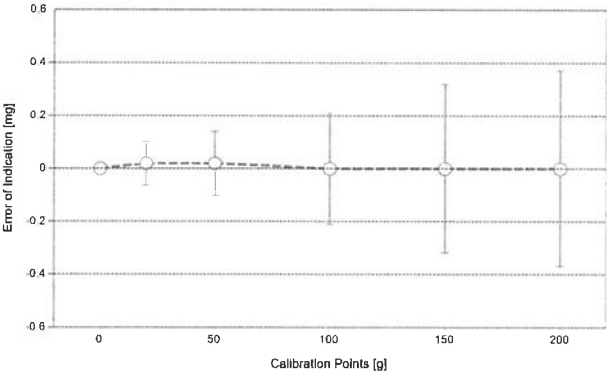
The "d" in the graph represents the readability of the range/interval in which the test was performed.

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.017 mg	2
2	0.01000 g	0.01000 g	0.00000 g	0.020 mg	2
3	0.10000 g	0.10000 g	0.00000 g	0.023 mg	2
4	1.00000 g	1.00000 g	0.00000 g	0.032 mg	2
5	4.99998 g	5.00000 g	0.00002 g	0.048 mg	2
6	10.00001 g	10.00001 g	0.00000 g	0.061 mg	2
7	19.99999 g	20.00001 g	0.00002 g	0.082 mg	2
8 *	50.00003 g	50.00005 g	0.00002 g	0.12 mg	2
9	100.00000 g	100.00000 g	0.00000 g	0.21 mg	2
10	150.00000 g	150.00000 g	0.00000 g	0.32 mg	2
11	200.00000 g	200.00000 g	0.00000 g	0.37 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.

The expanded measurement uncertainty is reported as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated.
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.:	WS37	Date of Issue:	17-Jun-2024
Certificate Number:	186753-1	Calibration Due Date:	20-Jan-2025

Weight Set 2: OIML E2

Weight Set No.:	WS87	Date of Issue:	04-Jul-2023
Certificate Number:	186520	Calibration Due Date:	02-Jan-2025

Thermo Hygrometer

Equipment No.:	IN279	Date of Issue:	19-Jun-2024
Certificate Number:	SG-H-00577/67	Calibration Due Date:	17-Jun-2025

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 · 10⁻⁸ / K
Temperature range on site for the evaluation of the measurement uncertainty in use: 3 K

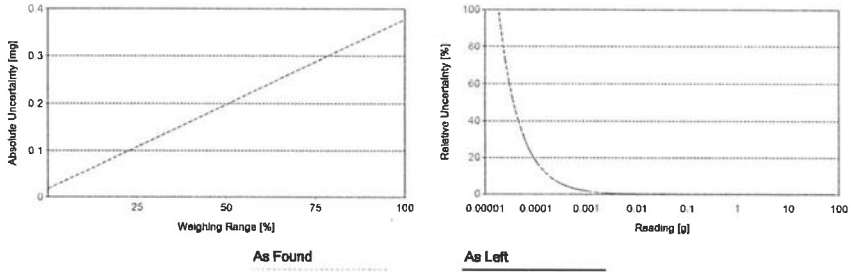
Linearization of Uncertainty Equation

Range		As Found		As Left
d	Max			
1	0.00001 g	81 g	U ₁ = 0.018 mg + 0.00444 mg/g · R	N/A
2	0.0001 g	220 g	U ₂ = 0.06 mg + 0.00439 mg/g · R	N/A

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

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

Net Indication	As Found		As Left	
0.00220 g	0.018 mg	0.82%	N/A	N/A
0.02200 g	0.018 mg	0.082%	N/A	N/A
0.22000 g	0.019 mg	0.0086%	N/A	N/A
2.20000 g	0.028 mg	0.0013%	N/A	N/A
220.0000 g	1.0 mg	0.00047%	N/A	N/A



The weighing range shown in the absolute uncertainty graph refers to the first interval/range of the device.

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As Found



As Left



The weighing device meets the given process requirements.

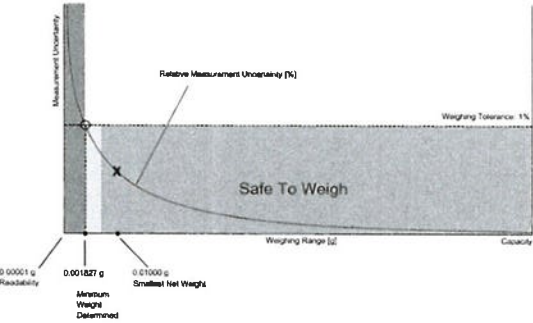
The weighing device meets the given process requirements.

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

Process Requirements

Weighing Tolerance: 1% | Smallest Net Weight: 0.01000 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 of the results and do not represent the actual measurement uncertainty of the device.

Minimum Weight

As Found Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036842 g	0.055511 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036842 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

The minimum weight table applies to the fine range of the weighing device.

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

As Left Minimum Weight Table

Range 1

Minimum weights for different weighing tolerances and safety factors					
Tolerance	Safety Factor				
	1	2	3	5	10
0.1%	0.018339 g	0.036842 g	0.055511 g	0.093358 g	0.191052 g
0.2%	0.009149 g	0.018339 g	0.027570 g	0.046156 g	0.093358 g
0.5%	0.003655 g	0.007316 g	0.010984 g	0.018339 g	0.036842 g
1%	0.001827 g	0.003655 g	0.005485 g	0.009149 g	0.018339 g
2%	0.000913 g	0.001827 g	0.002740 g	0.004569 g	0.009149 g
5%	0.000365 g	0.000730 g	0.001096 g	0.001827 g	0.003655 g

The minimum weight table applies to the fine range of the weighing device.

✓ 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.

Measurement Results

Results Summary

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

✓ = Passed

✗ = Failed

⚠ = Safety Factor not met

Repeatability

Test Load: 70 g

Tolerance	Control Limit	As Found		As Left	
		Std. Deviation	Result	Std. Deviation	Result
0.1%	0.000005 g	0.000008 g	✗	0.000008 g	✗
0.2%	0.000010 g		✓		⚠
0.5%	0.000025 g		✓		✓
1%	0.000050 g		✓		✓
2%	0.000100 g		✓		✓
5%	0.000250 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	0.0001 g	✓	0.0001 g	✓
0.2%	0.1000 g		✓		✓
0.5%	0.2500 g		✓		✓
1%	0.5000 g		✓		✓
2%	1.0000 g		✓		✓
5%	2.5000 g		✓		✓

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

Error of Indication

As Found

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
19.99999 g	0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
50.00003 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0000 g	0.1000 g	0.2000 g	0.5000 g	1.0000 g	2.0000 g	5.0000 g
Result		✓	✓	✓	✓	✓	✓

As Left

		Control limits for various weighing tolerances					
Reference Value	Error	0.1%	0.2%	0.5%	1%	2%	5%
0.00000 g	0.00000 g	N/A	N/A	N/A	N/A	N/A	N/A
19.99999 g	0.00002 g	0.01000 g	0.02000 g	0.05000 g	0.10000 g	0.20000 g	0.50000 g
50.00003 g	0.00002 g	0.02500 g	0.05000 g	0.12500 g	0.25000 g	0.50000 g	1.25000 g
100.0000 g	0.0000 g	0.0500 g	0.1000 g	0.2500 g	0.5000 g	1.0000 g	2.5000 g
150.0000 g	0.0000 g	0.0750 g	0.1500 g	0.3750 g	0.7500 g	1.5000 g	3.7500 g
200.0000 g	0.0000 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



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CALIBRATION CERTIFICATE

Certificate No. : L202405022-0013

Date Issued : 08-May-24

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

Equipment : Analog Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No./Tag No. : BM001/41

Date Received : 03-May-24

Date Calibrated : 06-May-24

Calibrated by : Mr. Saruth Srichutikul

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

CERTIFIED

Certificate No : L202405022-0013

Environment Ambient Temperature : $(25 \pm 2)^\circ\text{C}$
Relative Humidity : $(50 \pm 15)\%\text{RH}$

STD Reading	UUC Reading (mbar)	UUC Reading (mbar)	UUC Error	Uncertainty	MPE	Pass /
mbar	Before Adjusted	After Adjusted	mbar	\pm mbar	\pm mbar	with Gua
990.00	990	-	0.00	0.59	10.3	Pa
1000.00	1000	-	0.00	0.59	10.3	Pa
1010.00	1010	-	0.00	0.59	10.3	Pa
1020.00	1020	-	0.00	0.59	10.3	Pa
1030.00	1030	-	0.00	0.59	10.3	Pa

STD = Standard Pass = $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$

UUC = Unit Under Calibration Fail = $|\text{error}| + |\text{uncertainty}| > |\text{MPE}|$

MPE = Maximum Permissible Error

Calibrated condition : Pressure Medium Air : Density = 1.19 kg/m^3 @ 20°C . 1 bar
Mounting Position Vertical
Reference Level at center of its dial
Conversion Factor Multiply by $1.0 \text{ E}+02$ - 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. 1598, Due 09-Nov-24

End of Certificate

GAS CHROMATOGRAPH

Model : GC-2010 PLUS AF

Serial No. : C12095200986

SHIMADZU GAS CHROMATOGRAPH SYSTEM GC-2010Plus Series

Operational Qualification

Operational Qualification Report

System Name

System ID No. Gas Chromatograph LABE 0413

Installation Site Instrument Room GC/JC

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

• Performer

Signature Thawat Pumpak Date 15/08/2024Print Thawat PumpakTitle Service EngineerCompany Born Scientific Co., Ltd

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

• Reviewer

Signature Panupong Buranong Date 15/08/2024Print Panupong BuranongTitle ScientistCompany Eastern Thin Consulting 1992 Co., Ltd

• Manager

Signature Nunnapat Bakhutok Date 15/08/2024Print Nunnapat BakhutokTitle HSCompany Eastern Thin Consulting 1992 Co., Ltd

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

☒ Applicable ☐ Not Applicable

Model Name		GC-2010Plus PF					
Component ID	LABE 0413						
Serial Number (S/N)	C 1 2 0 9 5 2 0 0 7 8 C						
No.	Item	Criteria	Results	Pass	Fail		
1	Display, LED test	Verify the display and LED operation.	All LEDs light. Screen contrast adjustment is possible.	LED Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2	Standard self-diagnostic test	Verify the status and operation of all parts.	"Good" displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	Firmware version check	Verify the program version.	Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Ver. Controlled Ver. No.	Version: 2.1660 Build No.: 262 Version: 2.1660 Build No.: 262	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Temperature test	Verify that temperature control is normal.	TEMP LED lights green. Displayed actual values agree to the set values within $\pm 1.0^\circ\text{C}$.	Temperature controller (Name) Set value Measured value	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
			<input checked="" type="checkbox"/> COL <input checked="" type="checkbox"/> INJ1 <input type="checkbox"/> INJ2 <input checked="" type="checkbox"/> DET1 <input type="checkbox"/> DET2 <input type="checkbox"/> AUX3 <input type="checkbox"/> AUX4 <input type="checkbox"/> AUX5	Column 50.0°C 50.0°C 50.0°C 50.0°C 50.0°C 50.0°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 $\pm 10.0 \pm 3.0\text{kPa}$ Inspection pressure gauge reading $\pm 20.0 \pm 20.0\text{kPa}$ Inspection pressure gauge reading $\pm 500.0 \pm 35.0\text{kPa}$	Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading	0.0 kPa 9.3 kPa 9.3 kPa 0.4 kPa 197.4 kPa 197.0 kPa 0.3 kPa 497.1 kPa 496.3 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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 Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate 3.01 L/min Split vent 7.2 mL/min Total 10.2 mL/min Total of septum purge and split vent flow rate values 10.0 ± 3.0 mL/min Split vent 1.92 mL/min Total 1.96 mL/min Total of septum purge and split vent flow rate values 200 ± 20 mL/min Split vent 4.24 mL/min Total 4.28 mL/min Total of septum purge and split vent flow rate values 300 ± 28 mL/min (Carrier gas: N ₂) Total of septum purge and split vent flow rate values 500 ± 35 mL/min (Carrier gas: He)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature.	Inspection temperature sensor displayed value 150.0 ± 3.2°C Temp. correction value 0.4°C Temp. sensor reading 52.0°C Corrected temp. value 51.6°C Inspection temperature sensor displayed value 150.0 ± 4.2°C Temp. correction value -0.7°C Temp. sensor reading 151.4°C Corrected temp. value 152.1°C Inspection temperature sensor displayed value 280.0 ± 5.5°C Temp. correction value -0.4°C Temp. sensor reading 279.6°C Corrected temp. value 280.0°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify that the column temperature program operates normally.	Monitored temperature 6 minutes after start 200 ± 1°C Inspection temperature reading 8 minutes after start 200.0 ± 4.7°C Using a temperature sensor with 1°C minimum display increment 200 ± 3°C	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity.	FID (<input checked="" type="checkbox"/> Applicable) Calculated S value Inj. unit (5 µL) Make-up gas: N ₂ 10.0 × 10 ⁻³ C/g min. Make-up gas: He 7.00 × 10 ⁻³ C/g min. C ₁₀ AREA value 47787 Calculated S value 1.530 × 10 ⁻⁴ C/g TCD (<input type="checkbox"/> Applicable) Calculated S value Inj. unit () 4.00 × 10 ⁻³ mV·mL/mg min. C ₁₀ AREA value µV·s Flowrate at vent mL/min Calculated S value × 10 ³ mV·mL/mg	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

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

Model Name		AOC-20i			
Component ID		LARE 04/3			
Serial No. (S/N)		C12125410309			
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation.	All LEDs light, except decimal point.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000".	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed. The version number matches the controlled version number.	<input checked="" type="checkbox"/>	<input 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"/>	<input type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

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

Operational Qualification Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Model Name		AOC-20s			
Component ID	LABE 0473				
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"/>	<input type="checkbox"/>
2	Firmware version check	Verify the program version.	Version number is displayed. The version number matches the controlled version number.	Version No. 3.5 Controlled Ver. No. 3.2	<input checked="" type="checkbox"/> <input type="checkbox"/>

