

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการตรวจวิเคราะห์

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

Part Number:	E04N09E15ACX9C	Reference Number:	82-401135335-1
Cylinder Number:	EB0062815	Cylinder Volume:	144.4 CF
Laboratory:	124 - Riverton (SAP) - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	BS2018	Valve Outlet:	660
Gas Code:	CO,N0,NOX,S02,BALN	Certification Date:	Mar 13, 2018

Expiration Date: Mar 13, 2026

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	18060607	CC442564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jun 27, 2020	
PRM	12367	APEX1089237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Jun 02, 2017	
GMIS	0315201604	CC503358	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.8%	Mar 15, 2019	
NTRM	18011025	CC473218	48.02 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 GMS used in the assay and not part of the analysis.						
ANALYTICAL EQUIPMENT						
Instrument/Make/Model			Analytical Principle		Last Multipoint Calibration	
Nicolet 6700 APW1100391 CO			FTIR		Feb 08, 2018	
Nicolet 6700 APW1100391 NO			FTIR		Feb 15, 2018	
Nicolet 6700 APW1100391 NO2			FTIR		Feb 16, 2018	
Nicolet 6700 APW1100391 SO2			FTIR		Mar 01, 2018	

NOTES: NET WEIGHT: 10.43lbs
GROSS WEIGHT: 60.93lbs

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 EPA-600/R-12/531 and ISO/IEC 17025 and relate only to items identified on this certificate. All measurements 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.



ACCREDITED

TESTING CERT No. 3082.05

Approved for Release

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CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030

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 000/R-12/021, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder lies a full analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
METHANE	180.0 PPM	177.0 PPM	G1	+/- 1.0% NIST Traceable
PROPANE	185.0 PPM	187.0 PPM	G1	+/- 1.0% NIST Traceable
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%
NTRM	200602-06	6162660Y	243.3 PPM PROPANE/AIR	+/- 0.5%
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



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Michael A. Huber
Approved for Release

DRY GAS METER XC-572-OV

Serial No. : A2204323



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SALE AND SERVICE GROUP COMPANY LIMITED

Certificate Of Calibration

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

Meter Console Information

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

Calibration Condition

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

Factors/Conversion

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

Reference Equipment

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

UUT Meter (DGM)				Reference Meter (WTM)					
Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
e	P _{mid}	V _{mid}	V _{mid}	t _{mid}	t _{mid}	V _{mid}	V _{mid}	t _{mid}	t _{mid}
15.00	13.0	18.0685	18.2252	25	26	17.55844	17.71573	25	25
10.00	25.0	18.2477	18.3984	25	26	17.73637	17.88948	25	25
8.00	50.0	18.4339	18.6056	25	26	17.92517	18.09730	25	25
7.00	80.0	18.6458	18.8344	25	27	18.13775	18.32707	25	25
5.00	120.0	18.8839	19.0510	25	27	18.37705	18.54528	25	25

Standardized Data

Test Meter		Reference Meter		Correction Factor		Calibration Results		
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Flow Rate	ΔH@ (mm H ₂ O)	Variation
V _{mid} (m ³)	Q _{mid} (m ³ /min)	V _{mid} (m ³)	Q _{mid} (m ³ /min)	(Y)	(ΔY)	Q _{mid} (m ³ /min)	ΔH _e	ΔΔH _e
0.154	0.010	0.154	0.010	1.004	0.003	0.010	54.437	3.293
0.148	0.015	0.148	0.015	1.002	0.001	0.015	50.528	-0.616
0.169	0.021	0.169	0.021	0.999	-0.001	0.021	50.086	-1.058
0.186	0.027	0.186	0.027	0.999	-0.001	0.027	50.928	-0.216
0.165	0.033	0.165	0.033	0.999	-0.002	0.033	49.741	-1.403

1.001 = Y Avg.

51.144 = ΔH@ 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 is ±0.02

Note: For ΔH_e, orifice pressure differential that equates to 0.75cfm (0.0212m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2inches (5.1mm) H₂O.

Approved By:

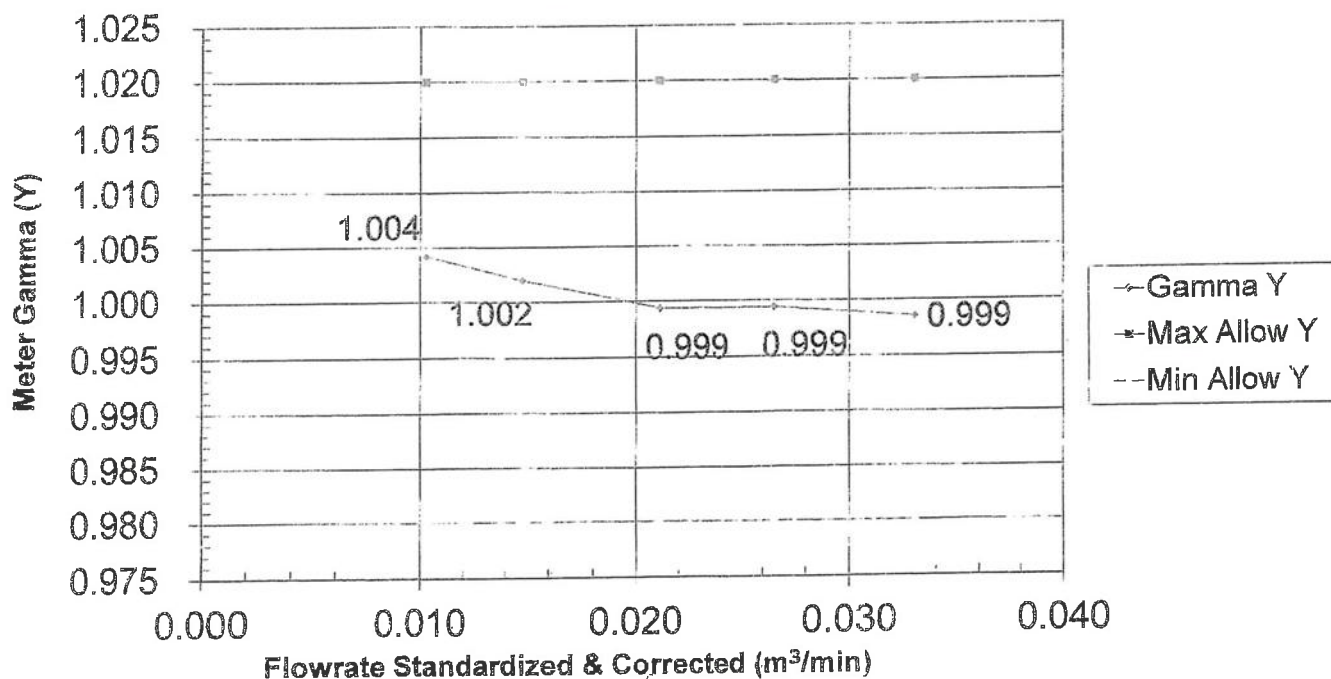
(Patpasu Chaisana)
Service Manager

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

Date:

2-May-2023

Meter Gamma vs Flowrate



Console Serial:

A2204323

Console Model:

XC-572-OV

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TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model : XC-572-OV
Console Serial : A2204323
Temp. Indicator Model : 765-KF
Temp. Indicator Serial : JC-19022

Calibration Conditions

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

Reference Equipment

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

Temperature Sensor Calibration

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

Note

* For valid test results, the maximum difference between temperature readings should $\leq 1.0^{\circ}\text{C}$ (EPA Method 5, Section 6.1.1.8).
Perform AUX, STACK, PROBE, OVEN, FILTER, EXIT. Except meter (DGM) channel

