

ภาคผนวก ค : เอกสารสอบเทียบความถูกต้อง
ของเครื่องมือเก็บตัวอย่าง

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15ACX8C
Cylinder Number: EB0062815
Laboratory: 124 - Riverton (SAP) - NJ
PGVP Number: B52018
Gas Code: CO, NO, NOX, SO2, BALN
Reference Number: 82-401135335-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Mar 13, 2018
Expiration Date: Mar 13, 2026

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)* document EPA 600/R-12/531, using the assay procedures and methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below.

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

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
NOX	50.00 PPM	50.65 PPM	G1	03/06/2018, 03/13/2018
NITRIC OXIDE	50.00 PPM	50.50 PPM	G1	03/06/2018, 03/13/2018
SULFUR DIOXIDE	50.00 PPM	51.01 PPM	G1	03/06/2018, 03/13/2018
CARBON MONOXIDE	2000 PPM	1977 PPM	G1	03/06/2018
NITROGEN	Balance			
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRM	16060607	CC42564	50.42 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%
PRM	12367	APEX1089237	9.82 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%
GWMS	0315201604	CC503368	4.975 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%
NTRM	16011025	CC473218	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
NTRM	12060735	CC366192	2498 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%
The SRM, PRM or RGM noted above is only in reference to the GWMS 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		

Triad Data Available Upon Request

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

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



TESTING CERT No. 3082.05

Dana M. Morris
Approved for Release

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645



NSC-TS12-TS 17025
CALIBRATION 0394

Cert. No. : ACC23037
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR

Manufacturer : RION

Model : NC-75

Serial No.: 34802645

ID No.:

Condition As Found : GOOD

Customer :

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

Location :

Ambient Temperature : (23.0 ± 3) °C

Pressure : (101.3 ± 3) kPa

Relative Humidity : (50.0 ± 20) %

Received Date :

06 SEPTEMBER 2023

Calibration Date :

12 OCTOBER 2023

Date of Issue :

16 OCTOBER 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

COPY

Cert. No. : ACC23037
Job No. : VC66AC0097
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/02/66	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/02/67	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 31/02/66	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

COPY

T. Petchurai

Continuation of Calibration Certificate

Cert No. : ACC23037

Job No. : VC66AC0097

Pages : 3 of 3

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

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

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

_____ End of Calibration Certificate _____

COPY

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, Sukhaphibam 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-52A (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 20µPa. Other dB levels are relative values.

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

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

Preconditioning:

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

Instruments and Program:

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

Equipment standards used:

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

Traceability

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

Sound Pressure Level: EEI, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand
Voltage: TPA, Thailand
Frequency: TPA, Thailand

This certificate of calibration is issued by Acoustic Laboratory (Thailand) (ALT). It also states that the laboratory has a satisfactory 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
Reference conditions: 23.0 °C
Measurement conditions: 101.1 ± 0.10 kPa 22.1 ± 1.0 °C

Relative humidity: 50 %RH
51.1 ± 2.0 %RH

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	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 Tolerance limit (dB)
63	-0.2	-0.2	±1.0
125	-0.1	0.0	±1.0
250	-0.1	-0.1	±1.0
500	-0.1	0.0	±1.0
1000	0.0	0.0	±0.7
2000	-0.1	0.0	±1.0
4000	0.0	0.0	±1.0
8000	0.1	0.1	±1.5-2.5
16000	-1.2	-1.2	±1.5-2.5

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

Certificate No.: S2402-0650

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
LAeq	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

COPY

Certificate No.: S2402-0650

6. Level linearity on the reference level range

6.1 Measured at 31.5 Hz

Anticipated value (dB)	Measured value (dB)	Deviated value	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

COPY



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



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





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
SEL	0.25	108.9	-0.1	+1.0,-3.0
	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		
139.5	139.6	0.1	±1.5

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	0.13 dB
4. Frequency and time weightings at 1 kHz	0.13 dB
5. Long term stability test	0.10 dB
6. Level linearity on the reference level range	0.14 dB
7. Tone burst response	0.14 dB
8. 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.