Operational Qualification

Operational Qualification Record

3-4 SPL-2010Plus Split/Splitless Injection Unit

☐ Applicable ☒ Not Applicable

Model Name		SPL-2010Plus			
Component ID					
Serial No. (S/N)					
No.	Item	Criteria	Results	Pass	Fail
1	Column inlet pressure test	Verify the accuracy of the column inlet pressure. Inspection pressure gauge reading $\square 10.0 \pm 3.0 \text{ kPa}$ Inspection pressure gauge reading $\square 200.0 \pm 20.0 \text{ kPa}$ Inspection pressure gauge reading $\square 500.0 \pm 35.0 \text{ kPa}$	Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading	 kPa kPa kPa kPa kPa kPa kPa kPa kPa	
2	Pressure program test	Verify that the pressure program operates normally.	Monitored pressure 6 minutes after start $250.0 \pm 5.0 \text{ kPa}$ Inspection pressure gauge reading 8 minutes after start $250.0 \pm 20.0 \text{ kPa}$	 kPa kPa	
3	Flowrate test	Verify the accuracy of the full-flow and septum purging. Septum purge vent measured flow rate $3.0 \pm 1.0 \text{ mL/min}$ \square Total of septum purge and split vent flow rate values $10.0 \pm 3.0 \text{ mL/min}$ \square Total of septum purge and split vent flow rate values $200 \pm 20 \text{ mL/min}$ \square Total of septum purge and split vent flow rate values $300 \pm 28 \text{ mL/min}$ (Carrier gas: N_2) \square Total of septum purge and split vent flow rate values $500 \pm 35 \text{ mL/min}$ (Carrier gas: He)	Septum purge Split vent Total Split vent Total Split vent Total	 mL/min mL/min mL/min mL/min mL/min mL/min mL/min	

3-5 WBI-2010Plus Direct Injection Unit

☐ Applicable ☒ Not Applicable

Model Name		WBI-2010Plus					
Component ID							
Serial No. (S/N)							
No.	Item	Criteria			Results	Pass	Fail
1	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Inspection pressure gauge reading <input type="checkbox"/> 10.0± 3.0kPa	Pressure gauge correction value	_____ kPa	<input type="checkbox"/>	<input type="checkbox"/>
				Pressure gauge reading	_____ kPa		
				Post-correction reading	_____ kPa		
			Inspection pressure gauge reading <input type="checkbox"/> 50.0± 10.0kPa	Pressure gauge correction value	_____ kPa		
				Pressure gauge reading	_____ kPa		
				Post-correction reading	_____ kPa		
			Inspection pressure gauge reading <input type="checkbox"/> 200.0±20.0kPa	Pressure gauge correction value	_____ kPa		
				Pressure gauge reading	_____ kPa		
				Post-correction reading	_____ kPa		
2	Pressure program test	Verify that the pressure program operates normally.	Monitored pressure 6 minutes after start 250.0 ± 5.0 kPa		_____ kPa	<input type="checkbox"/>	<input type="checkbox"/>
			Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa		_____ kPa		
3	Flowrate test	Verify total flow (column outlet flow) and septum purge accuracy.	Septum purge vent measured flow rate 3.0 ± 1.0mL/min		Septum purge _____ mL/min	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/> Column outlet measured flow rate 5.0± 1.5mL/min		Measured flow _____ mL/min		
			<input type="checkbox"/> Column outlet measured flow rate 20.0± 5.0mL/min		Measured flow _____ mL/min		
			<input type="checkbox"/> Column outlet measured flow rate 100± 15mL/min		Measured flow _____ mL/min		

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3-6 OCI/PTV-2010 On-column/Programmable Temperature Injection Unit

☐ Applicable ☒ Not Applicable

Model Name		OCI/PTV-2010					
Component ID							
Serial No. (S/N)							
No.	Item	Criteria		Results	Pass	Fail	
1	Temperature test	Verify that temperature control is normal.	Measured temperature value displayed immediately after start: $50 \pm 5^{\circ}\text{C}$		____ $^{\circ}\text{C}$	<input type="checkbox"/>	<input type="checkbox"/>
			Measured temperature value displayed 3 minutes after start: $250 \pm 5^{\circ}\text{C}$		____ $^{\circ}\text{C}$	<input type="checkbox"/>	<input type="checkbox"/>
			Fan operation begins 8 minutes after start.			<input type="checkbox"/>	<input type="checkbox"/>
2	Column inlet pressure test	Verify column inlet pressure accuracy.	Inspection pressure gauge reading <input type="checkbox"/> $10.0 \pm 3.0\text{ kPa}$	Pressure gauge correction value	____ kPa	<input type="checkbox"/>	<input type="checkbox"/>
				Pressure gauge reading	____ kPa		
				Post-correction reading	____ kPa		
			Inspection pressure gauge reading <input type="checkbox"/> $50.0 \pm 10.0\text{ kPa}$	Pressure gauge correction value	____ kPa		
				Pressure gauge reading	____ kPa		
				Post-correction reading	____ kPa		
			Inspection pressure gauge reading <input type="checkbox"/> $200.0 \pm 20.0\text{ kPa}$	Pressure gauge correction value	____ kPa		
				Pressure gauge reading	____ kPa		
				Post-correction reading	____ kPa		
			Inspection pressure gauge reading <input type="checkbox"/> $500.0 \pm 35.0\text{ kPa}$	Pressure gauge correction value	____ kPa		
				Pressure gauge reading	____ kPa		
				Post-correction reading	____ kPa		
3	Pressure program test	Verify that the pressure program operates normally.	Monitored pressure 3 minutes after start $250.0 \pm 5.0\text{ kPa}$		____ kPa	<input type="checkbox"/>	<input type="checkbox"/>
			Inspection pressure gauge reading 8 minutes after start $250.0 \pm 20.0\text{ kPa}$		____ kPa		
4	Flow rate test <input type="checkbox"/> Used for OCI, so not conducted.	Verify accuracy of total flow and septum purge.	Septum purge vent measured flow rate $3.00 \pm 1.00\text{ mL/min}$		Septum purge ____ mL/min	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/> Total of septum purge and split vent flow rate values $10.0 \pm 3.0\text{ mL/min}$	Split vent ____ mL/min			
				Total ____ mL/min			
			<input type="checkbox"/> Total of septum purge and split vent flow rate values $200 \pm 20\text{ mL/min}$	Split vent ____ mL/min			
				Total ____ mL/min			
			<input type="checkbox"/> Total of septum purge and split vent flow rate values $300 \pm 28\text{ mL/min}$ (Carrier gas: N_2)	Split vent ____ mL/min			
				Total ____ mL/min			
			<input type="checkbox"/> Total of septum purge and split vent flow rate values $500 \pm 35\text{ mL/min}$ (Carrier gas: He)	Total ____ mL/min			

3-7 FID-2010Plus Flame Ionization Detector

☐ Applicable ☒ Not Applicable

Addition 1

Component ID		Model Name FID-2010Plus				
Serial No. (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	<input type="checkbox"/> Sensitivity test	Verify detector sensitivity	Sensitivity S calculated value	C ₁₆ AREA value	μV·s	
	Injection unit ()	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g <input type="checkbox"/> Make-up gas: He ≥7.00×10 ⁻³ C/g	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g	Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
						<input type="checkbox"/>
	<input type="checkbox"/> Sensitivity test	Verify detector sensitivity	Sensitivity S calculated value	C ₈ AREA value	μV·s	
	OCI Injection unit	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g <input type="checkbox"/> Make-up gas: He ≥7.00×10 ⁻³ C/g	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g	Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
				C ₁₆ AREA value	μV·s	
				Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
				C ₂₄ AREA value	μV·s	
				Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>

Addition 2 ☐ Applicable ☒ Not Applicable

Component ID		Model Name FID-2010Plus				
Serial No. (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	<input type="checkbox"/> Sensitivity test	Verify detector sensitivity	Sensitivity S calculated value	C ₁₆ AREA value	μV·s	
	Injection unit ()	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g <input type="checkbox"/> Make-up gas: He ≥7.00×10 ⁻³ C/g	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g	Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
						<input type="checkbox"/>
	<input type="checkbox"/> Sensitivity test	Verify detector sensitivity	Sensitivity S calculated value	C ₈ AREA value	μV·s	
	OCI Injection unit	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g <input type="checkbox"/> Make-up gas: He ≥7.00×10 ⁻³ C/g	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g	Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
				C ₁₆ AREA value	μV·s	
				Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
				C ₂₄ AREA value	μV·s	
				Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>

Addition 3 ☐ Applicable ☒ Not Applicable

Component ID		Model Name FID-2010Plus				
Serial No. (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	<input type="checkbox"/> Sensitivity test	Verify detector sensitivity	Sensitivity S calculated value	C ₁₆ AREA value	μV·s	
	Injection unit ()	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g <input type="checkbox"/> Make-up gas: He ≥7.00×10 ⁻³ C/g	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g	Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
						<input type="checkbox"/>
	<input type="checkbox"/> Sensitivity test	Verify detector sensitivity	Sensitivity S calculated value	C ₈ AREA value	μV·s	
	OCI Injection unit	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g <input type="checkbox"/> Make-up gas: He ≥7.00×10 ⁻³ C/g	<input type="checkbox"/> Make-up gas: N ₂ ≥10.0×10 ⁻³ C/g	Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
				C ₁₆ AREA value	μV·s	
				Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>
				C ₂₄ AREA value	μV·s	
				Sensitivity S calculated value	— ×10 ⁻³ C/g	<input type="checkbox"/>

3-8 FTD-2010Plus Flame Thermionic Detector

☐ Applicable ☒ Not Applicable

Addition 1						
Model Name FTD-2010Plus						
Component ID						
Serial No. (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. N (<input type="checkbox"/> Applicable <input type="checkbox"/> N/A) Azobenzene MDQ $\leq 1.40 \times 10^{-12}$ gN/s	AREA value	$\mu\text{V}\cdot\text{s}$	<input type="checkbox"/>	<input type="checkbox"/>
			MDQ	$\times 10^{-12}$ gN/s		
		P (<input type="checkbox"/> Applicable <input type="checkbox"/> N/A) <input type="checkbox"/> Malathion <input type="checkbox"/> Tributyl phosphate MDQ $\leq 0.900 \times 10^{-12}$ gP/s	AREA value	$\mu\text{V}\cdot\text{s}$	<input type="checkbox"/>	<input type="checkbox"/>
			MDQ	$\times 10^{-12}$ gP/s		

Addition 2 ☐ Applicable ☒ Not Applicable

Addition 2						
Model Name FTD-2010Plus						
Component ID						
Serial No. (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. N (<input type="checkbox"/> Applicable <input type="checkbox"/> N/A) Azobenzene MDQ $\leq 1.40 \times 10^{-12}$ gN/s	AREA value	$\mu\text{V}\cdot\text{s}$	<input type="checkbox"/>	<input type="checkbox"/>
			MDQ	$\times 10^{-12}$ gN/s		
		P (<input type="checkbox"/> Applicable <input type="checkbox"/> N/A) <input type="checkbox"/> Malathion <input type="checkbox"/> Tributyl phosphate MDQ $\leq 0.900 \times 10^{-12}$ gP/s	AREA value	$\mu\text{V}\cdot\text{s}$	<input type="checkbox"/>	<input type="checkbox"/>
			MDQ	$\times 10^{-12}$ gP/s		

Performer (signature):

Jm

Date: 15 / 03 / 2024

Reviewer (signature):

Jm

Date: 15 / 3 / 2024

3-9 FPD-2010Plus Flame Photometric Detector

☐ Applicable ☒ Not Applicable

Addition 1						
Model Name FPD-2010Plus						
Component ID						
Serial No. (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. S (<input type="checkbox"/> Applicable <input type="checkbox"/> N/A) Dodecane thiol MDQ $\leq 30.0 \times 10^{-12}$ gS/s	AREA value	$\mu\text{V}\cdot\text{s}$	<input type="checkbox"/>	<input type="checkbox"/>
			MDQ	$\times 10^{-12}$ gS/s		
		P (<input type="checkbox"/> Applicable <input type="checkbox"/> N/A) Tributyl phosphate MDQ $\leq 0.300 \times 10^{-12}$ gP/s	AREA value	$\mu\text{V}\cdot\text{s}$	<input type="checkbox"/>	<input type="checkbox"/>
			MDQ	$\times 10^{-12}$ gP/s		

3-10 ECD-2010Plus Electron Capture Detector

☐ Applicable ☒ Not Applicable

Addition 1						
Model Name ECD-2010Plus						
Component ID						
Serial No. (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. $\gamma\text{-BHC MDQ} \leq 60.0 \times 10^{-15}$ g/s	AREA value	$\mu\text{V}\cdot\text{s}$	<input type="checkbox"/>	<input type="checkbox"/>
			MDQ	$\times 10^{-15}$ g/s		

Performer (signature):

Jm

Date: 15 / 03 / 2024

Reviewer (signature):

Jm

Date: 15 / 3 / 2024

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Addition 2 ☐ Applicable ☐ Not Applicable

Model Name		ECD-2010Plus					
Component ID							
Serial No. (S/N)							
No.	Item	Criteria	Results	Pass	Fail		
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. γ -BHC MDQ $\leq 60.0 \times 10^{-15}$ g/s	AREA value	$\mu\text{V}\cdot\text{s}$			
			MDQ	$\times 10^{-15}$ g/s			

Addition 3 ☐ Applicable ☐ Not Applicable

Model Name		ECD-2010Plus					
Component ID							
Serial No. (S/N)							
No.	Item	Criteria	Results	Pass	Fail		
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. γ -BHC MDQ $\leq 60.0 \times 10^{-15}$ g/s	AREA value	$\mu\text{V}\cdot\text{s}$			
			MDQ	$\times 10^{-15}$ g/s			