DGM Out Temperature Sensor Calibration

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

Difference Rang

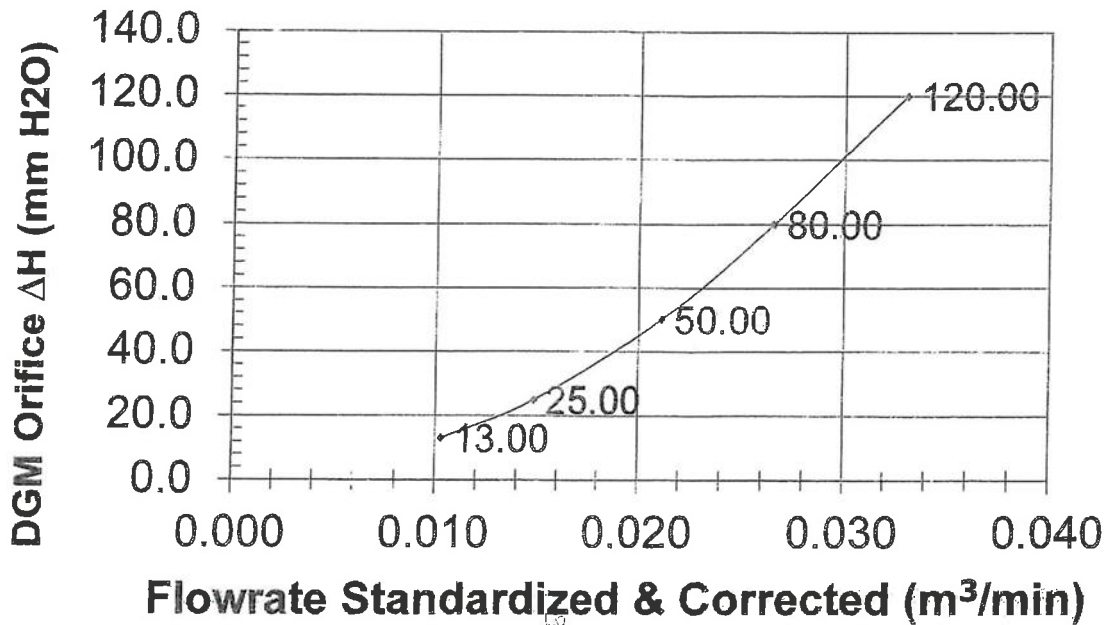
DGM Out Temp. Diff. $\pm 3^{\circ}\text{C}$

Approved By :

W. Pongsakorn Chaisaeng
Service Manager

WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
11130 Thailand

Meter Pressure vs Flowrate



Console Serial: A2204323

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Console Model: XC-572-OV

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DRY GAS METER XC572V

Serial No. : 1110070

Certificate Of Calibration

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

Meter Console Information

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

Calibration Condition

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

Factors/Conversion

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

Reference Equipment

WTM Model: W-NKoDa-5B
 WTM Serial: 600245
 WTM Cal Due Date: Nov. 2022
 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 _{orifice}	V _{in}	V _{out}	t _{in}	t _{out}	V _{in}	V _{out}	L _{in}	t _{out}
15.00	13.0	599.3828	599.5462	27	27	20.05690	20.22163	28	27
10.00	25.0	599.5689	599.7246	27	26	20.24425	20.39999	27	27
8.00	50.0	599.7405	599.9176	26	26	20.41592	20.59344	27	27
7.00	80.0	599.9333	600.1337	26	26	20.60920	20.81034	27	27
5.00	120.0	600.1559	600.3319	26	26	20.83271	21.00950	27	27

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 _{measured} (m ³)	Q _{measured} m ³ /min	V _{reference} (m ³)	Q _{reference} m ³ /min	(Y)	(ΔY)	Q _{measured/corr}	ΔH ₀	ΔΔH ₀	
0.159	0.011	0.160	0.011	1.005	0.010	0.011	50.181	2.747	
0.152	0.015	0.152	0.015	0.996	0.000	0.015	48.096	0.662	
0.174	0.022	0.173	0.022	0.995	-0.001	0.022	47.605	0.171	
0.197	0.028	0.196	0.028	0.993	-0.003	0.028	45.688	-1.747	
0.174	0.035	0.172	0.034	0.990	-0.006	0.034	45.602	-1.832	
				0.996	= Y Avg		47.434	= ΔH@ Avg	

Pass/Fail Result: Pass

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02
 Note: For ΔH₀, 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: _____

(Palpasu Chaisana)
 Service Manager

Date: 3-Jul-23

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TEMPERATURE DISPLAY CALIBRATION

Calibration Conditions

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

Meter Console Information

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

Reference Equipment

Temp Simulator Model: FLUKE 714B
 Serial No: 60590035

Temperature Sensor Calibration

Reference Point	Ref. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	149.0	0.0
5	280.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	594.0	-1.0
9	816.0	816.0	0.0
10	1038.0	1039.0	-1.0
		Maximum ¹	1.0

PASS

Note

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

DGM Out Temperature Sensor Calibration

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

DGM Out Temp. Diff. ±3 °C

PASS

Approved By: _____

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Palpasu Chaisana
 Service Manager
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Address: 9/115 Lumphini Town Ville Ratchaphruek-Pinkkiao Village No. 4, Bang Kham, Bangkok, Thailand
 Tel: 090-660 1392 084-598-1944 084-704-1620

ELAPSED TIMER CALIBRATION

Meter Console Information

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

Calibration Conditions

Cal. Date : 03-Jul-23
Due Date : 02-Jul-24
Cal. Report No. : WDS-SV860107
Ambient Temp. (°C) : 25
Pressure (mm Hg) : 758
Humidity (%) : 60

Reference Equipment

Calibration Standard: JS-307
Method Reference: Compare

Calibration Results					
Run Time	Elapsed Time				Division
Elapsed STD.	1	2	3	4	
Minute	Minute	Minute	Minute	Minute	Minute
2.00	2.00	2.00	2.00	2.00	0.000
3.00	3.00	3.00	3.00	3.00	0.000
5.00	5.00	5.00	5.00	5.00	0.000
7.00	7.00	7.00	7.00	7.00	0.000
9.00	9.00	9.00	9.00	9.00	0.000

Approved By

[Signature]

(Patpasu Chaisana)
Service Engineer

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WISDOM SCIENCE SALE AND SERVICE GROUP COMPANY LIMITED
Address 9/115 Lumpini Town Villa Ratchapruk-Pinklao Village No. 4, Bang Kham, Bang Kruai, Nonthaburi 11130 Thailand
Tel. 090-660-1392, 084-598-1944, 084-704-1620

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Flue gas Analyzer

Testo 350 NEW

Serial No. 63455658/0722



Calibration Certificate

Certificate No.: G 660488
Date of issue : 17-Aug-23

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Instrument serial no. : 63455658/0722
Control unit serial no. : 03601409/0722
ID no. or control no. :
Manufacturer : Testo SE & Co. KGaA
Probe description :
Probe model :
Probe serial :
Customer name : Eastern Thai Consulting 1992 Company Limited
Customer address : 683 Moo 11, Sukhapiarn 8 Road, Nongkham, Si Racha, Chon Buri 20280

Total pages of certificate : 2 Pages
Receiving no. : L-232624
Receiving date. : 10-Aug-23
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 80.96 ppm, Nitric Oxide 151.5 ppm, Sulphur Dioxide 100.8 ppm)
Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laks, Bangkok 10210
Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration work instruction no. WI-CL-28-C

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

Date of calibration : 17-Aug-23

Kwanchai Khamdoun

Mr. Kwanchai Khamdoun
Calibration Technician

Mis. Nongluck Wongsettee

Mis. Nongluck Wongsettee
Technical Manager

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Calibration Certificate

Certificate No.: G 660488

Standard References (Table 1)

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

Measured room conditions

Temperature : 23.5 °C Humidity : 61.2 %RH Pressure : 1009.5 mbar

Calibration conditions

Gas Temperature : 24 °C Flow rate : 1,300 ml/min Gas pressure : 1016.4 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.498	2.58	0.082	0.15
O2 (%Vol)	10.04	10.10	0.06	0.20
O2 (%Vol)	21.02	21.11	0.09	0.30
CO (ppm)	80.14	80	-0.14	3.0
CO (ppm)	302	301	-1	6.0
CO (ppm)	1003	997	-6	12
*NO2 (ppm)	80.96	80.3	-0.66	8.0
*NO (ppm)	151.5	153	1.5	8.0
*SO2 (ppm)	100.8	101	0.2	6.0

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

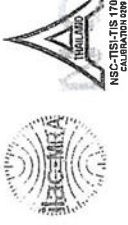
* Calibrations marked Not TISI Accredited "in this Certificate have been included for completeness."

End of Report

UV/VIS SPECTROPHOTOMETER

Model : UV - 1800

Serial No. : A11635101643 CD



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

Bara Scientific
Specialist of Success

Certificate of Calibration

Certificate No. BSCC-UV-152/23
Number of Page(s) 1 of 3

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

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

Equipment condition Good Operation

Calibration Location Analysis Department

Calibration Procedure In-house method W-LUV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 94780 and 94775
Photometric Accuracy is traceable to certificate No. 94808 and 100147
Stray Light is traceable to certificate No. 94791
The above certificate are traceable to SI unit through Starna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr. Pannaphong Phannmekakul

Approved by

Mr. Kanchit Choothep
Technical Manager

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



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

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Specialist of Success

Certificate of Calibration

Certificate No. BSCC-UV-152/23
Number of Page(s) 2 of 3

Calibration Results:

1. Wavelength Accuracy

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

2. Photometric Accuracy (UV)

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

*CNR = Customer not request

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

Certificate No.