Signature

Calibrated By : (Mr.Chaiyaporn Sornpichai)

Signature

Approved By : (Mr.Pitupong Sarapho)

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

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

SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 01120953

Cert. No. : ACL24046
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 01120953 / 22355 / 22342
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 : 11 JANUARY 2024
Calibration Date : 16 - 17 JANUARY 2024
Date of Issue : 18 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : *Y. Petchurai*
(Thanakul Petchurai)

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

COPY

Cert. No. : ACL24046
Job No. : VC67AC0042
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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA	34560495	AA-3002-23	14-FEB-24

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

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

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

COPY
Y. Petchurai

Cert. No. : ACL24046
Job No. : VC67AC0042
Pages : 3 of 8Summary 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	0.3	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

COPY
T. RethehResult of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	14.8
Flat	20.7

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	0.1	0.1	0.1
8000	0.1	0.2	0.2
Acceptance Limits			
± 1.0			
± 0.7			
+ 1.5, - 2.5			

COPY
T. Retheh

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	0.1
250	0.1	0.0	0.0
500	0.1	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
16000	0.0	-1.2	-1.1

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	± 0.1

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±0.8
136.0	136.1	0.1	±0.8
135.0	135.1	0.1	±0.8
134.0	134.1	0.1	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.1	0.1	±0.8
99.0	99.0	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	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	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

COPY

T. Reteh.

COPY

T. Reteh.

Cert. No. : ACL24046
Job No. : VC67AC0042
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	116.9	-0.1	1.0 ; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.8	-0.2	1.0 ; -3.0
	2	8	108.0	107.9	-0.1	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

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	±2.0
One	136.4	135.3	-1.1	±2.0

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	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

11. Overload indication

Measured value (dB)	Deviated Value (dB)		Acceptance Limits (dB)
	Positive one-half cycle	Negative one-half cycle	
89.6	89.7	0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

COPY
T. Retcha.

COPY
T. Retcha.

SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230989

Certificate of Calibration

Certificate No.: S2402-0644

Customer:

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

Date of calibration:

2024-03-04

Date of issue:

2024-03-05

Instrument Calibrated:

Sound Level Meter

Manufacturer:

Rion

Model:

NL-52A (Meter), UC-59 (Microphone), NH-25 (Preamplifier)

Serial no:

00230989 (Meter), 22337 (Microphone), 22425 (Preamplifier)

Calibration and verification performed:

Acoustical levels are stated relative to 20µPa. 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 Nori 1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

Traceability

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

Sound Pressure Level: 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 without prior written permission.

Page 1 of 8

Certificate No.: S2402-0644

Environmental conditions:

Reference conditions: Pressure: 101.325 kPa
Measurement conditions: 101.21 ± 0.10 kPa

Temperature: 23.0 °C
23.0 ± 1.0 °C

Relative humidity: 50 %RH
52.1 ± 2.0 %RH

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	93.8	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	Measured value (dB)
A-Weighting	9.9
C-Weighting	14.0
Z-Weighting	19.3

3. Electrical signal test of frequency weighting at 93 dB

Frequency (Hz)	Deviation from various frequency weighting response curve			Tolerance limit (dB)
	A-Weighting (dB)	C-Weighting (dB)	Z-Weighting (dB)	
63.0	0.0	0.0	0.0	±1.0
125.0	0.0	0.1	0.0	±1.0
250.0	0.0	0.0	0.0	±1.0
500.0	0.0	0.1	0.1	±1.0
1000.0	0.0	0.0	0.0	±0.7
2000.0	-0.2	-0.1	-0.2	±1.0
4000.0	-0.3	-0.3	-0.3	±1.0
8000.0	0.1	0.1	0.0	±1.5-2.5
16000.0	-1.6	-1.7	-0.5	±1.5-2.5

Date of calibration : 2024-03-04

Date of issue : 2024-03-05

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	94.0	0.0	±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)
27:31	94.0	94.0	0.0	±0.1

Date of calibration : 2024-03-04
Date of issue : 2024-03-05

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	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 : 2024-03-04
Date of issue : 2024-03-05



Certificate No.: S2402-0644

6.2 Measured at 1 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptant limit (dB)
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
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	138.0	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	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	44.0	0.0	±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 : 2024-03-04
Date of issue : 2024-03-05

COPY
Page 5 of 8



Certificate No.: S2402-0644

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	132.9	0.0	±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	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	53.9	-0.1	±0.8
49.0	49.0	0.0	±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	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 : 2024-03-04
Date of issue : 2024-03-05