Addition 4 ☐ Applicable ☐ Not Applicable

Model Name		ECD-2010Plus					
Component ID							
Serial No. (S/N)							
No.	Item	Criteria	Results	Pass	Fail		
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. γ -BHC MDQ $\leq 60.0 \times 10^{-15}$ g/s	AREA value	$\mu\text{V}\cdot\text{s}$			
			MDQ	$\times 10^{-15}$ g/s			

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3-11 ECD-2010 Exceed Electron Capture Detector

☐ Applicable ☒ Not Applicable

Addition 1

Model Name		ECD-2010 Exceed					
Component ID							
Serial No. (S/N)							
No.	Item	Criteria	Results	Pass	Fail		
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. γ -BHC MDQ $\leq 40.0 \times 10^{-15}$ g/s	AREA value	$\mu\text{V}\cdot\text{s}$			
			MDQ	$\times 10^{-15}$ g/s			

Addition 2 ☐ Applicable ☐ Not Applicable

Model Name		ECD-2010 Exceed					
Component ID							
Serial No. (S/N)							
No.	Item	Criteria	Results	Pass	Fail		
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. γ -BHC MDQ $\leq 40.0 \times 10^{-15}$ g/s	AREA value	$\mu\text{V}\cdot\text{s}$			
			MDQ	$\times 10^{-15}$ g/s			

Addition 3 ☐ Applicable ☐ Not Applicable

Model Name		ECD-2010 Exceed					
Component ID							
Serial No. (S/N)							
No.	Item	Criteria	Results	Pass	Fail		
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. γ -BHC MDQ $\leq 40.0 \times 10^{-15}$ g/s	AREA value	$\mu\text{V}\cdot\text{s}$			
			MDQ	$\times 10^{-15}$ g/s			

Addition 4 ☐ Applicable ☐ Not Applicable

Model Name		ECD-2010 Exceed			
Component ID					
Serial No. (S/N)					
No.	Item	Criteria	Results	Pass	Fail
1	Sensitivity test Injection unit ()	Verify the detector sensitivity. $7\text{-RHC MDQ} \leq 40.0 \times 10^{-15} \text{ g/s}$	AREA value $\mu\text{V}\cdot\text{s}$ MDQ $\times 10^{-15} \text{ g/s}$	<input type="checkbox"/>	<input type="checkbox"/>

3-12 BID-2010Plus Barrier Discharge Ionization Detector

☐ Applicable ☒ Not Applicable

Model Name		BID-2010Plus			
Component ID					
Serial No. (S/N)					
No.	Item	Criteria	Results	Pass	Fail
1	Noise Baseline Level test	Verify the detector noise and baseline level. Noise (P-P) is 80 μV or less. Baseline level is $10.0 \times 10^4 \mu\text{V}$ or less.	Noise (P-P) μV Baseline level $\times 10^4 \mu\text{V}$	<input type="checkbox"/>	<input type="checkbox"/>
2	Sensitivity test Injection unit ()	Verify the detector sensitivity. Dodecane(C_{12}) Minimum detection quantity (MDQ) $\leq 5.00 \times 10^{-12} \text{ gC/s}$	AREA value $\mu\text{V}\cdot\text{s}$ MDQ $\times 10^{-12} \text{ gC/s}$	<input type="checkbox"/>	<input type="checkbox"/>

3-13 HS-20 Headspace Sampler

☐ Applicable ☒ Not Applicable

Model Name		HS-20				
Component ID						
Serial Number (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	Transfer Test	Directions from LabSolutions are properly sent to the HS-20.		<input type="checkbox"/>	<input type="checkbox"/>	
2	Firmware version check	The version number is displayed.	Ver.	<input type="checkbox"/>	<input type="checkbox"/>	
3	Column pressure test inlet	Inspection pressure gauge reading <input type="checkbox"/> $10.0 \pm 3.0 \text{ kPa}$ Inspection pressure gauge reading <input type="checkbox"/> $200.0 \pm 20.0 \text{ kPa}$ Inspection pressure gauge reading <input type="checkbox"/> $500.0 \pm 35.0 \text{ kPa}$	Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading	kPa kPa kPa kPa kPa kPa kPa kPa kPa	<input type="checkbox"/>	<input type="checkbox"/>
4	Flowrate test	Septum purge vent measured flow rate $3.0 \pm 1.0 \text{ mL/min}$ <input type="checkbox"/> Total of septum purge and split vent flow rate values $10.0 \pm 3.0 \text{ mL/min}$ <input type="checkbox"/> Total of septum purge and split vent flow rate values $200 \pm 20 \text{ mL/min}$ <input type="checkbox"/> Total of septum purge and split vent flow rate values $300 \pm 28 \text{ mL/min}$ (Carrier gas: N_2) <input type="checkbox"/> Total of septum purge and split vent flow rate values $500 \pm 35 \text{ mL/min}$ (Carrier gas: He)	Septum purge mL/min Split vent mL/min Total mL/min Split vent mL/min Total mL/min Split vent mL/min Total mL/min	mL/min mL/min mL/min mL/min mL/min mL/min mL/min mL/min mL/min	<input type="checkbox"/>	<input type="checkbox"/>

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No.	Item	Criteria	Results	Pass	Fail
5	<input type="checkbox"/> Leakage test 1	The P2-P1 difference is 6 kPa or less in two minutes.	(P2-P1) kPa	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/> Leakage test 2	The P2-P1 difference is 6 kPa or less in two minutes.	(P2-P1) kPa	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/> Leakage test 3	The P2-P1 difference is 6 kPa or less in two minutes.	(P2-P1) kPa	<input type="checkbox"/>	<input type="checkbox"/>
6	A vial pressurization pressure test, a test of operation	1. Vial Carrying in, 2. Pressurization & Load Operation, and 3. Vial Return don't occur the error in each sequence	Vial Carrying in	<input type="checkbox"/>	<input type="checkbox"/>
			Pressurization & Load Operation	<input type="checkbox"/>	<input type="checkbox"/>
			Vial Return	<input type="checkbox"/>	<input type="checkbox"/>
		Maximum pressure value is 50kPa±5kPa The difference between the maximum pressure value and the minimum pressure value is 2 kPa or less	(Maximum Value) kPa	<input type="checkbox"/>	<input type="checkbox"/>
			(Minimum Value) kPa		
			(Maximum Value) -(Minimum Value) kPa		

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3-14 HS-10 Headspace Sampler

☐ Applicable ☒ Not Applicable

		Model Name		HS-10		
Component ID						
Serial Number (S/N)						
No.	Item	Criteria	Results	Pass	Fail	
1	Transfer Test	Directions from LabSolutions are properly sent to the HS-10.		<input type="checkbox"/>	<input type="checkbox"/>	
2	Firmware version check	The version number is displayed.	Vcr.	<input type="checkbox"/>	<input type="checkbox"/>	
3	Column inlet pressure test	Inspection pressure gauge reading <input type="checkbox"/> 10.0± 3.0 kPa	Pressure gauge correction value	_____ kPa	<input type="checkbox"/>	<input type="checkbox"/>
			Pressure gauge reading	_____ kPa		
			Post-correction reading	_____ kPa		
		Inspection pressure gauge reading <input type="checkbox"/> 200.0±20.0 kPa	Pressure gauge correction value	_____ kPa		
			Pressure gauge reading	_____ kPa		
			Post-correction reading	_____ kPa		
		Inspection pressure gauge reading <input type="checkbox"/> 500.0±35.0 kPa	Pressure gauge correction value	_____ kPa		
			Pressure gauge reading	_____ kPa		
Post-correction reading	_____ kPa					
4	Flowrate test	Septum purge vent measured flow rate 3.0 ± 1.0 mL/min <input type="checkbox"/> Total of septum purge and split vent flow rate values 10.0±3.0 mL/min	Septum purge	_____ mL/min	<input type="checkbox"/>	<input type="checkbox"/>
			Split vent	_____ mL/min		
			Total	_____ mL/min		
		<input type="checkbox"/> Total of septum purge and split vent flow rate values 200±20 mL/min	Split vent	_____ mL/min		
			Total	_____ mL/min		
			<input type="checkbox"/> Total of septum purge and split vent flow rate values 300± 28 mL/min (Carrier gas: N ₂) <input type="checkbox"/> Total of septum purge and split vent flow rate values 500± 35 mL/min (Carrier gas: He)	Split vent		
		Total		_____ mL/min		
5	<input type="checkbox"/> Leakage test 1	No error occurs when checking leakage.		<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/> Leakage test 2	Decreased pressure is 6 kPa or less for two minutes.	_____ kPa	<input type="checkbox"/>	<input type="checkbox"/>	
6	Vial Pressurization Test Operation Test	No error occurs in the pretreatment log.		<input type="checkbox"/>	<input type="checkbox"/>	

3-15 AOC-6000 Auto Sampler

☐ Applicable ☒ NotApplicable

Component ID		Model Name AOC-6000			
Serial Number (S/N)					
No.	Item	Criteria	Results	Pass	Fail
1	Firmware Version Check	The version number is displayed. Ver.		<input type="checkbox"/>	<input type="checkbox"/>
2	Program Alteration Check	"Pass" is displayed for all programs. The version number matches the controlled version number. Ver.		<input type="checkbox"/>	<input type="checkbox"/>
3	Leakage Test	Pressure drop of the flash gas regulator is 10kPa (0.1bar) or less in ten minutes.		<input type="checkbox"/>	<input type="checkbox"/>
4	Check of gas supply control	Flash gas supply to the HS syringe is controlled.		<input type="checkbox"/>	<input type="checkbox"/>
5	Temperature Test	Each Actual Temperature is within $\pm 2.0^{\circ}\text{C}$ of the preset temperature.	HS syringe _____ $^{\circ}\text{C}$	<input type="checkbox"/>	<input type="checkbox"/>
		The absolute temperature inside the vial in the Agitator is within $60.0^{\circ}\text{C} \pm 3.0^{\circ}\text{C}$.	Agitator _____ $^{\circ}\text{C}$	<input type="checkbox"/>	<input type="checkbox"/>
		(preset temperature) HS syringe : 100°C Agitator : 60°C	Agitator (absolute temperature) _____ $^{\circ}\text{C}$	<input type="checkbox"/>	<input type="checkbox"/>
6	Check of syringe reference point	For each syringe, a ring at the bottom of the syringe is within the circle of the reference point.		<input type="checkbox"/>	<input type="checkbox"/>
7	Liquid injection vial transfer test	Vial transfer operation is normal.		<input type="checkbox"/>	<input type="checkbox"/>
8	Headspace vial transfer test	Vial transfer operation is normal.		<input type="checkbox"/>	<input type="checkbox"/>

3-16 Chromatopac C-R7A plus/C-R7Ae

☐ Applicable ☒ Not Applicable

Component ID		Model Name		C-R7 plus					
Serial Number (S/N)									
No.	Item	Criteria			Inspection results		Pass	Fail	
1	Memory self-diagnostic test	Initialization completes without error.			ROM		<input type="checkbox"/>	<input type="checkbox"/>	
					VRAM		<input type="checkbox"/>	<input type="checkbox"/>	
					RAM		<input type="checkbox"/>	<input type="checkbox"/>	
					Power LED lights		<input type="checkbox"/>	<input type="checkbox"/>	
					Keyboard LEDs light		<input type="checkbox"/>	<input type="checkbox"/>	
					BOOT Version		<input type="checkbox"/>	<input type="checkbox"/>	
					Program Version	Ver.		<input type="checkbox"/>	<input type="checkbox"/>
			The version number matches the controlled version number.	Controlled Ver.		<input type="checkbox"/>	<input type="checkbox"/>		
2	Hardware validation	"PASS" is displayed for all results falling within the specified tolerances	C H 1	Zero point		$\pm 750 \mu V$	μV	<input type="checkbox"/>	<input type="checkbox"/>
				Span		992000 to 1008000 μV	μV	<input type="checkbox"/>	<input type="checkbox"/>
				Zeroing		$\pm 96 \mu V$	μV	<input type="checkbox"/>	<input type="checkbox"/>
				Linearity		$\pm 0.1\%FS$	%FS	<input type="checkbox"/>	<input type="checkbox"/>
				Slope test		1 to 70 $\mu V/min$	$\mu V/min$	<input type="checkbox"/>	<input type="checkbox"/>
				Accuracy	Area	$\pm 2 \%$	%	<input type="checkbox"/>	<input type="checkbox"/>
					Height	$\pm 1 \%$	%	<input type="checkbox"/>	<input type="checkbox"/>
					Retention time	$\pm 1 \%$	%	<input type="checkbox"/>	<input type="checkbox"/>
				Range	Area	1 %	%	<input type="checkbox"/>	<input type="checkbox"/>
					Height	1 %	%	<input type="checkbox"/>	<input type="checkbox"/>
					Retention time	2 %	%	<input type="checkbox"/>	<input type="checkbox"/>
				Repeatability	Area	0.1 %	%	<input type="checkbox"/>	<input type="checkbox"/>
			Height		0.5 %	%	<input type="checkbox"/>	<input type="checkbox"/>	
			Retention time		0.8 %	%	<input type="checkbox"/>	<input type="checkbox"/>	
			C H 2	Zero point		$\pm 750 \mu V$	μV	<input type="checkbox"/>	<input type="checkbox"/>
				Span		992000 to 1008000 μV	μV	<input type="checkbox"/>	<input type="checkbox"/>
				Zeroing		$\pm 96 \mu V$	μV	<input type="checkbox"/>	<input type="checkbox"/>
				Linearity		$\pm 0.1\%FS$	%FS	<input type="checkbox"/>	<input type="checkbox"/>
				Slope test		1 to 70 $\mu V/min$	$\mu V/min$	<input type="checkbox"/>	<input type="checkbox"/>
				Accuracy	Area	$\pm 2 \%$	%	<input type="checkbox"/>	<input type="checkbox"/>
					Height	$\pm 1 \%$	%	<input type="checkbox"/>	<input type="checkbox"/>
					Retention time	$\pm 1 \%$	%	<input type="checkbox"/>	<input type="checkbox"/>
				Range	Area	1 %	%	<input type="checkbox"/>	<input type="checkbox"/>
					Height	1 %	%	<input type="checkbox"/>	<input type="checkbox"/>
Retention time	2 %	%			<input type="checkbox"/>	<input type="checkbox"/>			
Repeatability	Area	0.1 %		%	<input type="checkbox"/>	<input type="checkbox"/>			
	Height	0.5 %	%	<input type="checkbox"/>	<input type="checkbox"/>				
	Retention time	0.8 %	%	<input type="checkbox"/>	<input type="checkbox"/>				