BSCC-JV-152/23

Number of Page(s) 3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

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

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
200.75±0.11nm	200.72	0.9630
		2.0164

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

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

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SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230988

Certificate of Calibration

Certificate No.: S2402-0650

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

Date of calibration: 2024-03-08
Date of issue: 2024-03-08

Instrument Calibrated: Sound Level Meter
Manufacturer: Rion
Model: NL-S2A (Meter), UC-59 (Microphone), NH-25 (Preamplifier)
Serial no: 00230988 (Meter), 22332 (Microphone), 22424 (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 PTC300 S/NM2520568

Traceability

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

Sound Pressure Level: EEL, 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 quality assurance system and traceability to accredited or national calibration laboratories. This certificate may not be reproduced other than in full.

Certificate No.: S2402-0650

Environmental conditions: Pressure: 101.325 kPa Temperature: 23.0 °C Relative humidity: 50 %RH
Reference conditions: 101.11 \pm 0.10 kPa 22.1 \pm 1.0 °C 51.1 \pm 2.0 %RH
Measurement conditions:

1. Indication at the calibration check frequency

Reference Acoustic Signal (dB)	Measured value (dB)		Deviated value (dB)	Acceptant limit (dB)
	Before adjust	After adjusted		
93.9	93.9	93.9	0.0	± 0.7

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 Weighting (dB)	Measured value (dB)
A-Weighting	10.3
C-Weighting	14.4
Z-Weighting	19.8

3. Electrical signal test of frequency weighting at 93 dB

Frequency (Hz)	Deviation from various frequency weighting response curve		
	A-Weighting (dB)	C-Weighting (dB)	Z-Weighting (dB)
63	-0.2	-0.2	-0.2
125	-0.1	0.0	-0.1
250	-0.1	-0.1	-0.1
500	-0.1	0.0	-0.1
1000	0.0	0.0	0.0
2000	-0.1	0.0	-0.1
4000	0.0	0.0	-0.1
8000	0.1	0.1	0.0
16000	-1.2	-1.2	0.0

Date of calibration : 2024-03-08
Date of issue : 2024-03-08

4. Frequency and time weighting at 1 kHz

4.1 Frequency weighting at 1 kHz

Frequency weightings	Measured value (dB)	Deviated value (dB)	Acceptant limit (dB)
A	94.0	0.0	± 0.2
C	93.9	-0.1	± 0.2
Z	94.0	0.0	± 0.2

4.2 Time weighting at 1 kHz

Time weightings	Measured value (dB)	Deviated value (dB)	Acceptant limit (dB)
Fast	94.0	0.0	± 0.1
Slow	94.0	0.0	± 0.1
L-Aeq	94.0	0.0	± 0.1

5. Long term stability

Time interval (mm:ss)	Start level (dB)	Stop level (dB)	Deviated value (dB)	Acceptant limit (dB)
28:58	94.0	94.0	0.0	± 0.1

Date of calibration : 2024-03-08
Date of issue : 2024-03-08

6. Level linearity on the reference level range

6.1 Measured at 31.5 Hz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptant limit (dB)
84.0	84.0	0.0	± 0.8
89.0	89.0	0.0	± 0.8
94.6	94.6	0.0	± 0.8
95.6	95.6	0.0	± 0.8
96.6	96.6	0.0	± 0.8
97.6	97.6	0.0	± 0.8
98.6	98.6	0.0	± 0.8
84.0	84.0	0.0	± 0.8
79.0	79.0	0.0	± 0.8
74.0	74.0	0.0	± 0.8
69.0	69.0	0.0	± 0.8
64.0	64.0	0.0	± 0.8
59.0	59.0	0.0	± 0.8
54.0	54.0	0.0	± 0.8
49.0	49.0	0.0	± 0.8
44.0	44.1	0.1	± 0.8
42.0	42.0	0.0	± 0.8
41.0	41.0	0.0	± 0.8
40.0	40.0	0.0	± 0.8
39.0	39.0	0.0	± 0.8
38.0	38.0	0.0	± 0.8

Date of calibration : 2024-03-08
Date of issue : 2024-03-08



Certificate No.: S2402-0650

6.2 Measured at 1 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptant limit (dB)
109.0	108.9	-0.1	± 0.8
114.0	114.0	0.0	± 0.8
119.0	119.0	0.0	± 0.8
124.0	124.0	0.0	± 0.8
129.0	129.0	0.0	± 0.8
134.0	134.0	0.0	± 0.8
135.0	135.0	0.0	± 0.8
136.0	136.0	0.0	± 0.8
137.0	137.0	0.0	± 0.8
138.0	137.9	-0.1	± 0.8
94.0	94.0	0.0	± 0.8
89.0	89.0	0.0	± 0.8
84.0	84.0	0.0	± 0.8
79.0	78.9	-0.1	± 0.8
74.0	74.0	0.0	± 0.8
69.0	68.9	-0.1	± 0.8
64.0	63.9	-0.1	± 0.8
59.0	59.0	0.0	± 0.8
54.0	53.9	-0.1	± 0.8
49.0	48.9	-0.1	± 0.8
44.0	43.9	-0.1	± 0.8
42.0	42.0	0.0	± 0.8
41.0	41.0	0.0	± 0.8
40.0	40.0	0.0	± 0.8
39.0	38.9	-0.1	± 0.8
38.0	38.0	0.0	± 0.8

Date of calibration : 2024-03-08
Date of issue : 2024-03-08

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Certificate No.: S2402-0650

6.3 Measured at 8 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptant limit (dB)
94.0	94.0	0.0	± 0.8
99.0	99.0	0.0	± 0.8
104.0	104.0	0.0	± 0.8
109.0	109.0	0.0	± 0.8
114.0	114.0	0.0	± 0.8
119.0	119.0	0.0	± 0.8
124.0	124.0	0.0	± 0.8
129.0	129.0	0.0	± 0.8
132.9	132.8	-0.1	± 0.8
133.9	133.9	0.0	± 0.8
134.9	134.9	0.0	± 0.8
135.9	135.9	0.0	± 0.8
136.9	136.9	0.0	± 0.8
94.0	94.0	0.0	± 0.8
89.0	89.0	0.0	± 0.8
84.0	84.0	0.0	± 0.8
79.0	78.9	-0.1	± 0.8
74.0	74.0	0.0	± 0.8
69.0	69.0	0.0	± 0.8
64.0	63.9	-0.1	± 0.8
59.0	59.0	0.0	± 0.8
54.0	53.9	-0.1	± 0.8
49.0	48.9	-0.1	± 0.8
44.0	44.0	0.0	± 0.8
42.0	42.0	0.0	± 0.8
41.0	41.0	0.0	± 0.8
40.0	39.9	-0.1	± 0.8
39.0	38.9	-0.1	± 0.8
38.0	37.9	-0.1	± 0.8

Date of calibration : 2024-03-08
Date of issue : 2024-03-08

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Certificate No.: S2402-0650

7. Tone burst response

Time weightings	Tone burst duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Tolerance limit (dB)
Fast	200	135.1	0.1	±0.5
	2	118.0	0.0	+1.0,-1.5
	0.25	108.9	-0.1	+1.0,-3.0
SEL	200	129.1	0.1	±0.5
	2	109.0	0.0	+1.0,-1.5
	0.25	99.9	-0.1	+1.0,-3.0

8. Overload indication

Measured value (dB)		Deviated value (dB)	Tolerance limit (dB)
Positive one half cycle	Negative one half cycle	139.6	±1.5
139.5			

9. High level stability

Initial level (dB)	Final level (dB)	Deviated value (dB)	Acceptant limit (dB)
137.0	137.0	0.0	±0.1

Date of calibration : 2024-03-08
Date of issue : 2024-03-08




Certificate No.: S2402-0650


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	0.090 dB
- Frequency Weighting Z	0.13 dB
3. Electrical signal test of frequency weighting	
4. Frequency and time weightings at 1 kHz	0.13 dB
5. Long term stability test	0.13 dB
6. Level linearity on the reference level range	0.10 dB
7. Tone burst response	0.14 dB
8. Overload indication	0.13 dB
9. 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.

Calibrated By:  (Mr. Chaiyaporn Sompichai)

Approved By:  (Mr. Piupong Sarapho)

Date of calibration : 2024-03-08
Date of issue : 2024-03-08

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

SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00222592



Cert. No. : ACL24132
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00222592 / 195904 / 15424
ID No.: -

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

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

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

Calibrated by : Natbakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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

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Cert. No. : ACL24132
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).

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Cert. No. : ACL24132
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

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Cert. No. : ACL24132
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)
14.4

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

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

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight Acceptance Limits
125	0.0	0.0	± 1.5
1000	-0.1	-0.1	± 1.0
8000	1.4	1.5	±5.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

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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
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.1	-0.3	±3.0

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322750



Calibration Certificate

Cert. No. : ACL24137
Pages : 1 of 8

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

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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Cert. No. : ACL24137
Job No. : VC67ACW83
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).

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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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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	12.6
C - weight	19.3
Flat	24.5

3. Acoustical signal tests of frequency weightings

Meter free field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighing response curve (dB)		
	Flat	C-weight	A-weight
125	0.0	0.1	0.1
1000	0.0	0.0	0.0
8000	0.5	0.5	0.5

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Cert. No. : ACL24137
Job No. : VC67AC0083
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	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	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.3	0.3	± 1.1

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Job No. : VC67AC0083

Pages : 7 of 8

Cert. No. : ACL24137

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Pages : 8 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-0.8	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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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 :
(Thanakul Petchurai)

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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).

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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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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
125	0.0	0.0	0.1
1000	0.0	0.0	0.0
8000	1.5	1.6	1.6
			Acceptance Limits
			±1.5
			±1.0
			±5.0

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	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, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.7	-0.7	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322754

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00322754 / 196477 / 15486
ID No.: -

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :
(Thanakul Petchurai)

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Cert. No. : ACL24141
Pages : 1 of 8

Cert. No. : ACL24141
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
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Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EELBP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EELBP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EELBP 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).

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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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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.4

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	16.7
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.1	0.1	0.1
1000	0.0	0.0	0.0
8000	0.5	0.5	0.5
Acceptance Limits			±1.5 ±1.0 ±5.0

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7. Petch.

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 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	108.0	0.0	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	2	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

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BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41



CALIBRATION CERTIFICATE

Certificate No. : L202405022-0013

Date Issued : 08-May-24

Customer
 : Eastern Thai Consulting 1992 Co., Ltd.
 683 Moo 11, Sukhaphibarn 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 Srichaiikul

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

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

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

Approved by: 
 (Mr. Sarayuth Tochua)

Page 1 of 2

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Certificate No : 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 / Fail
mbar	Before Adjusted	After Adjusted	mbar	\pm mbar	\pm mbar	with Guard Band
990.00	990	-	0.00	0.59	10.3	Pass
1000.00	1000	-	0.00	0.59	10.3	Pass
1010.00	1010	-	0.00	0.59	10.3	Pass
1020.00	1020	-	0.00	0.59	10.3	Pass
1030.00	1030	-	0.00	0.59	10.3	Pass

STD = Standard 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 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

Page 2 of 2

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GAS CHROMATOGRAPH

Model. : GC-2010 PLUS AF

Serial No. : C12095200986

SHIMADZU GAS CHROMATOGRAPH SYSTEM
GC-2010Plus Series

Operational Qualification

System Name			
System ID No. Gas Chromatograph LABE 04/3			
Installation Site Instrument Room GC/IC			
The undersigned performer reports that the Operational Qualification Protocol has been successfully completed for the system stated above.			
• Performer			
Signature	Print	Date	
	Thirawat Pungkha	16/08/2023	
Title Service Engineer			
Company Parascientific Co., Ltd			
The undersigned reviewer and manager report that the performer has completed the Operational Qualification Protocol successfully.			
• Reviewer			
Signature	Print	Date	
	Panyong Pungkha	16/08/2023	
Title Scientist			
Company Eastern Thai Consulting 1992 Co., Ltd			
• Manager			
Signature	Print	Date	
	Nuanapha Bahtulod	16/08/2023	
Title HS			
Company Eastern Thai Consulting 1992 Co., Ltd			

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Operational Qualification Definitions

1-2 Scope

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

(Address): 105/11 Sukhaphiban 3 Rd Nongkhuaeng, Siacha, (Bangkok 20110)
(Company): Eastern Thai Consulting 1992 Co., Ltd
(Department):
(Installation Site): Instrument Room GC/IC
(Equipment ID No.): Gas Chromatograph LABE 04/3
(Product Model Name): GC-2010 Plus JADC-201 JADC-205

Performer (signature): Jm Date: 16/08/2023
Reviewer (signature): Panyong Pungkha Date: 16/08/2023

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Operational Qualification

Operational Qualification Record

3. Operational Qualification Record

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

Component ID		Model Name		GC-2010Plus AE	
Serial Number (S/N)		LABE 041/3		C 1 2 0 9 k 2 0 0 9 3 6	
No.	Item	Criteria	Results	Pass	Fail
1	Display, LED test	All LEDs light. Screen contrast adjustment is possible.	LED Display	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Standard self-diagnostic test	"Good" displayed as the result of the self-diagnostic test.	Good	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Hardware version check	Version number and build number are displayed. The version No. and build No. matches the controlled version number.	Ver. 2.1.0 Build No. 2.1.0	<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) COL-1 Set value 50.0 $^{\circ}\text{C}$ Measured value 50.0 $^{\circ}\text{C}$ INJ1 50.0 $^{\circ}\text{C}$ INJ2 50.0 $^{\circ}\text{C}$ DET1 50.0 $^{\circ}\text{C}$ DET2 50.0 $^{\circ}\text{C}$ AUX3 50.0 $^{\circ}\text{C}$ AUX4 50.0 $^{\circ}\text{C}$ AUX5 50.0 $^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Column inlet pressure test	Verify the accuracy of the column inlet pressure. Inspection pressure gauge reading 20.0 \pm 3.0kPa Inspection pressure gauge reading 20.0 \pm 2.0kPa Inspection pressure gauge reading 20.0 \pm 3.0kPa	Pressure gauge correction value 0.1 kPa Pressure gauge reading 20.1 kPa Post-correction reading 20.0 kPa Pressure gauge correction value 0.1 kPa Pressure gauge reading 20.1 kPa Post-correction reading 20.0 kPa Pressure gauge correction value 0.1 kPa Pressure gauge reading 20.1 kPa Post-correction reading 20.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 16 / 07 / 2023

Reviewer (signature):

Date: 18 / 8 / 2023

Operational Qualification

Operational Qualification Record

No.	Item	Criteria	Results	Pass	Fail
6	Pressure program test	Verify that the pressure program operates normally. Monitored pressure 6 minutes after start 250.0 \pm 5.0 kPa Inspection pressure gauge reading 8 minutes after start 250.0 \pm 20.0 kPa	250.0 kPa 250.0 kPa	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Flowrate test	Verify the accuracy of the full-flow and septum purging. Septum purge vent measured flow rate 3.0 \pm 1.0 mL/min Total of septum purge and split vent flow rate values 10.0 \pm 3.0 mL/min Total of septum purge and split vent flow rate values 20.0 \pm 2.0 mL/min Total of septum purge and split vent flow rate values 300.0 \pm 28 mL/min (Carrier gas: N ₂) Total of septum purge and split vent flow rate values 500.0 \pm 35 mL/min (Carrier gas: He)	Septum purge 3.0 mL/min Split vent 7.0 mL/min Total 10.0 mL/min Split vent 2.0 mL/min Total 20.0 mL/min Split vent 300.0 mL/min Total 500.0 mL/min	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Column oven test	Verify the accuracy of the column oven temperature. Inspection temperature sensor displayed value 50.0 \pm 2.0 $^{\circ}\text{C}$ Inspection temperature sensor displayed value 50.0 \pm 2.0 $^{\circ}\text{C}$ Inspection temperature sensor displayed value 50.0 \pm 2.0 $^{\circ}\text{C}$ Inspection temperature sensor displayed value 50.0 \pm 2.0 $^{\circ}\text{C}$	Temp. correction value -1.0 $^{\circ}\text{C}$ Temp. sensor reading 50.0 $^{\circ}\text{C}$ Corrected temp. value 50.0 $^{\circ}\text{C}$ Temp. correction value -1.0 $^{\circ}\text{C}$ Temp. sensor reading 50.0 $^{\circ}\text{C}$ Corrected temp. value 50.0 $^{\circ}\text{C}$ Temp. correction value -1.0 $^{\circ}\text{C}$ Temp. sensor reading 50.0 $^{\circ}\text{C}$ Corrected temp. value 50.0 $^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Temperature program test	Verify that the temperature program operates normally. Monitored temperature 6 minutes after start 200 \pm 1 $^{\circ}\text{C}$ Inspection temperature reading 8 minutes after start 200.0 \pm 4.7 $^{\circ}\text{C}$ Using a temperature sensor with 1 $^{\circ}\text{C}$ minimum display increment 200 \pm 3 $^{\circ}\text{C}$	200.0 $^{\circ}\text{C}$ 200.0 $^{\circ}\text{C}$ 200.0 $^{\circ}\text{C}$	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Sensitivity test	Verify the detector sensitivity. FID () Applicable Calculated S value Inj. unit (S/L) Make-up gas: N ₂ 10.0 \times 10 ⁻³ C/g min. Make-up gas: He 7.00 \times 10 ⁻³ C/g min. TCD () Applicable Calculated S value Inj. unit () 4.00 \times 10 ⁻³ mV·mL/mg min.	C16AREA value 41698 Calculated S value 1.0 \times 10 ⁻³ C/g C16AREA value Flowrate at vent Calculated S value	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Performer (signature):