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3-17 Chromatopac C-R8A

☐ Applicable ☒ Not Applicable

Model Name		C-R8A											
Component ID													
Serial Number (S/N)													
No.	Item	Criteria		Inspection results	Pass	Fail							
1	Memory self-diagnostic test	Initialization completes without error.	Program Version	Ver.	<input type="checkbox"/>	<input type="checkbox"/>							
			Memory Check Status Diagnostic Status		<input type="checkbox"/>	<input type="checkbox"/>							
		The version number matches the controlled version number.	Controlled Ver.	<input type="checkbox"/>	<input type="checkbox"/>								
2	Hardware validation	"PASS" is displayed for all results falling within the specified tolerances	C H 1	Zero point	$\pm 750 \mu V$	μV	<input type="checkbox"/>	<input type="checkbox"/>					
				Span	992000 to 1008000 μV	μV	<input type="checkbox"/>	<input type="checkbox"/>					
				Zeroing	$\pm 96\mu V$	μV	<input type="checkbox"/>	<input type="checkbox"/>					
				Linearity	$\pm 0.1\%FS$	$\%FS$	<input type="checkbox"/>	<input type="checkbox"/>					
				Slope test	1 to 70 $\mu V/min$	$\mu V/min$	<input type="checkbox"/>	<input type="checkbox"/>					
				Accuracy	Area	$\pm 2 \%$	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
					Height	$\pm 1 \%$	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
					Retention time	$\pm 1 \%$	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
				Range	Area	1 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
					Height	1 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
					Retention time	2 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
				Repeatability	Area	0.1 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
					Height	0.5 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
					Retention time	0.8 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>				
				2	Hardware validation	"PASS" is displayed for all results falling within the specified tolerances	C H 2	<input type="checkbox"/> Zero point	$\pm 750\mu V$	μV	<input type="checkbox"/>	<input type="checkbox"/>	
								Span	992000 to 1008000 μV	μV	<input type="checkbox"/>	<input type="checkbox"/>	
								Zeroing	$\pm 96\mu V$	μV	<input type="checkbox"/>	<input type="checkbox"/>	
								Linearity	$\pm 0.1\%FS$	$\%FS$	<input type="checkbox"/>	<input type="checkbox"/>	
								Slope test	1 to 70 $\mu V/min$	$\mu V/min$	<input type="checkbox"/>	<input type="checkbox"/>	
								Accuracy	Area	$\pm 2 \%$	$\%$	<input type="checkbox"/>	<input type="checkbox"/>
									Height	$\pm 1 \%$	$\%$	<input type="checkbox"/>	<input type="checkbox"/>
									Retention time	$\pm 1 \%$	$\%$	<input type="checkbox"/>	<input type="checkbox"/>
								Range	Area	1 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>
									Height	1 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>
									Retention time	2 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>
								Repeatability	Area	0.1 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>
									Height	0.5 %	$\%$	<input type="checkbox"/>	<input type="checkbox"/>
Retention time	0.8 %	$\%$	<input type="checkbox"/>						<input type="checkbox"/>				

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3-18 GC-2010Plus Gas Chromatograph Analysis System

☒ Applicable ☐ Not Applicable

Gas Chromatograph Analysis System								
No.	Item	Criteria	Inspection result		Pass	Fail		
1	Repeatability test (calculation method) with a calculator with PC software	Verify the repeatability for the peak, area and retention time. <input type="checkbox"/> Auto injector not used AREA value CV < 10.00% Retention time CV < 2.00% <input checked="" type="checkbox"/> Auto injector (AOC-20i) used AREA value CV % <1.00% (injection unit except OCL/PTV for FID, TCD) <2.00% (OCL/PTV injection unit for FID) < 8.00%(FTD) < 3.00%(FPD) < 5.00%(ECD) < 2.00%(BID) Retention time CV% < 0.30%	Injection unit <u>SP1</u>	AREA value <u>0.35</u> %	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
			Detector <u>FID</u>	Retention time <u>0.02</u> %				
			<input type="checkbox"/> N/A					
			Injection unit	AREA value _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			Detector	Retention time _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			<input checked="" type="checkbox"/> N/A					
			Injection unit	AREA value _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			Detector	Retention time _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			<input checked="" type="checkbox"/> N/A					
			Injection unit	AREA value _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			Detector	Retention time _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			<input checked="" type="checkbox"/> N/A					
			Injection unit	AREA value _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			Detector	Retention time _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			<input checked="" type="checkbox"/> N/A					
			Injection unit	AREA value _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			Detector	Retention time _____ %	<input type="checkbox"/>	<input type="checkbox"/>		
			<input checked="" type="checkbox"/> N/A					

3-19 HS-20 Headspace Sampler System ☐ Applicable ☒ Not Applicable

Headspace Sampler System						
No.	Item	Criteria		Inspection result		Pass/Fail
1	Repeatability test Carry-Over Test (calculation method) with a calculator with PC software	Verify the repeatability of peak area, retention time & carry-over.	At FID AREA value CV% \leq 3.00 % (LOOP mode) Retention time CV% \leq 0.50 % (LOOP mode) Carry Over \leq 0.50% (LOOP mode) AREA value CV% \leq 5.00 % (TRAP mode) Retention time CV% \leq 0.50 % (TRAP mode) Carry Over \leq 1.00% (TRAP mode)	<input type="checkbox"/> LOOP mode <input type="checkbox"/> TRAP mode	AREA value _____ %	<input type="checkbox"/>
				Detector <input type="checkbox"/> N/A	Retention time _____ %	
					Carry-Over _____ %	
				<input type="checkbox"/> LOOP mode <input type="checkbox"/> TRAP mode	AREA value _____ %	<input type="checkbox"/>
				Detector <input type="checkbox"/> N/A	Retention time _____ %	
					Carry-Over _____ %	
				<input type="checkbox"/> LOOP mode <input type="checkbox"/> TRAP mode	AREA value _____ %	<input type="checkbox"/>
				Detector <input type="checkbox"/> N/A	Retention time _____ %	
					Carry-Over _____ %	
				<input type="checkbox"/> LOOP mode <input type="checkbox"/> TRAP mode	AREA value _____ %	<input type="checkbox"/>
				Detector <input type="checkbox"/> N/A	Retention time _____ %	
					Carry-Over _____ %	

3-20 HS-10 Headspace Sampler System ☐ Applicable ☒ Not Applicable

Headspace Sampler System						
No.	Item	Criteria		Inspection result		Pass/Fail
1	Repeatability test Carry-Over Test (calculation method) with a calculator with PC software	Verify the repeatability of peak area, retention time & carry-over.	At FID AREA value CV% \leq 3.00 % Retention time CV% \leq 0.50 % Carry Over \leq 0.50%	Detector <input type="checkbox"/> N/A	AREA value _____ %	<input type="checkbox"/>
					Retention time _____ %	
					Carry-Over _____ %	
				Detector <input type="checkbox"/> N/A	AREA value _____ %	<input type="checkbox"/>
					Retention time _____ %	
					Carry-Over _____ %	
				Detector <input type="checkbox"/> N/A	AREA value _____ %	<input type="checkbox"/>
					Retention time _____ %	
					Carry-Over _____ %	
				Detector <input type="checkbox"/> N/A	AREA value _____ %	<input type="checkbox"/>
					Retention time _____ %	
					Carry-Over _____ %	

3-21 AOC-6000 Auto Sampler System

☐ Applicable ☒ Not Applicable

Auto Sampler System						
No.	Item	Criteria	Inspection result	Pass	Fail	
1	Liquid injection repeatability test with a calculator with PC software	Verify the repeatability for the peak area and retention time. (SPL / WBI, FID / TCD)	AREA value CV% < 2.00% Retention time CV% < 0.50%	Injection unit	AREA value	
				Detector	_____ %	
				<input type="checkbox"/> N/A	Retention time	
					_____ %	
				Injection unit	AREA value	
				Detector	_____ %	
				<input type="checkbox"/> N/A	Retention time	
					_____ %	
				Injection unit	AREA value	
				Detector	_____ %	
				<input type="checkbox"/> N/A	Retention time	
					_____ %	

No.	Item	Criteria	Inspection result	Pass	Fail
2	Headspace injection repeatability test, Carry-over test (calculation method) with a calculator with PC software	Verify the repeatability of peak area, retention time and carry-over (SPL, FID)	AREA value CV% < 5.00 % Retention time CV% < 1.00 % Carry Over < 0.50%	Detector	AREA value
				<input type="checkbox"/> N/A	_____ %
					Retention time
					_____ %
					Carry-Over
					_____ %
				Detector	AREA value
				<input type="checkbox"/> N/A	_____ %
					Retention time
					_____ %
					Carry-Over
					_____ %

4. Change List

When changing or deleting the contents of this document, or adding new information to this document, record the revision letter, change list number, page number, reason, date, and name of the Performer in the Change List below, and obtain the approval of the Reviewer and the Manager.

Revision letter: Assign an alphabetical letter for each revision, starting from A. Give the same revision letter for changes made at the same time.

Change No: Enter the change number assigned in sequence from 1 onwards in accordance with "1-3 Entries and Revisions". Increase this number over different revision letters (do not revert the Change No. to 1 when the revision letter proceeds from A to B, for example).

Page: Enter the page number in which the change, deletion or addition was made.

Reason: Enter the reason for the change, deletion or addition.

Date: Enter the date on which the change, deletion or addition was made.

Revision letter	Change No.	Page	Reason	Date	Performer	Reviewer	Manager

Revision letter	Change No.	Page	Reason	Date	Performer	Reviewer	Manager

Operational Qualification

Change List

Revision letter	Change No.	Page	Reason	Date	Performer	Reviewer	Manager

Operational Qualification

Attached Documents

5. Attached Documents

Attached	Item	Description		Page
<input checked="" type="checkbox"/>	2-4	Calibration Certificates	238290	Certificate of traceability
<input checked="" type="checkbox"/>		Pressure gauge	1122215034	Certificate of traceability
<input checked="" type="checkbox"/>		Flow meter	CT240054	Certificate of traceability
<input type="checkbox"/>		Digital temperature indicator		Certificate of traceability
<input type="checkbox"/>		Resistance temperature sensor		Certificate of traceability
<input type="checkbox"/>		Thermocouple		Certificate of traceability
<input type="checkbox"/>		Programmable DC voltage/current generator		Certificate of traceability
<input checked="" type="checkbox"/>		Standard reagents for performance inspections		Certificate
<input checked="" type="checkbox"/>	3-1	GC-2010Plus Gas Chromatograph Test 10 FID Sensitivity test		Verification Data Appendix 48-A1/1
<input type="checkbox"/>		TCD sensitivity test		Verification Data Appendix 48-
<input type="checkbox"/>	3-7	FID-2010Plus Flame Ionization Detector Test 10 FID Sensitivity test		Verification Data Appendix 48-
<input type="checkbox"/>	3-8	FTD-2010Plus Flame Thermionic Detector		Verification Data Appendix 48-
<input type="checkbox"/>	3-9	FPD-2010Plus Flame Photometric Detector		Verification Data Appendix 48-
<input type="checkbox"/>	3-10	ECD-2010Plus Electron Capture Detector		Verification Data Appendix 48-
<input type="checkbox"/>	3-11	ECD-2010 Exceed Electron Capture Detector		Verification Data Appendix 48-
<input type="checkbox"/>	3-12	BID-2010Plus Barrier Discharge Ionization Detector		Verification Data Appendix 48-
<input type="checkbox"/>	3-16	Chromatopac C-R7Aplus/C-R7Aeplus		Verification data Appendix 48-
<input type="checkbox"/>	3-17	Chromatopac C-R8A		Verification data Appendix 48-
<input checked="" type="checkbox"/>	3-18	GC-2010Plus Analysis System Test 1 Repeatability Test		Verification data Appendix 48-B 1/2 - B2/2
<input type="checkbox"/>	3-19	HS-20 Headspace Sampler System Test 1 Repeatability Test Carry-Over Test		Verification Data Appendix 48-
<input type="checkbox"/>	3-20	HS-10 Headspace Sampler System Test 1 Repeatability Test Carry-Over Test		Verification Data Appendix 48-
<input type="checkbox"/>	3-21	AOC-6000 Auto Sampler System(Headspace) Test 1 Repeatability Test Carry-Over Test		Verification Data Appendix 48-


* Appended data shall be numbered by adding letters in sequence from A to the final page number of this document (e.g. 48-A1/3 - A3/3) and appended to this document after entry in the list above.

ICP-OES/Avio550

Serial No. : M81S2210101

ICP-OES/Avio550 Preventive Maintenance (PM)

Company Name:	Eastern Thai Consulting 1992 Cl.,Ltd.		
Address (Instrument Location):	683 Moo 11 Sukapibal 8 Rd. Nong Kham,Si Racha, Chonburi 20230		
Serial Number:	M8152210101	PM Number:	2 of 2
Customer Name (if applicable):		Telephone Number:	
Service Engineer Name:	Khwanchai	Service Order Number:	WO-02963150
Date PM Performed: (DD-MMM-YYYY)	25-Oct-2024	Next PM Due Date: (DD-MMM-YYYY)	25-Apr-2025
Standard Labor Hours to Complete PM :		4 hours	

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

Scope

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

General Instructions:

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

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

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes
NA	NA	NA

Parts Lists

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

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N0691579	Muti-Element Standard	AR	61-176CRX1	06/2025
N9300221	DL Standard diluted 100 X	AR	59-091CRY1	11/2024
N0582152	Wave Cal Solution	AR	61-023CRX1	02/2025
N9302946	VIS Wavecal Solution	AR	58-145CRT1	04/2025

Procedure Checklist

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

1. General:

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

2. Mechanical:

- ☒ Inspect and clean all fans and filters.
- ☒ Inspect and replace torch components and necessary.
- Torch Components Replaced: ☐ Yes ☒ No
- ☐ Inspect all tubing for signs of cracking or leaking and replace as necessary.
- Tubing Replaced: ☐ Yes ☒ No

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

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

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

3. Electrical

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

RF Generator:

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

Spectrometer:

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

4. Optical:

- ☒ Clean or replace the axial and radial view windows as necessary.
- Axial Window Replaced: ☐ Yes ☒ No
- Radial Window Replaced: ☐ Yes ☒ No

5. PM Performance Tests:

- ☒ Perform View Align.