Date: 16 / 07 / 2023

Reviewer (signature):

Date: 18 / 8 / 2023

Operational Qualification

Operational Qualification Record

3-2 AOC-20i Auto Injector

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

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

☒ Not Applicable ☐ Dual system, sub injector

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

Performer (signature):

Date: 16 / 07 / 2023

Reviewer (signature):

Date: 18 / 8 / 2023

Operational Qualification

Operational Qualification Record

3-3 AOC-20s Auto Sampler

☒ Applicable ☐ Not Applicable

Component ID		Model Name		AOC-20s	
Serial No. (S/N)		C 1 2 1 3 5 4 6 5 9 1 0			
No.	Item	Criteria		Results	Pass/Fail
1	Initial operation test	Verify that the auto sampler basic operation is correct.		LED lights green, not red.	Pass
2	Firmware version check	Verify the program version.		Version number is displayed.	Pass
		The version number matches the controlled version number.		Version No. Controlled Ver. No.	Pass

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Performer (signature):

Date: 16 / 08 / 2023

Reviewer (signature):

Date: 18 / 8 / 2023

Primary Flow Calibrator

Serial No. : 110619 , 207510

Certificate No : 24-AFM-023

Request No : Req-2024-0095

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
24.80	101.23	0	0.00	0.0000	0.0058
24.40	101.18	50	49.639	-0.4	3.3
24.40	101.16	100	100.73	0.7	2.8
24.30	101.13	200	198.30	-1.7	5.6
24.30	101.10	300	298.14	-1.9	8.4
24.40	101.06	400	397.45	-3	11
24.20	101.00	500	496.93	-3.1	7.1

Note

STD : Standard UUC : Unit Under Calibration

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

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

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

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

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

End of Certificate



Certificate of Calibration

Certificate No : 24-AFM-023

Request No : Req-2024-0095

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.

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

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : Bios

Model : Defender S10-L

Serial Number : 110619

ID : -

Sensor Model : -

Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 0.3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 11 January 2024

Calibration Date : 30 January 2024

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

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

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LLA Accreditation No. 3943 01

Note :

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

Calibration By :

Mr. Noppadon Luangart

Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date : 30 January 2024



Certificate of Calibration

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.

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

Certificate No : 24-AFM-022

Request No : Req-2024-0094

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : MesaLabs

Model : Defender 510-M

Serial Number : 207510

ID : -

Sensor Model : -

Sensor Serial Number : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 11 January 2024

Calibration Date : 30 January 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	080000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

Traceability :

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

Note :

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

Calibration By : 

Mr. Noppadon Luangart

Service Calibration Engineer

Approved By : 

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date : 30 January 2024

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)
24.80	101.23	0	0.00	0.0000	0.0058
24.70	101.58	101	101.48	0.5	2.8
24.80	101.50	200	201.14	1.1	5.6
24.70	101.50	500	503.87	3.9	7.1
24.80	101.50	1003	1010.1	7	14
24.70	101.60	2002	2014.6	13	29
24.60	101.33	2995	3007.6	13	43
24.60	101.65	4027	4007.5	-19	57
24.50	101.70	5035	5010.7	-24	72

Note
STD : Standard
UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition
- Flow Rate was corrected for non-standard operating condition by using equation :

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

where Q Flow Rate P Absolute Pressure T Absolute Temperature
 Q_{meas} Measurement Condition Q_{ref} Standard Condition

* Indicates non accredited

End of Certificate



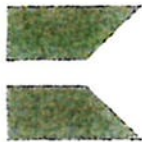
NOISE DOSI METER

MODEL : CR:110A


SERIAL No. : CB1365

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 19 January 2024 CERTIFICATE NUMBER 206870



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

Page 1 of 2
Approved signatory N Smith
Electronically signed: 

Dosemeter : IEC 61252-1993+A1:2000

Instrument Information

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

Test summary

Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	18586334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

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

CERTIFICATE OF CALIBRATION

Environmental conditions

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

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

Test results summary

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

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1497

CERTIFICATE OF CALIBRATION

ISSUED BY

Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206888



Cirrus Research plc

Acoustic House

Bridlington Road

Hummanby

North Yorkshire

YO14 0PH

United Kingdom

Page 1 of 2

Approved signatory

N Smith

Electronically signed:



Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:

Cirrus Research plc

Model:

CR-110A

Serial number:

GB1487

Firmware version:

5.4

Notes:

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

Test summary

Date of calibration:

19 January 2024

The calibration was performed

respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing

successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing

conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33611B	MY56001553
Attenuator	Cirrus Research	ZE952	78713
Environmental Monitor	Comet	T7510	16986334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

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

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CERTIFICATE OF CALIBRATION

Certificate Number:

206888

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Environmental conditions

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

Before

Pressure: 100.13 kPa

Temperature: 22.0 °C

Humidity: 37.0 %

After

Pressure: 100.15 kPa

Temperature: 21.9 °C

Humidity: 35.4 %

Test results summary

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

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1498

CERTIFICATE OF CALIBRATION

ISSUED BY

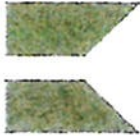
Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206877



Cirrus Research plc

Acoustic House

Bridlington Road

Hunmanby

North Yorkshire

YO14 0PH

United Kingdom

Page 1 of 2

Approved signatory

N Smith

Electronically signed:



Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:

Cirrus Research plc

Model:

CR:110A

Serial number:

CB1498

Firmware version:

5.4

Notes:

Eastern Thai Consulting 1992 Co.,Ltd.
883 Moo.11, Sukaphibal 8 Rd., Nongkham,
Sriacha, Chonburi 20230

Test summary

Date of calibration:

19 January 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:

206877

Page

2 of 2

Environmental conditions

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

Before

Pressure: 100.96 kPa

Temperature: 21.6 °C

Humidity: 33.2 %

After

Pressure: 100.97 kPa

Temperature: 21.5 °C

Humidity: 33.4 %

Test results summary

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

COPY

COPY

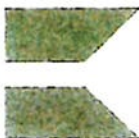
NOISE DOSI METER

MODEL : CR:110A


SERIAL No. : CB1499

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 19 January 2024 CERTIFICATE NUMBER 206881



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

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

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thal Consulting 1992 Co., Ltd.
Model: CR-110A 683 Moo. 11, Sukaphibal 8 Rd., Nongkham,
Serial number: CB1498 Sriracha, Chonburi 20230
Firmware version: 5.4

Test summary

Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDQ8R6309
Attenuator	Cirrus Research	ZE-962	93862
Environmental Monitor	Comet	T7510	16966334
dosaBadge Reader	Cirrus Research plc	RC-110A	40068

Notes

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

Before Pressure: 100.90 kPa Temperature: 21.3 °C Humidity: 31.5 %
After Pressure: 100.91 kPa Temperature: 21.5 °C Humidity: 32.6 %

Test results summary

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

COPY

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1500

CERTIFICATE OF CALIBRATION

ISSUED BY

Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206866

Cirrus Research plc

Acoustic House

Bridlington Road

Hunmanby

North Yorkshire

YO14 0PH

United Kingdom

Page 1 of 2

Approved signatory

N. Smith

Electronically signed:



Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:

Cirrus Research plc

Model:

CR110A

Serial number:

CB1500

Firmware version:

5.4

Notes:

Eastern Thal Consulting 1992 Co., Ltd.
683 Moo.11, Sukaphibal 8 Rd., Nongkham,
Sriacha, Chonburi 20230

Test summary

Date of calibration:

19 January 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC110A	40088

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:

206866

Page

2 of 2

Environmental conditions

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

Before

Pressure: 100.96 kPa

Temperature: 21.6 °C

Humidity: 34.1 %

After

Pressure: 100.95 kPa

Temperature: 21.6 °C

Humidity: 34.7 %

Test results summary

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

COPY

Relic

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0954

CERTIFICATE OF CALIBRATION

ISSUED BY
Cirrus Research plc

DATE OF ISSUE
19 January 2024

CERTIFICATE NUMBER
206864



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

Page 1 of 2

Approved signatory
N Smith
Electronically signed:


Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:
Model:
Serial number:
Firmware version:

Cirrus Research plc
CR110A
C80954
5.4

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

Test summary

Date of calibration: 19 January 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC110A	100498