Test Spectral Resolution:

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

Parameter	Specification	Test Result	Pass/Fail
As 193.696 - Resolution	≤0.007	0.00528	Passed
Ni 231.604 - Resolution	≤0.008	0.00724	Passed
Ni 341.476 - Resolution	≤0.012	0.00911	Passed
La 408.672 - Resolution	≤0.020	0.01596	Passed
Ba 455.403 - Resolution	≤0.025	0.02165	Passed

Test Precision:

- ☒ Test for reproducibility of a set of measurement.

Parameter	Specification	Test Result	Pass/Fail
As 193.696	%RSD ≤ 1 %	0.26	Passed
Zn 213.856	%RSD ≤ 1 %	0.21	Passed
Mn 257.610	%RSD ≤ 1 %	0.20	Passed
La 379.478	%RSD ≤ 1 %	0.21	Passed
Ba 455.403	%RSD ≤ 1 %	0.21	Passed
Ba 493.408	%RSD ≤ 1 %	0.19	Passed

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

Test Axial BEC Cd:

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

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

Element	Conc.	IB	IS	
Cd 226	500	523.1	223029.5	
IB*Conc	IS-IB	BEC	Spec	Pass/Fail
261550	222506.4	1.18	<150 PPB	Passed

Test Radial BEC Mn:

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

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

Element	Conc.	IB	IS	
Mn 257	1,000	586.9	253416.6	
IB*Conc	IS-IB	BEC	Spec	Pass/Fail
586900	252829.7	2.32	<45 PPB	Passed

6. Review:

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

Additional Comments

Additional Comments Regarding the PM

None

Review

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

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

Review of Preventive Maintenance:

Authorized PerkinElmer		Date: 25-Oct-2024 (DD-MMM-YYYY)
Authorized Customer		Date: 25-Oct-2024

LIQUID IN GLASS THERMOMETER

Model / Type : 0-100 °C

Serial No. : 43560



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : LIQUID IN GLASS THERMOMETER
MANUFACTURER : AA PRECISION
MODEL / TYPE : 0-100 °C
SERIAL NO. : 43560[LABE 16/1]
CLID. NO. : 232403905
JOB CONTROL NO. : 241031116258
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : EASTERN THAI CONSULTING 1992 CO., LTD.
683 MOO 11, SUKHAPIBARN 8 RD,
NONGKHAM, SRIRACHA, CHONBURI 20230

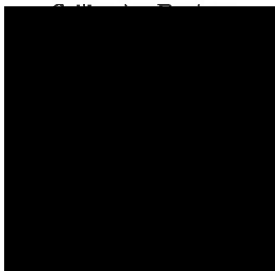
DATE OF RECEIVED : 31 October 2024

DATE OF ISSUED : 05 November 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Pimsiri Hemtanon

Approved By :



This Calibration Certificate documents the traceability to national standards, which realize the units of
according to the International System of Units (SI)

Certificate No. Q24116258

F3-011-05/12-23

page 1 of 3



@clccalibration



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : LIQUID IN GLASS THERMOMETER
MANUFACTURER : AA PRECISION
MODEL / TYPE : 0-100 °C
SERIAL NO. : 43560[LABE 16/1]
DATE OF CALIBRATION : 04 November 2024

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPH-02 based on ASTM E 77-07 as calibration guidelines.
The calibration was performed by comparison with Calibration Bath, Precision Thermometer and IPRT
which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Calibration Bath, Kambic Model OB-22/2 ULT,OB-22/2 S/N. 17115653,17115654.
2. Precision Thermometer, ASL Model F200-A-8 S/N. 014433/03 with IPRT S/N. L0193A-1-1,PO106346-1-18.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q23136342,Q23126517. Due Date 20 December 2024,20 November 2024.
2. The measurements are traceable to International System of Units (SI), through Thailand Institute of Scientific and Technological Research (TISTR) and National Institute of Metrology (Thailand).
Certificate No. PSL-T 0203/67,TT-0136-23,TT-0110-24. Due Date 07 December 2024,12 December 2024,06 August 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied
by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration"

Certificate No. Q24116258

F3-011-05/12-23



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC Reading were recorded and the means value were reported of four times measurement in the table below.

CALIBRATION DATA

CORRECTION OF TEMPERATURE

STD Reading (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty \pm (°C)
0.039	0.00	+0.039	0.065
25.003	25.00	+0.003	
50.008	50.00	+0.008	
100.013	100.00	+0.013	

Range : 0 °C to 100 °C

Graduation : 0.1 °C

Immersion Type : Total Immersion.

Correction of Reference Temperature (0 °C) = 0.039 °C

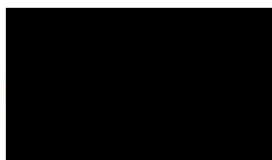
Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 56 of 67

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q24116258

F3-011-05/12-23



@dcalibration

pH Meter

Model : SevenCompact S220

Serial No. : B835349235

Certificate Number CCP-0403-25

Calibration Certificate

SevenCompact™ pH/Ion Meter S220

Customer

Company EASTERN THAI CONSULTING 1992 CO., LTD.

Address 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham

Siracha

CHONBURI 20230

Customer ID number 301608441

Customer representative คุณ ศิริกร นาคฉันท

Instrument

Type SevenCompact™ S220

Instrument Serial Number B835349235

Internal identification LABE 11/6

Firmware version 1.20.06

Technical specifications

Measuring Range -1999.9 ... 1999.9 mV -2.000 ... 20.000 pH

Resolution 0.1 mV 0.001 pH

Limit of Error ± 0.2 mV ± 0.002 pH

Temperature range MTC -30.0 ... 130.0 °C

Temperature range ATC -5.0 ... 130.0 °C

Resolution 0.1 °C

Limit of Error ± 0.1 °C

Procedure Statement

METTLER TOLEDO Certification SOP (Doc. No. ME-30027577B) will be used as referring documentation to adjust and certify the instrument indicated in the "Type" and "Serial number" section. The measurement results of this certification were obtained at ambient conditions.

Certificate Number CCP-0403-25

Certification Tools

Certified digital voltmeter

Manufacturer KEYSIGHT TECHNOLOGIES

Type 34461A

Control No. ANA143

Serial number MY60036967

Certificate number E1U2401054

Due date March 10, 2025

Certified Temperature Resistors

Manufacturer METTLER-TOLEDO

Type 51302410

Control No. ANA114

Serial number A275

Certificate number 73757

Due date February 12, 2026

Designation	Nominal value	Certified value
NTC 30 k Ω , 0 °C	94.980 k Ω	94.9730 k Ω
NTC 30 k Ω , 25 °C	30.000 k Ω	29.9950 k Ω
NTC 30 k Ω , 50 °C	10.969 k Ω	10.9704 k Ω
NTC 30 k Ω , 75 °C	4.528 k Ω	4.5275 k Ω
NTC 30 k Ω , 100 °C	2.070 k Ω	2.0714 k Ω
PT1000, 0 °C	1.000 k Ω	1.0001 k Ω
PT1000, 25 °C	1.0974 k Ω	1.0975 k Ω
PT1000, 50 °C	1.1940 k Ω	1.1942 k Ω
PT1000, 75 °C	1.2899 k Ω	1.2900 k Ω
PT1000, 100 °C	1.3851 k Ω	1.3851 k Ω

Certificate Number **CCP-0403-25**

Certification Measurements

pH/mV Sensor Input	Designation	Certified value	Measured value	Max. Tolerance	Passed / Failed
	-1900 mV	-1900.0 mV	-1899.98 mV	0.2 mV	Passed
	-1000 mV	-1000.0 mV	-1000.00 mV	0.2 mV	Passed
	-500 mV	-500.0 mV	-499.98 mV	0.2 mV	Passed
	-180 mV	-180.0 mV	-180.00 mV	0.2 mV	Passed
	0 mV	0.0 mV	0.01 mV	0.2 mV	Passed
	180 mV	180.0 mV	179.98 mV	0.2 mV	Passed
	500 mV	500.0 mV	499.90 mV	0.2 mV	Passed
	1000 mV	1000.0 mV	1000.00 mV	0.2 mV	Passed
	1900 mV	1900.0 mV	1899.99 mV	0.2 mV	Passed

pH/mV Sensor Input at high impedance	Designation	Measured low imp.	Measured high imp.	Max. Tolerance	Passed / Failed
	1900 mV	1900.0 mV	1899.8 mV	0.6 mV	Passed

Temperature Sensor Input	Designation	Nominal value	Measured value	Max. Tolerance	Passed / Failed
	NTC 30 k Ω , 0 °C	0.0 °C	0.0 °C	0.1 °C	Passed
	NTC 30 k Ω , 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
	NTC 30 k Ω , 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
	NTC 30 k Ω , 75 °C	75.0 °C	74.9 °C	0.1 °C	Passed
	NTC 30 k Ω , 100 °C	100.0 °C	100.0 °C	0.1 °C	Passed
	PT1000, 0 °C	0.0 °C	0.1 °C	0.1 °C	Passed
	PT1000, 25 °C	25.0 °C	25.0 °C	0.1 °C	Passed
	PT1000, 50 °C	50.0 °C	50.0 °C	0.1 °C	Passed
	PT1000, 75 °C	75.0 °C	74.9 °C	0.1 °C	Passed
	PT1000, 100 °C	100.0 °C	99.9 °C	0.1 °C	Passed

Summary of Certification

Certification of instrument

Passed

The instrument referred to in this certificate has fulfilled the criteria of the certification. This is indicated by the notation Passed in the column above.

Remarks - Test high impedance at 1900.0 mV, Results : 1899.8 mV

Difference = 0.005% Within MPE (0.033%)

Mettler-Toledo (Thailand) Limited

Performance Test

Attachment to Certificate No. CCP-0403-25

pH Electrode

Type: **InLab Expert Pro-ISM** S/N: **2463982**

Certified standards used

Standard 1:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: 3-Dec-2026
	Nominal value: pH (25.00 °C):	4.01	Lot No.: 1J338E
Standard 2:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: 27-Nov-2026
	Nominal value: pH (25.00 °C):	7.00	Lot No.: 1J331B
Standard 3:	Type: pH Buffer	Manufacturer: METTLER TOLEDO	Exp. date: 11-Jan-2026
	Nominal value: pH (25.00 °C):	10.00	Lot No.: 1K011B
Standard 4:	Type: Redox Solution	Manufacturer: METTLER TOLEDO	Exp. date: -
	Nominal value: pH (25.00 °C):	-	Lot No.: -

Adjustment

Set Calibration Buffer	B1 (25 °C) 1.68, 4.01, 7.00, 10.01					
	3-Point calibration		2-Point calibration		2-Point calibration	
Select Calibration Mode Segment	3-Point Calibration					
	°C	pH	°C	pH	°C	pH
Cal 1	ATC 25.5	7.00	ATC		ATC	
Cal 2	ATC 25.5	4.00	ATC		ATC	
Offset (mV)	-27.2					
Slope % (or mV/pH)	95.9					
Cal 3	ATC 25.5	10.01				
Offset (mV)	-27.2					
Slope % (or mV/pH)	97.4					

Measurements

Resolution: 2 Decimal places

As Found					As Left				
Buffer Values		Measured		Difference	Buffer Values		Measured		Difference
pH	°C	pH		pH	pH	°C	pH		pH
4.01	25.3	ATC	4.02	0.01	4.01	25.3	ATC	4.01	0.00
7.00	25.2	ATC	6.98	-0.02	7.00	25.2	ATC	7.01	0.01
9.99	25.3	ATC	10.11	0.12	9.99	25.2	ATC	10.00	0.01

Redox Measurement Result = - mV

STANDARD WEIGHT 50 g



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

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 31 May 2022

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

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

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



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

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g
Manufacturer : METTLER TOLEDO
Class : F1
Serial No. : N/A
ID No. : LABE 10/1

Result of Calibration : ☒ Without adjustment ☐ Adjustment

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

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

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3

Certificate No. : 22-052238

Sample Code : 22-19150-003

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 1.20 kg/m³

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

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

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

- End of Report -

STANDARD WEIGHT 100 g



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

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

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

Approved by

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

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

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



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

REPORT OF CALIBRATION

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

Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

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

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, which for a normal distribution is approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M30

Certificate No. : 22-052239

Sample Code : 22-19150-004

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 100 g
Shape :	Cylindrical weight with knob
Material :	Stainless steel
Case :	Wooden Box
Comments :	Recalibration

- End of Report -

STANDARD WEIGHT 50 g



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

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

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

Approved by

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

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3000.



Certificate No. : 22-052237

Sample Code : 22-19150-002

REPORT OF CALIBRATION

Condition of Calibration

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

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737

CERTIFICATE OF CALIBRATION

Certificate No. : 24-062442
Sample Code : 24-25546-002Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
683 Moo 11, Sukhapibarn 8 Rd., Nongkham,
Sriracha, Chonburi 20230Location of Calibration : Asia Medical and Agricultural Laboratory and Research Center Public Company Limited
(Calibration laboratory)

Equipment : Digital thermo-hygrometer

Manufacturer : testo Model : 608-H1
Serial No. : 45106737 ID No. : LABE 09/7
Date of Receipt : 23 May 2024 Date of Calibration : 27-28 May 2024

Condition of Calibration

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

2. Calibration method

- 2.1 In-house method: WI-CL-045 By comparison with thermometer standard / chilled mirror hygrometer in controlled chamber.
2.2 The calibration by comparison unit under calibration (UUC) to the thermometer standard / chilled mirror hygrometer in a chamber at the controlled temperature / relative humidity.