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:
206864

Page 2 of 2

Environmental conditions

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

Before

Pressure: 100.03 kPa
Temperature: 21.9 °C
Humidity: 34.8 %

After

Pressure: 100.06 kPa
Temperature: 21.7 °C
Humidity: 36.8 %

Test results summary

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

COPY

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0955

CERTIFICATE OF CALIBRATION

ISSUED BY
Cirrus Research plc

DATE OF ISSUE
19 January 2024

CERTIFICATE NUMBER
206865



Cirrus Research plc

Acoustic House

Bridlington Road

Hunmanby

North Yorkshire

YO14 0PH

United Kingdom

Page 1 of 2

Approved signatory
N Smith

Electronically signed:


Dosemeter : IEC 61252-1993+A1:2000

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

Test summary
Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment			
Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE-952	93892
Environmental Monitor	Cornel	T7510	18966334
doseBadge Reader	Cirrus Research plc	RC-110A	40088

Notes

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

COPY

CERTIFICATE OF CALIBRATION

Certificate Number:
206865

Page 2 of 2

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

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

Test results summary

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

COPY

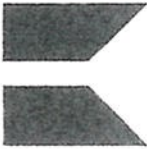
NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0956

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 19 January 2024 CERTIFICATE NUMBER 206875



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

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

Dosimeter : IEC 61252-1993+A1:2000

Instrument Information

Manufacturer: Cirrus Research plc Notes Eastern Thai Consulting 1992 Co.,Ltd.
Model: CR:110A 683 Moo.11, Sukaphibai 8 Rd., Nongkham,
Serial number: CB0956 Sriracha, Chonburi 20230
Firmware version: 5.4

Test summary

Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE-952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	4D088

Notes

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

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

Test results summary

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

Certificate Number: 206875
Page 2 of 2

COPY

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NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0957

CERTIFICATE OF CALIBRATION

ISSUED BY
Cirrus Research plc

DATE OF ISSUE
19 January 2024

CERTIFICATE NUMBER
206874

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

Page 1 of 2

Approved signatory
N Smith
Electronically signed:


Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:
Model:
Serial number:
Firmware version:

Cirrus Research plc
CR:110A
CB0957
5.4

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

Test summary
Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment			
Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

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COPY

CERTIFICATE OF CALIBRATION

Certificate Number:
206874

Page 2 of 2

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

Before	Pressure: 100.86 kPa	Temperature: 20.9 °C	Humidity: 28.6 %
After	Pressure: 100.89 kPa	Temperature: 20.7 °C	Humidity: 29.0 %

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

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB0958

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 19 January 2024 CERTIFICATE NUMBER 206885



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

Page 1 of 2
Approved signatory
N Smith
Electronically signed


Dosemeter : IEC 61252-1993+A1:2000

Instrument information
Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co.,Ltd.
Model: CR:110A 663 Moo.11, Sukaphibai 8 Rd., Nongkham,
Serial number: CB0958 Sriracha, Chonburi 20230
Firmware version: 5.4

Test summary
Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

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COPY

CERTIFICATE OF CALIBRATION

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

Before Pressure: 100.06 kPa Temperature: 21.8 °C Humidity: 35.6 %
After Pressure: 100.10 kPa Temperature: 21.9 °C Humidity: 37.4 %

Test results summary

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

COPY

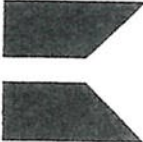
NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8879

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 19 January 2024 CERTIFICATE NUMBER 206901



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

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

Dosemeter : IEC 61252-1993+A1:2000

Instrument Information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co.,Ltd.
Model: CR:110A 683 Moo.11, Sukaphibai 8 Rd., Nongkham,
Serial number: CA8879 Sriracha, Chonburi 20230
Firmware version: 5.4

Test summary

Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG 1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE:952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

Notes

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COPY

CERTIFICATE OF CALIBRATION

Certificate Number:
206901
Page 2 of 2

Environmental conditions

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

Before Pressure: 100.92 kPa Temperature: 21.6 °C Humidity: 35.3 %
After Pressure: 100.93 kPa Temperature: 21.7 °C Humidity: 40.1 %

Test results summary

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

COPY

NOISE DOSI METER

MODEL : CR:110A

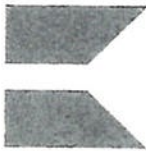
SERIAL No. : CA8886

CERTIFICATE OF CALIBRATION

ISSUED BY
Cirrus Research plc

DATE OF ISSUE
19 January 2024

CERTIFICATE NUMBER
206869



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

Page 1 of 2

Approved signatory
N.Smith

Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

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

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

Test summary

Date of calibration: 19 January 2024

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.

The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.

The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG 1032X	SDG1XDD06R6309
Attenuator	Cirrus Research	ZE 952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC.110A	40088

Notes

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COPY

CERTIFICATE OF CALIBRATION

Certificate Number:
206869

Page 2 of 2

Environmental conditions

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

Before Pressure: 100.96 kPa Temperature: 21.5 °C Humidity: 35.2 %
After Pressure: 100.96 kPa Temperature: 21.6 °C Humidity: 33.4 %

Test results summary

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

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8887

CERTIFICATE OF CALIBRATION

ISSUED BY

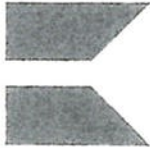
Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206883



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

Page 1 of 2

Approved signatory

N Smith

Electronically signed:

Dosemeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:

Cirrus Research plc

Model:

CR:110A

Serial number:

CA8887

Firmware version:

5.4

Notes:

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

Test summary
Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY58001553
Attenuator	Cirrus Research	ZE:952	78713
Environmental Monitor	Comet	T7510	16986334
doseBadge Reader	Cirrus Research plc	RC:110A	100498

Notes

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CERTIFICATE OF CALIBRATION

Certificate Number:

206883

Page

2 of 2

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

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

Test results summary

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

COPY

NOISE DOSI METER


MODEL : CR:110A

SERIAL No. : CA8888

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc
DATE OF ISSUE 19 January 2024 CERTIFICATE NUMBER 206880

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

Page 1 of 2
Approved signatory
N. Smith
Electronically signed


Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc Notes: Eastern Thai Consulting 1992 Co.,Ltd.
Model: CR-110A 683 Moo.11, Sukaphibai 8 Rd., Nongkham,
Serial number: CA8888 Sriracha, Chonburi 20230
Firmware version: 5.4

Test summary

Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000.
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY56001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

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

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CERTIFICATE OF CALIBRATION

Environmental conditions

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

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

Test results summary

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

Certificate Number:
206880
Page 2 of 2

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CA8889

CERTIFICATE OF CALIBRATION

ISSUED BY
Cirrus Research plc

DATE OF ISSUE
19 January 2024

CERTIFICATE NUMBER
206918

Cirrus Research plc

Acoustic House

Bridlington Road

Hummanby

North Yorkshire

YO14 0PH

United Kingdom

Page 1 of 2

Approved signatory
N.Smith

Electronically signed:


Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer:
Model:
Serial number:
Firmware version:

Cirrus Research plc
CR-110A
CA8889
5.4

Notes:

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

Test summary
Date of calibration: 19 January 2024
The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
The dosimeter submitted for testing successfully completed the periodic tests of IEC 61252-1993+A1:2000
The dosimeter submitted for testing conforms to the specifications in IEC 61252-1993+A1:2000.

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY50001553
Attenuator	Cirrus Research	ZE-952	78713
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC-110A	100498

Notes

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

CERTIFICATE OF CALIBRATION

Certificate Number:
206918

Page 2 of 2

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

Before	Pressure: 100.96 kPa	Temperature: 21.6 °C	Humidity: 34.6 %
After	Pressure: 100.94 kPa	Temperature: 21.5 °C	Humidity: 34.4 %

Test results summary

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

COPY

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ANALYTICAL BALANCE (DU)

Model : XS205DU

Serial No. : 1126323724



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

CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 22 December 2023

Date of Calibration : 22 December 2023

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

Issue date : 25 December 2023

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

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

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



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

REPORT OF CALIBRATION

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

Result of Calibration

1. Test weight and repeatability of reading

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

Unit : g	Range : 80	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	40 80 40 80	
<input checked="" type="checkbox"/> Adjustment	Standard weight	40.000054 80.000048 40.000054 80.000048	
	Average reading of indicator	40.000026 80.000037 40.000017 80.000017	
	Standard deviation	0.000015 0.000016 0.000008 0.000009	

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





Certificate No. : 23-148799

Sample Code : 23-56200-001

Page 3 of 4

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g

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

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.00000	0.00000	0.000012	2.05
0.01	0.0100025	0.01000	0.00000	0.000012	2.05
0.1	0.1000019	0.10001	-0.00001	0.000013	2.03
1	1.0000125	1.00001	0.00000	0.000015	2.02
5	5.0000208	5.00004	-0.00002	0.000021	2.00
10	10.0000004	10.00008	-0.00008	0.000026	2.00
20	20.0000030	20.00011	-0.00008	0.000036	2.00
50	50.000014	50.00014	-0.00013	0.000088	2.00
100	100.000042	100.0001	-0.0001	0.00016	2.00
150	150.000056	150.0001	0.0000	0.00022	2.00
200	200.000041	200.0002	-0.0002	0.00027	2.00