3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due Date
3.1 Chilled Mirror	Optidew 401	LB-DP-03 & LB-DP-03 (DP)	TH-0064-23	07 August 2024
3.2 Digital Thermometer	Optidew 401	LB-DP-03 & LB-DP-03 (Temp.)	23-103423	03 September 2024
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	23-101374	05 September 2024

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

- 4.1 Instrument No. 3.1 through National Institute of Metrology (Thailand).
4.2 Instrument No. 3.2 and 3.3 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal

Calibrated by Miss Pornsuda Lohabal Approved by

Scientist

Issue date 30 May 2024

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

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

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

REPORT OF CALIBRATION

Certificate No. : 24-062442
Sample Code : 24-25546-002

Results of Calibration

Temperature measurement

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

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

Humidity measurement

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

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.02	45.10	48.4	- 3.30	± 1.3
60	25.01	60.07	63.4	- 3.33	± 1.5
75	25.01	75.15	78.5	- 3.35	± 1.7

Notes

- Calibration results without adjustment.

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3.

- End of Report -

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACC24043

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No.: 34802645
ID No.: -

Condition As Found : GOOD

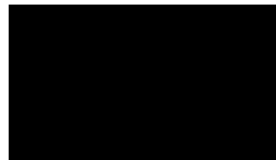
Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

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

Received Date : 09 SEPTEMBER 2024
Calibration Date : 26 SEPTEMBER 2024
Date of Issue : 26 SEPTEMBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :



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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACC24043

Job No. : VC67AC0150

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by follow 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 :

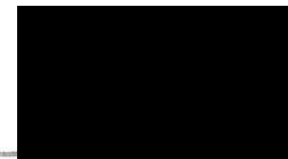
<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL.BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL.BP 20/0267	15-FEB-25
Digital Multimeter	33461A	MY60024273	EEL.BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KAI	34560495	AA-3001-24	05-FEB-25
Audio Analyzer	AVR-3360A	V744B6069	EF-0009-24	09-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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



Petch

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACC24043
Job No. : VC67AC0150
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	93.97	-0.03	0.14	0.40

2. Frequency

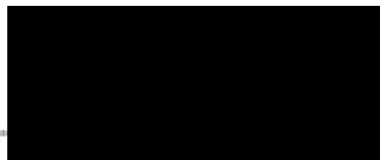
Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Acceptance limit (%)
1000	1000.0	0.0	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Acceptance limit (%)
0.15	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 —————



SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322753



Cert. No. : ACL24140
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00322753 / 196476 / 15485
ID No.: -

Condition As Found : GOOD

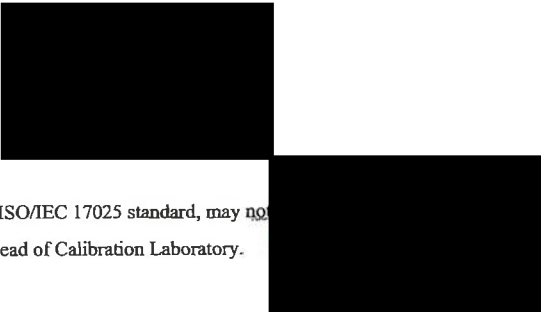
Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

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

Received Date : 29 APRIL 2024
Calibration Date : 13-17 MAY 2024
Date of Issue : 20 MAY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :



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



Cert. No. : ACL24140
Job No. : VC67AC0083
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

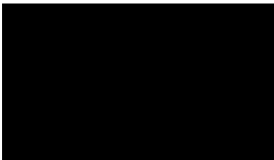
This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.
3. This certificate is traceable to the international system of unit maintained at :
3.1 National Institute of Metrology (Thailand).
3.2 Thailand Institute of Scientific and Technological Research (TISTR).



Signature

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACL24140
Job No. : VC67AC0083
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	0.2	N/A
2. Self-generated noise	0.2	N/A
3. Acoustical signal tests of frequency weightings		
125 Hz	0.3	0.6
1000 Hz	0.3	0.6
8000 Hz	0.3	0.7
4. Electrical signal tests of frequency weightings		
For 10 Hz to 4 kHz	0.3	0.6
For > 4 kHz to 10 kHz	0.3	0.7
For > 10 kHz to 20 kHz	-	1.0
5. Frequency and time weightings at 1 kHz	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

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACL24140
Job No. : VC67AC0083
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)
14.8

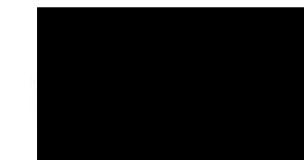
2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	11.3
C - weight	17.6
Flat	23.3

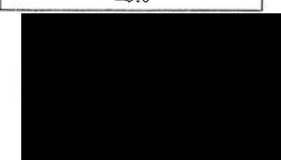
3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.0	0.0	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.5	1.6	1.6	±5.0



G. Petcha



G. Petcha

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

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8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	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	±3.0
Positive half cycle	135.4	135.2	-0.2	±3.0
Negative half cycle	135.4	135.2	-0.2	±3.0

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11. Overload indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - 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. : 00322749



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0252

MTC No. EEL. BP. 12/0267

CALIBRATION CERTIFICATE

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

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

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Level Meter

Manufacturer : Rion

Model : NL-42A

Serial No. : 00322749

Microphone : UC-52 No.196472

Preamplifier : NH-24 No.15481

Standards used :

1. Band Pass Filter Wavetek 752A S/N 90010494.
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 : 5 Feb. 2024

Date of Calibration : 5 Mar. 2024

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Request No. 21-67/0252

MTC No. EEL. BP. 12/0267

9. Power Amplifier Brüel&Kjær 2706 S/N 1517650.

10. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

11. Digital Multimeter Agilent 34401A S/N MY44005560.

12. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

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

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

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

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

Date of Calibration : 5 Mar. 2024

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value(dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust				
113.92	114.0	113.9	0.0	1.0	0.30	N/A

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

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
15.8	0.10	N/A

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

Frequency Weighting	Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
A-Weight	12.3	0.10	N/A
C-Weight	30.0	0.10	N/A
Flat	28.6	0.10	N/A

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve(dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
125	0.0	0.1	0.2	1.5	0.45	0.6
1 000	-0.2	-0.2	-0.3	1.0	0.45	0.6
8 000	-0.4	-0.4	-0.4	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response curve(dB)			Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	A-weight	C-weight	Flat			
63	0.0	0.1	0.0	2.0	0.20	0.6
125	0.0	0.1	0.0	1.5	0.20	0.6
250	0.0	0.1	0.0	1.5	0.20	0.6
500	0.0	0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.0	0.0	1.0	0.20	0.6
2 000	-0.2	-0.1	-0.2	2.0	0.20	0.6
4 000	-0.3	-0.3	-0.3	3.0	0.20	0.6
8 000	0.0	0.1	-0.1	5.0	0.20	0.7

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5. Long-term stability

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

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm 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 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm 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 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
137	137.0	0.0	1.1	0.30	0.3
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	124.0	0.0	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	1.1	0.30	0.3
104	104.0	0.0	1.1	0.30	0.3
99	99.0	0.0	1.1	0.30	0.3
94	94.0	0.0	1.1	0.30	0.3
89	89.0	0.0	1.1	0.30	0.3
84	84.0	0.0	1.1	0.30	0.3
79	79.0	0.0	1.1	0.30	0.3
74	74.0	0.0	1.1	0.30	0.3
69	68.9	-0.1	1.1	0.30	0.3
64	63.9	-0.1	1.1	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 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
59	58.9	-0.1	1.1	0.30	0.3
54	53.9	-0.1	1.1	0.30	0.3
49	48.9	-0.1	1.1	0.30	0.3
44	43.9	-0.1	1.1	0.30	0.3
39	38.9	-0.1	1.1	0.30	0.3
34	33.9	-0.1	1.1	0.30	0.3
29	28.9	-0.1	1.1	0.30	0.3
28	28.0	0.0	1.1	0.30	0.3
27	27.0	0.0	1.1	0.30	0.3
26	25.9	-0.1	1.1	0.30	0.3
25	25.0	0.0	1.1	0.30	0.3

8. Level linearity including the level range control

At reference sound level on the reference level range

Range	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
30-130	94.0	94.0	0.0	1.1	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 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
30-130	35	35.0	0.0	1.1	0.30	0.3

9. Tone burst response

Time Weighting	Toneburst Duration, Tb(ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (\pm dB)	Uncertainty (\pm dB)	Maximum-permitted uncertainty of measurement (\pm dB)
Fast	200	126.1	0.1	± 1.0	0.20	0.3
	2	109.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	100.0	0.0	+1.5; -5.0	0.20	0.3
Slow	200	119.6	0.0	± 1.0	0.20	0.3
	2	100.0	0.0	+1.0; -5.0	0.20	0.3
SEL	200	120.0	0.0	± 1.0	0.20	0.3
	2	100.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	91.0	0.0	+1.5; -5.0	0.20	0.3

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10. Peak C sound level

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

11. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit class 2(±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Positive one-half cycle	Negative one-half cycle				
136.6	136.6	0.0	1.5	0.20	0.25

12. High-level stability

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

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FM.BL.MTC.002 Rev.

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SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322755

Certificate of Calibration

Certificate No.: S2402-0651-01

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

Date of calibration: 2024-03-04
2024-03-26

Date of issue: 2024-03-26

Instrument Calibrated: Sound Level Meter

Manufacturer: Rion

Model: NL-42A (Meter), UC-59 (Microphone), NH-25 (Preamplifier)

Serial no: 00322755 (Meter), 21960 (Microphone), 22336 (Preamplifier)

Calibration and verification performed:

Acoustical levels are stated relative to 20 μ Pa. Other dB levels are relative values.

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which with the reported effective degree of freedom corresponds to coverage probability of approximately 95%.

The sound level meter instrument submitted for periodic testing following the periodic tests of IEC 61672-3 : 2013.

Preconditioning:

The equipment was preconditioned for more than 16 hours at the specified calibration temperature and humidity.

Instruments and Program:

A complete list of instruments, hardware, and software, that has been used for this calibration is separately available from the calibration laboratory.

Equipment standards used:

- Sound measuring equipment calibration unit 483B S/N31083
- Digital multimeter Keysight S/N HP34401A
- Ultra-low distortion function generator Stanford SRS DS360 S/N123625
- Acoustic sound calibrator class 1 Nor1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

Traceability

The measured values are traceable to following the ISO/IEC 17025 laboratories:

Sound Pressure Level: EEI, Thailand

Reference Pressure, Humidity and Temperature: TPA, Thailand

Voltage: TPA, Thailand

Frequency: TPA, Thailand

This certificate of calibration is issued by Acoustic Laboratory Thailand (ALT). It also states that the laboratory has a satisfactory accreditation or national calibration laboratories. This certificate may not be reproduced other than in full.

Environmental conditions: Pressure: 101.325 kPa Temperature: 23.0 °C Relative humidity: 50 %RH
Reference conditions: 101.325 kPa 23.0 °C 50 %RH
Measurement conditions: 100.87 \pm 0.10 kPa 23.5 \pm 1.0 °C 57.0 \pm 2.0 %RH

1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)		Deviated value (dB)	Acceptance limit (dB)
	Before adjust	After adjust		
93.9	93.9	93.9	0.0	\pm 1.0

Note: Indication at the checked calibration frequency was adjusted to 93.9 dB by the sound calibrator Type NC-75 S/N: 34234715

2. Self-generated noise

Frequency weightings	Measured value (dB)
A-Weighting	10.8
C-Weighting	15.3
Z-Weighting	20.7

3. Electrical signal test of frequency weighting at 91 dB

Frequency (Hz)	Deviation from various frequency weighting response curve			
	A-Weighting (dB)	C-Weighting (dB)	Z-Weighting (dB)	Acceptance limit (dB)
63	0.0	0.0	0.0	\pm 2.0
125	0.1	0.1	0.0	\pm 1.5
250	0.0	0.0	0.0	\pm 1.5
500	0.1	0.1	0.1	\pm 1.5
1000	0.0	0.0	0.0	\pm 1.0
2000	-0.1	-0.1	-0.2	\pm 2.0
4000	-0.3	-0.3	-0.3	\pm 3.0
8000	0.1	0.1	0.0	\pm 5.0

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

4. Frequency and time weighting at 1 kHz

4.1 Frequency weighting at 1 kHz

Frequency weightings	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
A	94.0	0.0	±0.3
C	94.0	0.0	±0.3
Z	94.0	0.0	±0.3

4.2 Time weighting at 1 kHz

Time weightings	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
Fast	94.0	0.0	±0.3
Slow	94.0	0.0	±0.3
LAeq	94.0	0.0	±0.3

5. Long term stability

Time interval (mm:ss)	Start level (dB)	Stop level (dB)	Deviated value (dB)	Acceptance limit (dB)
28:58	94.0	94.0	0.0	±0.3

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

6. Level linearity on the reference level range

6.1 Measured at 31.5 Hz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
84.0	84.0	0.0	±1.1
89.0	89.0	0.0	±1.1
92.6	92.6	0.0	±1.1
93.6	93.6	0.0	±1.1
94.6	94.6	0.0	±1.1
95.6	95.6	0.0	±1.1
96.6	96.6	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	44.1	0.1	±1.1
40.0	39.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
38.0	38.0	0.0	±1.1
37.0	37.0	0.0	±1.1
36.0	36.0	0.0	±1.1

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

6.2 Measured at 1 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
132.0	132.0	0.0	±1.1
133.0	133.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1
136.0	136.0	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
40.0	40.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
38.0	38.0	0.0	±1.1
37.0	36.9	-0.1	±1.1
36.0	35.9	-0.1	±1.1