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

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Certificate No. : 23-148799

Sample Code : 23-56200-001

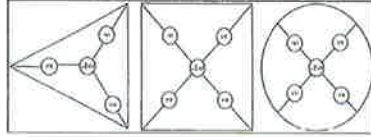
REPORT OF CALIBRATION

Result of Calibration :

4. Eccentric or off-centre loading

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

Weighing pan		Test weight : 50 and 100	
		Unit : g	
Range	Position	Reading of indicator	Reading of indicator
80	1	50.00015	100.0001
	2	50.00022	100.0001
	3	50.00008	100.0001
	4	50.00002	100.0000
	5	50.00016	100.0002
	6	50.00014	100.0001
Maximum difference		0.00013	0.0001



Condition of Calibration

Calibration Method : W1-C1-004 base on UKAS LAB 14: 2019		Ambient conditions	
		Min	Max
2. This result of calibration was found accurate as shown on date and place of calibration only.		Temperature (°C)	22.8 23.0
3. Condition of Calibration tem: Normal		Relative Humidity (%rh)	43.5 51.1
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).		Air pressure (hPa)	1012.5 1014.5

5. Reference standard instrument :

Instrument 1) STANDARD WEIGHT 1 kg to 1 kg

Class E2

ID No. LB-WE-79

Certificate No. 23-105642

Due Date 10 September 2024

End of Report

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ANALYTICAL BALANCE

Model : SECURA224-1S

Serial No. : 0036707137



Certificate No. : 23-148800

Sample Code : 23-56200-002

CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : SARTORIUS

Model : SECURA224-1S

Serial No. : 0036707137

ID No. : LABE 05/2

Date of Receipt : 22 December 2023

Date of Calibration : 22 December 2023

Calibrated by Mr. Somwang Sangdee
Scientist

Issue date : 25 December 2023

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

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

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



Certificate No. : 23-148800

Sample Code : 23-56200-002

REPORT OF CALIBRATION

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

Result of Calibration

1. Test weight and repeatability of reading

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

Unit : g	Range : 220	Before adjustment	After adjustment
<input type="checkbox"/> No adjustment	Nominal value	100 200 100	200
<input checked="" type="checkbox"/> Adjustment	Standard weight	100.000042 200.000041 100.000042	200.000041
	Average reading of indicator	99.9998 199.9998	200.0000
	Standard deviation	0.00006 0.00007	0.00003

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



Certificate No. : 23-148800

Sample Code : 23-56200-002

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

Change in the output variable of a measuring instrument divided by the associated change in the input variable.

Unit : g

Range : 220

Range :

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

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.0000	0.0000	0.000086	2.00
0.01	0.0100025	0.0100	0.0000	0.000086	2.00
0.1	0.1000019	0.1000	0.0000	0.000087	2.00
1	1.0000125	1.0000	0.0000	0.000087	2.00
2	2.0000089	2.0000	0.0000	0.000087	2.00
5	5.0000208	5.0001	-0.0001	0.000088	2.00
10	10.000004	10.0000	0.0000	0.000090	2.00
20	20.000030	20.0000	0.0000	0.000093	2.00
50	50.000014	50.0000	0.0000	0.00011	2.00
100	100.000042	100.0000	0.0000	0.00016	2.00
200	200.000041	200.0000	0.0000	0.00028	2.00

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

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Certificate No. : 23-148800

Sample Code : 23-56200-002

REPORT OF CALIBRATION

Result of Calibration :

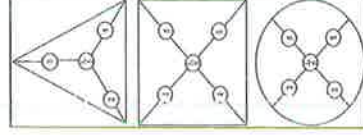
4. Eccentric or off-centre loading

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

Range	Position	Reading of indicator	Reading of indicator
1	100.0000	-	-
2	100.0000	-	-
3	100.0000	-	-
4	99.9999	-	-
5	100.0000	-	-
6	100.0000	-	-
Maximum difference	0.0001	-	-

Weighting pan : ☒ Circle
☐ Triangular
☐ Rectangular

Test weight : 100
Unit : g



Condition of Calibration

1. Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019
2. This result of calibration was found accurate as shown on date and place of calibration only.

3. Condition of Calibration item: Norma

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

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

Company Limited (Instrument number : 1)

5. Reference standard instrument :

Instrument

- 1) STANDARD WEIGHT 1 mg to 1 kg

Class

E2

ID No.

LB-WF-79

Certificate No.

23-105642

Due Date

10 September 2024

End of Report -

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fms

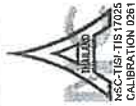
BOD INCUBATOR

Model : TC445S

Serial No. : 0223/007275

SK

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



Certificate of Calibration

Reference No. : C03190/2309-025
Customer : Eastern Thai Consulting 1992 Co.,Ltd.
683 Moo 11, Sukhaphiban 8, Tambol Nongkham,
Siracha District, Chonburi 20230, Thailand

Equipment : Incubator
Manufacturer : Lovibond
Model : TC445S
Serial No. : 0223/007275
ID No. :
Received Date : 15 September 2023
Calibrated Date : 15 September 2023
Issued Date : 18 September 2023
Environment :

	Minimum Value	Maximum Value
Ambient Temperature (°C)	27.5	28.1
Relative Humidity (% RH)	57	58
AC Line Voltage (VAC)	224	226

Place Of Calibration : Production Line
Calibrated by : Mr. Teerasak Chalyaporn

Calibration Method

In-house method : SK-WI-23 base on Thai Laboratory Accreditation Scheme Publication Reference G-20

Condition of this result of calibration

- Reference standard instrument

Instrument	Serial No.	Certificate No.	Due Date
1) Data acquisition/Switch unit	MY44047397	L2305-268	4 November 2023
2) Multiplexer Module	MY41105123	L2305-268	4 November 2023
- This result of calibration was found accurate as shown on date and place of calibration only
- This certificate can be traceable to International System of Unit :

Through Thailand Institute of Scientific And Technological Research (TISTR)

Approved by

☒ Mr. Suphachai Saksi ☐ Mr. Phayak Toolit ☐ Miss Tantaraporn Petpong

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

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

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Certificate No. : S2309-3014

Page 2 of 2

Table1 General Information

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

Table2 Chamber Performance

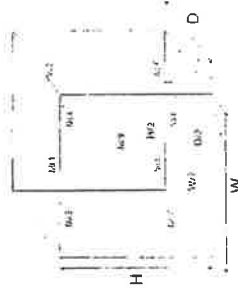
Setting Temperature (°C)	Average Indicating Temperature (°C)	Measured Stability (± °C)	Measured Uniformity (°C)	Overall Variation (°C)
20.0	20.0	0.37	0.64	0.98

Table3 Temperature Distribution

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

Resolution : 0.1 (°C)

* Probe No. 9 is Reference Probe



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

** End of Calibration Report **

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[Signature]

BOD INCUBATOR

ID No. : LABE 19/5

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C) reading (°C)	UUC*	Measured temperature at each positions (°C)										Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 [±]			
20	20.5	20.0	20.28	19.86	19.90	19.91	19.82	20.10	20.01	19.89	19.75	0.59	2.00	

2. Characterization results

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

Notes

UUC* = Unit Under Calibration

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

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

Equipment : Temperature controlled enclosures (Incubator)

Manufacturer : Lovibond

Model : Tc445S

Serial No. : 0520/005227

ID No. : LABE19/5

Date of Receipt : 18 April 2024

Date of Calibration : 18 April 2024

Condition of Calibration

1. Environment

1.1 Ambient temperature : Maximum 35.0 °C : Minimum 33.7 °C

1.2 Relative humidity : Maximum 69.1 % : Minimum 50.0 %

1.3 Line voltage supplied : Maximum 222.5 VAC : Minimum 218.8 VAC

2. Calibration method

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

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-Pt100)	LB-DA-08 (RTD-248 to RTD-256)	23-084070	06 August 2024

4. This certificate is traceable to the international system of unit (SI Unit).
The measurement is traceable to Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.

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

6. Condition of calibration item : Normal



REPORT OF CALIBRATION

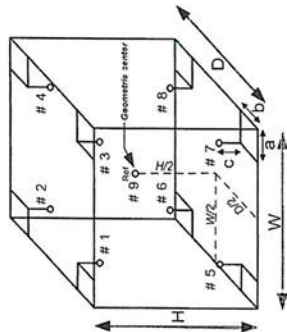
Certificate No. : 24-046203

Sample Code : 24-18906-002

Results of Calibration

Notes

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

Figure: Example of sensor
Installation Positions

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

- End of Report -

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Hot Air Oven

Model : UM 400

Serial No. : 900982

NSC-TSI-TS17025
CALIBRATION 0152

Page 1 of 3

CERTIFICATE OF CALIBRATION

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

Condition of Calibration

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

2. Calibration method

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

3. Reference standard instrument

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

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

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

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Sarawoot Thammo

Approved by

(Mr. Somchai Neampunt)

Issue date

09 January 2024

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

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

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

361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

FM CL 114

TEL 02-516-2422

FAX 02-516-6949

Rev 01

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21

NSC-TSI-TS17025
CALIBRATION 0152

Page 2 of 3

REPORT OF CALIBRATION

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

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

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

2. Characterization results

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

Notes

UUC* = Unit Under Calibration

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361 Soi Ladprao 122, Ladprao Road,

Phlabphla, Wang Thonglang, Bangkok 10310

FM CL 108

TEL 02-516-2422

FAX 02-516-6949

Rev 09

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date: 15/10/21

NSC-TISI-TIS17025
CALIBRATION 0152

REPORT OF CALIBRATION

Page 3 of 3

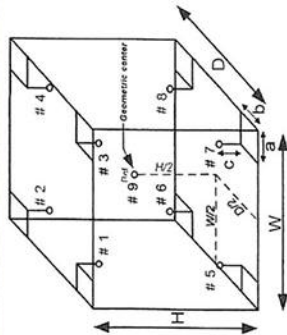
Certificate No. : 24-001944

Sample Code : 24-00963-001

Results of Calibration

Notes

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

Figure: Example of sensor
installation Positions

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

- End of Report -

COPY

LIQUID IN GLASS THERMOMETER

Model : Total Immersion

Serial No. : 43560



QUALITY CALIBRATION CO., LTD.

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



CERTIFICATE No : 23T10864
REFERENCE No : 71117-1

PAGE : 1 OF 2

Certificate of Calibration

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

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

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QUALITY CALIBRATION CO., LTD.

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

CERTIFICATE No : 23T10864

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1502	77964	23T3927	08-Mar-24
2) SPRT PROBE	5614	636636	23T3927	08-Mar-24
3) PRECISION BATH	7320	A21105	22T13199	14-Dec-23
4) PRECISION BATH	CTR-40	A68155	22T13198	09-Dec-23
5) PRECISION BATH	6045	3C023	22T13200	19-Dec-23

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.

4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-

- NATIONAL INSTITUTE OF METROLOGY (THAILAND).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

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

UUC* : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

COPY

pH Meter

Model : SevenCompact S220

Serial No. : B448305208

NSC-TIS-1517025
CALIBRATION0152

CERTIFICATE OF CALIBRATION

Page 1 of 3

Supersedes to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

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

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

Equipment : pH Meter
Manufacturer : METTLER TOLEDO
Serial No. : B448305208
Model : SevenCompact S220
ID No. : LABE 11/4
Date of Receipt : 09 January 2024
Date of Calibration : 09 January 2024

Condition of Calibration

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

2. Calibration method
In house method WI-CL-019; based on direct measurement by using standard voltage calibrator and using certified reference material (CRM).

3. Reference standard / Certified reference material

Instrument	ID No.	Certificate No.	Due Date
3.1 Voltage Calibrator	LB-AMC-01	23E3244	03 October 2024
3.2 Digital Thermometer	LB-TH-33	23-098974	25 August 2024
Certified Reference Material	Lot No.	Ref No.	Expire Date
3.3 Buffer Solution pH 4.008	919273	PH216.L5	24 September 2025
3.4 Buffer Solution pH 6.886	941727	PH107.L5	06 November 2024
3.5 Buffer Solution pH 9.997	919278	PH220.L5	24 September 2024

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

4.1 Instrument No. 3.1 through Technology Promotion Association (Thailand-Japan).
4.2 Instrument No. 3.2 through Asia Medical and Agricultural Laboratory and Research Center Public Company Limited.
4.3 Buffer Solution No. 3.3 and No. 3.5 traceable to CPA chem (through primary measurement method-Harned cell using calibrated thermometer, barometer, and nanovoltmeter Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).
4.4 Buffer Solution No. 3.4 traceable to CPA chem (CPA RefN HARNED CELL LoIN 61275737; CPA RefN HARNED CELL LoIN 61273986 Accredited laboratory ISO/IEC 17025 and ISO/IEC 17034).

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

6. Condition of calibration item : Normal

Calibrated by Mr. Nuttaput Timula Approved by (Mr. Somchai Neampunt)

Issue date 31 January 2024
The uncertainties are for a confidence probability of approximately 95%.
The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

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

NSC-TIS-1517025
CALIBRATION0152

REPORT OF CALIBRATION

Page 2 of 3

Supersedes to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

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

Results of Calibration

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

Nominal Value	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor k
		mV	pH		
0	414.113	413.9	0.00	± 0.083	2.00
4	177.477	177.4	4.00	± 0.083	2.00
7	0.000	0.1	7.00	± 0.083	2.00
10	-177.477	-177.3	10.00	± 0.083	2.00
14	-414.113	-413.8	14.00	± 0.083	2.00

Part 2. Performance of Electrode system

Electrode Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM

Electrode Serial No. : 2453982

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

Standard Buffer Solution pH (@ 25 °C)	Average indicator reading		Error Value pH	Uncertainty pH	Coverage factor k
	pH	mV			
4.008	4.01	182.1	0.002	± 0.010	2.00
6.886	7.00	7.8	0.014	± 0.011	2.00
9.997	10.01	-167.2	0.013	± 0.011	2.00

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

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REPORT OF CALIBRATION

Page 3 of 3

Supersede to Calibration Certificate No. 24-001949

Certificate No. : 24-001949/1

Sample Code : 24-00963-006

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO Model : SevenCompact S220

Serial No. : B44B305208 ID No. : LABE 11/4

Resolution : 0.1 °C Range : -5.0 °C to 130.0 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM

Serial No. : 2453982 ID No. : N/A

Condition of Calibration

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

2. Calibration method

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

3. Reference standard instrument

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

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Accreditation Under TLAS Laboratory Calibration No.0152)

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

6. Condition of Calibration item : Normal

Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration		Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C		
25	25.000	120	25.0	± 0.14	2.00

Notes

- Calibration results without adjustment

The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M0003

- End of report -

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STANDARD WEIGHT 50 g



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

Page 1 of 3

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

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

Issue date : 31 May 2022

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

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

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



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

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : METTLER TOLEDO

Class : F1

Serial No. : N/A

ID No. : LABE 10/1

Result of Calibration :

☒ Without adjustment

☐ Adjustment

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

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

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

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Certificate No. : 22-052238

Sample Code : 22-19150-003

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REPORT OF CALIBRATION

Condition of Calibration

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

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-79	21-078366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated Item :

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

- End of Report -

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STANDARD WEIGHT 100 g



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

Page 1 of 3

CERTIFICATE OF CALIBRATION

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

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

Equipment : Standard Weight 100 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/2

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

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

Issue date : 31 May 2022

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

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

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

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Rev.05



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

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

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

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Certificate No. : 22-052239

Sample Code : 22-19150-004

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REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °C ± 1.5°C, Relative humidity 50% ± 10% and air density 1.18 kg/m³

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

3. Reference standard instrument

Instrument	Class	ID No.	Certificate No.	Due Date
1) Standard Weight 1 mg to 1 kg	E2	LB-WE-78	21-079366	22 September 2022

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

Asia Medical and Agricultural Laboratory and Research Center Public Company Limited

(Instrument number 1).

5. Condition of Calibration item: Normal

6. Description of Calibrated item :

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

- End of Report -

COPY

STANDARD WEIGHT 50 g



Certificate No. : 22-052237

Sample Code : 22-19150-002

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

689 Moo 11, Sukhapiban 8 Rd., Nongkham,

Siracha, Chonburi 20230

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

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Date of Receipt : 18 May 2022

Date of Calibration : 30 May 2022

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 31 May 2022

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

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

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



Certificate No. : 22-052237

Sample Code : 22-19150-002

REPORT OF CALIBRATION

Equipment : Standard Weight 50 g

Manufacturer : N/A

Class : N/A

Serial No. : N/A

ID No. : LABE 10/4

Result of Calibration :

☒ Without adjustment☐ Adjustment

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

Description	Deviation	Conventional	Expanded	Maximum	ID No.
		Mass	Uncertainty	Permissible Error	
	(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 multiplied by the coverage factor $k=2.0$, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with UKAS M3003

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Certificate No. : 22-052237

Sample Code : 22-19150-002

Page 3 of 3

REPORT OF CALIBRATION

Condition of Calibration

1. Ambient Conditions : Temperature 20 °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 -

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