Date of calibration : 2024-03-04
2024-03-26
Date of issue : 2024-03-26

6.3 Measured at 8 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
130.9	130.9	0.0	±1.1
131.9	131.9	0.0	±1.1
132.9	132.8	-0.1	±1.1
133.9	133.9	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	78.9	-0.1	±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	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
40.0	39.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
38.0	37.9	-0.1	±1.1
37.0	36.9	-0.1	±1.1
36.0	35.9	-0.1	±1.1

Date of calibration : 2024-03-04
2024-03-26
Date of issue : 2024-03-26

7. Tone burst response

Time weightings	Tone burst duration, Tb (ms)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
Fast	200	133.0	0.0	±1.0
	2	116.0	0.0	+1.0,-2.5
	0.25	107.0	0.0	+1.5,-5.0
Slow	200	126.6	0.0	±1.0
	2	107.0	0.0	+1.0,-5.0
SEL	200	127.0	0.0	±1.0
	2	107.0	0.0	+1.0,-2.5
	0.25	97.9	-0.1	+1.5,-5.0

8. Peak C sound level

Number of cycles in test signal	Anticipated Value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
Complete cycle	128.4	127.4	-1.0	±3.0
Positive half cycle	130.4	130.1	-0.3	±2.0
Negative half cycle	130.4	130.1	-0.3	±2.0

9. Overload indication

Measured value (dB)		Deviated value (dB)	Acceptance limit (dB)
Positive one half cycle	Negative one half cycle		
139.1	138.9	0.2	±1.5

10. High level stability

Initial level (dB)	Final level (dB)	Deviated value (dB)	Acceptance limit (dB)
135.0	135.0	0.0	±0.3

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

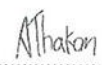
Uncertainty of measurement


Parameters	Uncertainty
1. Indication at the calibration check frequency	0.12 dB
2. Self-generated noise	
- Frequency Weighting A	0.090 dB
- Frequency Weighting C	0.13 dB
- Frequency Weighting Z	0.090 dB
3. Electrical signal test of frequency weighting	0.13 dB
4. Frequency and time weightings at 1 kHz	0.13 dB
5. Long term stability test	0.10 dB
6. Level linearity on the reference level range	0.14 dB
7. Tone burst response	0.14 dB
8. Peak C sound level	0.13 dB
9. Overload indication	0.13 dB
10. High level stability test	0.10 dB

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

Remark : The acoustical signal test of frequency weighting at 125Hz, 1kHz, and 8kHz is not included, along with correction values for environmental conditions in a free-field or diffuse field, and the effect of reflection and diffraction on the measurement microphone and the sound level meter.

Replacement Calibration Certificate for calibration certificate number S2402-0651

Calibrated By: 
(Mr.Athakom Sumphan)

Approved By: 
(Mr.Pitupong Sarapho)

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

----- End of Certificate of Calibration -----

SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322746

Cert. No. : ACL24229
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00322746 / 196469 / 15478
ID No.: -

Condition As Found : GOOD

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

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

Received Date : 02 JULY 2024
Calibration Date : 10 - 11 JULY 2024
Date of Issue : 15 JULY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

This certificate is issued in accordance with the requirements of
other than in full, except with the prior written approval of the

Cert. No. : ACL24229
Job No. : VC67AC0117
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference
Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand
 Tel. +66 2433 8331 Email : calibration@sithiporn.com

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Cert. No. : ACL24229
 Job No. : VC67AC0117
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Summary of Measurement Result :

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

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 Job No. : VC67AC0117
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Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.94)	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	Weighting (dB)
A - weight	10.8
C - weight	17.0
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.8	-0.8	-0.8	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.5	0.6	0.6	±5.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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Job No. : VC67AC0117
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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 Job No. : VC67AC0117
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8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{cp} peak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.3	-1.1	±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		
Positive half cycle	135.4	135.1		
Negative half cycle	135.4	135.1		

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Cert. No. : ACL24229
 Job No. : VC67AC0117
 Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

BAROMETER

Serial No. : N/A[S41020124]



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : BAROMETER
MANUFACTURER : BARIO
MODEL / TYPE : N/A
SERIAL NO. : N/A[S41020124]
CLID. NO. : 212500828
JOB CONTROL NO. : 250507051351
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : EASTERN THAI CONSULTING 1992 CO., LTD.
683 MOO 11, SUKHAPIBARN 8 RD,
NONGKHAM, SRIRACHA, CHONBURI 20230

DATE OF RECEIVED : 07 May 2025 DATE OF ISSUED : 09 May 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q25051351

F3-011-05/12-23



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : BAROMETER
MANUFACTURER : BARIO
MODEL / TYPE : N/A
SERIAL NO. : N/A[S41020124]
DATE OF CALIBRATION : 08 May 2025

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-08 according to DKD-R 6-1 as calibration guidelines.

The calibration was performed by direct measurement with Reference Pressure Monitor which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Reference Pressure Monitor, Fluke Model RPM3 S/N. 829.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).

Certificate No. MP-0245-24, Due Date 11 November 2025.

UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2$. It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q25051351

F3-011-05/12-23



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

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Tel. 02-576-0353-4 Fax. 02-578-2672 www.cil.laboratory.com E-mail:sale@cal.laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (hPa)	STD Reading (hPa)		Correction (hPa)	
	Up	Down	Up	Down
990	990.7	990.7	+0.7	+0.7
1000	1000.7	1000.8	+0.7	+0.8
1010	1010.8	1010.8	+0.8	+0.8
1020	1020.8	1020.9	+0.8	+0.9
1030	1030.9	1030.9	+0.9	+0.9

Uncertainty of measurement ± 0.7 hPa

Transmitting fluid : Air.

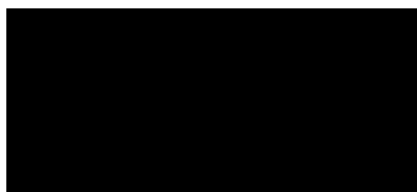
Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 44 of 68

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q25051351

F3-011-05/12-23



@cccombratim

GAS CHROMATOGRAPH

Model : GC-2010 PLUS AF

Serial No. : C12095200986

SHIMADZU GAS CHROMATOGRAPH SYSTEM

GC-2010Plus Series

Operational Qualification

Operational Qualification Report

System Name _____

System ID No. Gas Chromatograph LABE 0413Installation Site Instrument Room GC 1/c

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

• Performer

Signature [Signature] Date _____Print Thammarat Pongpakka 15 / 08 / 2024Title Service EngineerCompany Bioscientific Co., Ltd

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

• Reviewer

Signature [Signature] Date _____Print Panupong Burmungsas 15 / 08 / 2024Title ScientistCompany Eastern Thai Consulting 1997 Co., Ltd

• Manager

Signature [Signature] Date _____Print Nurungnat Bakhuntad 15 / 08 / 2024Title HSCompany Eastern Thai Consulting 1997 Co., Ltd

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

☒ Applicable ☐ Not Applicable

Component ID		Model Name		GC-2010Plus PF	
Serial Number (S/N)		LABE 0413			
Serial Number (S/N)		C 1 2 0 9 2 0 0 9 2 C			
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation. All LEDs light. Screen contrast adjustment is possible.	LED Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Standard self-diagnostic test	Verify the status and operation of all parts. "Good" displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Verify the program version. Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Ver. Controlled Ver. No. Version: 2.1060 Build No.: 262 Version: 2.1060 Build No.: 262	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Temperature test	Verify that temperature control is normal. TEMP LED lights green. Displayed actual values agree to the set values within $\pm 1.0^{\circ}\text{C}$.	Temperature controller (Name) Set value Measured value <input checked="" type="checkbox"/> COL Column 50.0°C 50.0°C <input checked="" type="checkbox"/> INJ1 50.0°C 50.0°C <input type="checkbox"/> INJ2 $^{\circ}\text{C}$ $^{\circ}\text{C}$ <input checked="" type="checkbox"/> DET1 50.0°C 50.0°C <input type="checkbox"/> DET2 $^{\circ}\text{C}$ $^{\circ}\text{C}$ <input type="checkbox"/> AUX3 $^{\circ}\text{C}$ $^{\circ}\text{C}$ <input type="checkbox"/> AUX4 $^{\circ}\text{C}$ $^{\circ}\text{C}$ <input type="checkbox"/> AUX5 $^{\circ}\text{C}$ $^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure. Inspection pressure gauge reading $\pm 10.0 \pm 3.0 \text{ kPa}$ Inspection pressure gauge reading $\pm 200.0 \pm 20.0 \text{ kPa}$ Inspection pressure gauge reading $\pm 500.0 \pm 35.0 \text{ kPa}$	Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading Pressure gauge correction value Pressure gauge reading Post-correction reading	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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	✓	□
			Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa		
7	Flowrate test	Verify the accuracy of the full-flow and septum purging.	Septum purge vent measured flow rate 3.0 ± 1.0 mL/min	✓	□
			Split vent 2.0 mL/min		
			Total 1.0 ± 2.0 mL/min		
			Split vent 1.92 mL/min		
8	Column oven test	Verify the accuracy of the column oven temperature.	Inspection temperature sensor displayed value 150.0 ± 1.2°C	✓	□
			Temp. correction value -0.4°C		
			Temp. sensor reading 151.6°C		
			Corrected temp. value 151.2°C		
9	Temperature program test	Verify that the column temperature program operates normally.	Inspection temperature sensor displayed value 200.0 ± 4.7°C	✓	□
			Temp. correction value -0.7°C		
			Temp. sensor reading 199.3°C		
			Corrected temp. value 198.6°C		
10	Sensitivity test	Verify the detector sensitivity.	Inspection temperature sensor displayed value 280.0 ± 5.5°C	✓	□
			Temp. correction value -0.4°C		
			Temp. sensor reading 280.4°C		
			Corrected temp. value 280.0°C		
10	Sensitivity test	Verify the detector sensitivity.	Monitored temperature 6 minutes after start 200 ± 1°C	✓	□
			Inspection temperature reading 8 minutes after start 200.0 ± 4.7°C		
			Using a temperature sensor with 1°C minimum display increment 200 ± 3°C		
			Temp. sensor reading 200.4°C		
10	Sensitivity test	Verify the detector sensitivity.	FID (✓ Applicable) □ Not Applicable)	✓	□
			Calculated S value Inj. unit (5 µL)		
			Make-up gas: N ₂ 10.0 × 10 ⁻³ C/g min.		
			Make-up gas: He 7.00 × 10 ⁻³ C/g min.		
10	Sensitivity test	Verify the detector sensitivity.	ICD (□ Applicable) ✓ Not Applicable)	✓	□
			Calculated S value Inj. unit (5 µL)		
			Make-up gas: N ₂ 10.0 × 10 ⁻³ C/g min.		
			Make-up gas: He 7.00 × 10 ⁻³ C/g min.		

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

☒ Applicable ☐ Not Applicable

☒ Single ☐ Dual system, main injector

Model Name		AOC-20i				
Component ID		LARE 0413				
Serial No. (S/N)		C 1 2 1 2 5 4 1 0 3 0 9				
No.	Item	Criteria		Results	Pass	Fail
1	Display, LED test	Verify the display and LED operation.	All LEDs light, except decimal point.		<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	ROM, RAM self diagnosis	Verify that ROM and RAM memory operates normally.	Display shows "000".	Display: 000	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Firmware version check	Verify the program version.	Version number is displayed.	Version No. 3.4	<input checked="" type="checkbox"/>	<input type="checkbox"/>
			The version number matches the controlled version number.	Controlled Ver. No. 3.4	<input checked="" type="checkbox"/>	<input 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"/>	<input type="checkbox"/>

☒ Not Applicable ☐ Dual system, sub injector

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

Operational Qualification

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Model Name		AOC-20s				
Component ID		L A N E 021175				
Serial No. (S/N)		C 1 2 1 3 5 4 0 5 6 1 0				
No	Item	Criteria		Results	Pass	Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct	LED lights green, not red.		<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Firmware version check	Verify the program version.	Version number is displayed.	Version No.	3.5	
			The version number matches the controlled version number	Controlled Ver. No.	3.5	<input checked="" type="checkbox"/>

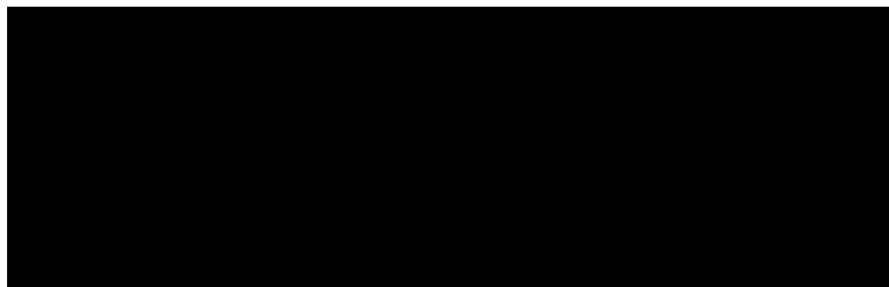
Operational Qualification

Operational Qualification Record

3-4 SPL-2010Plus Split/Splitless Injection Unit

☐ Applicable ☒ Not Applicable

Component ID		Model Name		SPL-2010Plus			
Serial No. (S/N)							
No.	Item	Criteria			Results	Pass	Fail
1	Column inlet pressure test	Verify the accuracy of the column inlet pressure.	Inspection pressure gauge reading 10.0 ± 3.0 kPa	Pressure gauge correction value	_____ kPa		
				Pressure gauge reading	_____ kPa		
				Post-correction reading	_____ kPa		
			Inspection pressure gauge reading 200.0 ± 20.0 kPa	Pressure gauge correction value	_____ kPa		
				Pressure gauge reading	_____ kPa		
				Post-correction reading	_____ kPa		
			Inspection pressure gauge reading 500.0 ± 35.0 kPa	Pressure gauge correction value	_____ kPa		
				Pressure gauge reading	_____ kPa		
				Post-correction reading	_____ kPa		
2	Pressure program test	Verify that the pressure program operates normally.	Monitored pressure 6 minutes after start 250.0 ± 5.0 kPa	_____ kPa			
			Inspection pressure gauge reading 8 minutes after start 250.0 ± 20.0 kPa	_____ kPa			
3	Flowrate test	Verify the accuracy of the full-flow septum purging.	Septum purge vent measured flow rate 3.0 ± 1.0 mL/min	Septum purge mL/min			
			<input type="checkbox"/> Total of septum purge and split vent flow rate values 10.0 ± 3.0 mL/min	Split vent mL/min			
				Total mL/min			
			<input type="checkbox"/> Total of septum purge and split vent flow rate values 200 ± 20 mL/min	Split vent mL/min			
				Total mL/min			
			<input type="checkbox"/> Total of septum purge and split vent flow rate values 300 ± 28 mL/min (Carrier gas: N ₂) <input type="checkbox"/> Total of septum purge and split vent flow rate values 500 ± 35 mL/min (Carrier gas: He)	Split vent mL/min			
				Total mL/min			



Primary Flow Calibrator

Serial No. : 110619 , 207510



CALIBRATION LABORATORY Co.,LTD.

2/10-11 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : FLOW METER
MANUFACTURER : BIOS INTERNATIONAL
MODEL / TYPE : DEFENDER 510-L
SERIAL NO. : 110619
CLID. NO. : 212500238
JOB CONTROL NO. : 250128010260
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : EASTERN THAI CONSULTING 1992 CO., LTD.
683 MOO 11, SUKHAPIBARN 8 RD,
NONGKHAM, SRIRACHA, CHONBURI 20230

DATE OF RECEIVED : 28 January 2025

DATE OF ISSUED : 31 January 2025

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CALIBRATION LABORATORY Co.,LTD.

2/10-11 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : FLOW METER
MANUFACTURER : BIOS INTERNATIONAL
MODEL / TYPE : DEFENDER 510-L
SERIAL NO. : 110619
DATE OF CALIBRATION : 29 January 2025

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPF-03. The calibration was performed by comparison with Gas Flow Meter which refers to the standard condition of 101.325 kPa and 0 $^\circ\text{C}$.

REFERENCE STANDARD USED :

Gas Flow Meter, Alicat Scientific Model M-500SCCM-D-DB15 S/N. 261329.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Chell Instrument Ltd.

Certificate No. N037063, Due Date 26 February 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate

F3-011-



@calibration



CALIBRATION LABORATORY CO., LTD.

2/10-11/14, 55 Soi Prasert Manukul 29 Yaek 4 Prasert Manukul Rd., Ladolrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring flow meter.

CALIBRATION DATA

FLOW METER RESULT

Nominal Value (cc/min)	STD Applied (cc/min)	DUC Reading (cc/min)	Correction (cc/min)	Uncertainty ± (cc/min)
0	0.00	0.00	0.00	-
50	50.00	48.75	+1.25	2.10
100	100.00	97.66	+2.34	2.10
200	200.00	195.22	+4.78	2.10
300	300.00	292.56	+7.44	2.10
400	400.00	390.82	+9.18	2.10
500	500.00	490.04	+9.96	2.10

Technical Note. Media of Gas : Air

Setting Temperature 0 ° C ; Pressure 101.3 kPa

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 49 of 68

This report is valid for the above stated instrument/s only.





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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : FLOW METER
MANUFACTURER : MESALABS
MODEL / TYPE : DEFENDER 510-M
SERIAL NO. : 207510
CLID. NO. : 212500237
JOB CONTROL NO. : 250128010259
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : EASTERN THAI CONSULTING 1992 CO., LTD.
683 MOO 11, SUKHAPIBARN 8 RD,
NONGKHAM, SRIRACHA, CHONBURI 20230

DATE OF RECEIVED : 28 January 2025

DATE OF ISSUED : 31 January 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.



CALIBRATION LABORATORY Co.,LTD.

2/10-11 14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : FLOW METER
MANUFACTURER : MESALABS
MODEL / TYPE : DEFENDER 510-M
SERIAL NO. : 207510
DATE OF CALIBRATION : 29 January 2025

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 10) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPF-03. The calibration was performed by comparison with Gas Flow Meter which refers to the standard condition of 101.325 kPa and 0 $^\circ\text{C}$.

REFERENCE STANDARD USED :

Gas Flow Meter, Alicat Scientific Model M-500SCCM-D-DB15 S/N. 261329.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Chell Instrument Ltd.
Certificate No. N037063, Due Date 26 February 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q25010259

F3-011-05/12-23





CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4 Prasert Manukit Rd., Ladphrao Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cai-laboratory.com E-mail: sale@cai-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring flow meter.

CALIBRATION DATA

FLOW METER RESULT

Nominal Value (cc/min)	STD Applied (cc/min)	DUC Reading (cc/min)	Correction (cc/min)	Uncertainty ± (cc/min)
0	0.00	0.00	0.00	-
50	50.00	45.81	+4.19	2.10
100	100.00	99.10	+0.90	2.10
200	200.00	198.03	+1.97	2.10
300	300.00	298.30	+1.70	2.10
400	400.00	396.50	+3.50	2.10
500	500.00	495.31	+4.69	2.10

Technical Note, Media of Gas : Air

Setting Temperature 0 ° C ; Pressure 101.3 kPa

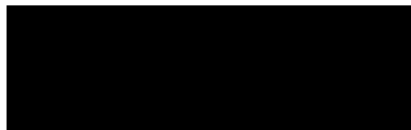
Note, The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 014 Page 49 of 68

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q25010259

F3-011-05/12-23



ation

NOISE DOSI METER

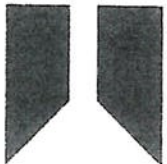
MODEL : CR:110A

SERIAL No. : CA8879

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231822



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

Page 1 of 2

Approved signature:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd
Model: CR:110A 683 Moo 11,
Serial number: CA8879 Sukaphibal 8 Rd.,
Firmware version: 5.4 Nongkham,
Sriracha,

Test summary

Date of calibration: 30 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The re standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

231822

Page 2 of 2

Environmental conditions

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

Before Pressure: 101.00 kPa Temperature: 21.2 °C Humidity: 35.1 %
After Pressure: 101.04 kPa Temperature: 21.5 °C Humidity: 35.7 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8886

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231821

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

Dosemeter : IEC 61252-1993+A1

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CA8886
Firmware version: 5.4

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

Test summary

Date of calibration: 30 January 2025

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	MY58001613
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised by a national metrology institute. This certificate may not be reproduced other than in full and with the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The report standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

231821

Page 2 of 2

Environmental conditions

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

Before Pressure: 100.92 kPa Temperature: 20.8 °C Humidity: 34.1 %
After Pressure: 100.96 kPa Temperature: 20.9 °C Humidity: 34.3 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8887

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231823

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

Dosimeter : IEC 61252-1993+A1

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CA8887
Firmware version: 5.4

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

Test summary

Date of calibration: 29 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised by the Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, and without the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

231823

Page 2 of 2

Environmental conditions

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

Before Pressure: 99.41 kPa Temperature: 22.0 °C Humidity: 38.6 %
After Pressure: 99.41 kPa Temperature: 22.3 °C Humidity: 38.8 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8888

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231838



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

Dosimeter : IEC 61252-1993+A1

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CA8888
Firmware version: 5.4

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

Test summary

Date of calibration: 29 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement of a Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than with the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

231838

Page 2 of 2

Environmental conditions

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

Before	Pressure: 99.43 kPa	Temperature: 22.3 °C	Humidity: 39.0 %
After	Pressure: 99.45 kPa	Temperature: 22.3 °C	Humidity: 39.5 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8889

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231820

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

Dosemeter : IEC 61252-1993+

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CA8889
Firmware version: 5.4

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

Test summary

Date of calibration: 29 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement of the International System of Units (SI) as maintained by the International Bureau of Weights and Measures (BIPM) or other recognised national metrology institutes. This certificate may not be reproduced or used for any other purpose without the written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated, and are not valid for any other items. The standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

231820

Page 2 of 2

Environmental conditions

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

Before Pressure: 99.52 kPa Temperature: 22.4 °C Humidity: 40.5 %
After Pressure: 99.55 kPa Temperature: 22.3 °C Humidity: 40.4 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0644

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231828

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

Page 1 of 2

Approved signatory
N. Smith

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB0644
Firmware version: 5.4

Notes: Eastern Thai Co.
683 Moo 11,
Sukaphibai 8 Rd.,
Nongkham,
Sriracha,

Test summary

Date of calibration: 30 January 2025

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	MY58001613
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement maintained by a national metrology institute. This certificate may not be reproduced other than by the issuing laboratory. The results within this certificate relate only to the items calibrated. The standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

231828

Page 2 of 2

Environmental conditions

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

Before Pressure: 100.98 kPa Temperature: 21.0 °C Humidity: 35.4 %
After Pressure: 101.03 kPa Temperature: 21.4 °C Humidity: 35.5 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0955

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231830



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

Page 1 of 2

Approved signature:

Dosemeter : IEC 61252-1993-

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB0955
Firmware version: 5.4

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

Test summary

Date of calibration: 29 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement of the International System of Units (SI) or other recognised national metrology institutes. This certificate may not be reproduced without the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:
231830

Page 2 of 2

Environmental conditions

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

Before Pressure: 99.58 kPa Temperature: 22.3 °C Humidity: 40.4 %
After Pressure: 99.62 kPa Temperature: 22.3 °C Humidity: 40.9 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0956

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231840

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

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd
Model: CR:110A 683 Moo 11,
Serial number: CB0956 Sukaphibai 8 Rd.,
Firmware version: 5.4 Nongkham,
Sriracha,

Test summary

Date of calibration: 29 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:
231840

Page 2 of 2

Environmental conditions

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

Before Pressure: 99.30 kPa Temperature: 21.9 °C Humidity: 38.5 %
After Pressure: 99.32 kPa Temperature: 22.0 °C Humidity: 38.7 %

Test results summary

Test	Result
Absolute Acoustic Sensitivity	Complies
Linearity	Complies
Short Duration	Complies
Overload Latching	Complies
Weighting	Complies

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0957

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231839

Page 1 of 2

Approved signatory
N Smith

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

Dosimeter : IEC 61252-1993+A1

Instrument information

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

Notes: Eastern Thai Cor
683 Moo 11,
Sukaphibai 8 Rd.,
Nongkham,
Sriracha,

Test summary

Date of calibration: 30 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement of the International System of Units (SI) or other recognised national metrology institutes. This certificate may not be reproduced without the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:
231839

Page 2 of 2

Environmental conditions

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

Before Pressure: 101.13 kPa Temperature: 22.0 °C Humidity: 36.7 %
After Pressure: 101.16 kPa Temperature: 22.2 °C Humidity: 36.6 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1365

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231836



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

Page 1 of 2

Dosimeter : IEC 61252-1993

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,
Sukaphibai 8 Rd.,
Nongkham,
Sriracha,

Test summary

Date of calibration: 29 January 2025

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	MY58001613
Attenuator	Cirrus Research	ZE:952	64370
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

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

CERTIFICATE OF CALIBRATION

Certificate Number:

231836

Page 2 of 2

Environmental conditions

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

Before Pressure: 99.57 kPa Temperature: 22.4 °C Humidity 40.6 %
After Pressure: 99.63 kPa Temperature: 22.3 °C Humidity 41.0 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1497

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231832



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

Dosimeter : IEC 61252-1993+

Instrument information

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

Test summary

Date of calibration: 29 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement of the International System of Units (SI) by comparison with the standards of the International System of Units (SI) or other recognised national metrology institutes. This certificate may not be reproduced other than by the issuing laboratory. The results within this certificate relate only to the items calibrated. The results are expressed as standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

231832

Page 2 of 2

Environmental conditions

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

Before Pressure: 99.33 kPa Temperature: 22.0 °C Humidity: 39.0 %
After Pressure: 99.38 kPa Temperature: 22.0 °C Humidity: 39.0 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1498

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231833

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

Dosemeter : IEC 61252-1993+A1

Instrument information

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

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

Test summary

Date of calibration: 30 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Cornet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised by the National Metrology Institute of the United Kingdom or other recognised national metrology institutes. This certificate may not be reproduced other than in full and with the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:
231833

Page 2 of 2

Environmental conditions

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

Before Pressure: 101.04 kPa Temperature: 21.6 °C Humidity: 35.6 %
After Pressure: 101.06 kPa Temperature: 21.7 °C Humidity: 36.4 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1499

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231834

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

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd
Model: CR:110A 683 Moo 11,
Serial number: CB1499 Sukaphibal 8 Rd.,
Firmware version: 5.4 Nongkham,
Sriracha,

Test summary

Date of calibration: 29 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised by a national metrology institute. This certificate may not be reproduced other than in full and with the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The report includes the standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

231834

Page 2 of 2

Environmental conditions

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

Before Pressure: 99.19 kPa Temperature: 21.9 °C Humidity: 38.3 %
After Pressure: 99.22 kPa Temperature: 21.9 °C Humidity: 38.4 %

Test results summary

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

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1500

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 31 January 2025 CERTIFICATE NUMBER 231835

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

Dosemeter : IEC 61252-1993+A1

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co., Ltd
Model: CR:110A 683 Moo 11,
Serial number: CB1500 Sukaphibai 8 Rd.,
Firmware version: 5.4 Nongkham,
Sriracha,

Test summary

Date of calibration: 29 January 2025

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	SDG1XDDC7R0237
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	79620

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement recognised by the International Bureau of Weights and Measures (BIPM) or other recognised national metrology institutes. This certificate may not be reproduced other than in full and with the approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The report standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:
231835

Page 2 of 2

Environmental conditions

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

Before	Pressure: 99,64 kPa	Temperature: 22.2 °C	Humidity: 41,1 %
After	Pressure: 99,68 kPa	Temperature: 22.4 °C	Humidity: 42.4 %

Test results summary

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