COPY
Page 6 of 8

7. Tone burst response

Time weightings	Tone burst duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Tolerance limit (dB)
Fast	200	135.0	0.0	±0.5
	2	118.0	0.0	+1.0, -1.5
	0.25	109.0	0.0	+1.0, -3.0
SEL	200	129.0	0.0	±0.5
	2	109.0	0.0	+1.0, -1.5
	0.25	100.0	0.0	+1.0, -3.0

8. Overload indication

Measured value (dB)		Deviated value (dB)	Tolerance limit (dB)
Positive one half cycle	Negative one half cycle	0	±1.5
139.1	139.1		

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 : 2024-03-04
Date of issue : 2024-03-05


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

Approved By: 
(Mr. Pitupong Sarapho)

Date of calibration : 2024-03-04
Date of issue : 2024-03-05

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

Analytical Balances

Model : XS205DU

Serial No : B814654693

Mettler-Toledo (Thailand) Ltd.

846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District

Bangna District, Bangkok 10260

+662 723 0382

MT-TH.ServiceSupport@mt.com



NSC-TISI-TIS 17025
CALIBRATION 0062

Accuracy Calibration Certificate

Customer

Company: Eastern Thai Consulting 1992 Co., Ltd.
Address: 129 Moo 1, Nonsi
City: Kabin Buri Contact: Tassawan Chansamrong
Zip / Postal: 25110
State / Province: Prachinburi
Order Number: 
0 3 3 3 0 5 7 4 7 2

Weighing Device

Manufacturer: Mettler Toledo Instrument Type: Weighing Instrument
Model: XS205DU Asset Number: KB-LAB-61/002
Serial No.: B814654693 Terminal Model: SAT
Building: Office Laboratory Terminal Serial No.: B814654693
Floor: 1 Terminal Asset No.: N/A
Room: Laboratory

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)

METTLER TOLEDO Work Instruction: CP/W002/20

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

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

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

As Found	Temperature		Humidity	
	Start: 23.2 °C	End: 22.8 °C	Start: 60.8 %	End: 65.0 %

As Found Calibration Date: 23-Mar-2024
As Left Calibration Date: N/A
Issue Date: 24-Mar-2024

Calibrator: Naruephon C.
Naruephon Chonprasertsuk

Approved Signatory:

Surachai P.
Technical Manager / Head of Calibration Center

COPY

Measurement Results

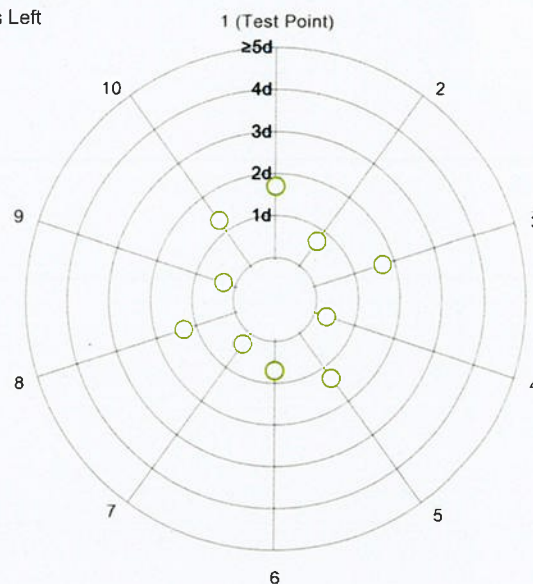
Repeatability

Test Load: 70 g

	As Found	As Left
1	69.99996 g	N/A
2	69.99997 g	N/A
3	69.99996 g	N/A
4	69.99998 g	N/A
5	69.99999 g	N/A
6	69.99997 g	N/A
7	69.99998 g	N/A
8	69.99999 g	N/A
9	69.99998 g	N/A
10	69.99999 g	N/A

Standard Deviation	0.000012 g	N/A
--------------------	------------	-----

○ As Found
◆ As Left



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

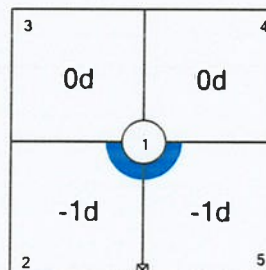
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

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

Maximum Deviation	0.0001 g	N/A
-------------------	----------	-----



As Found

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

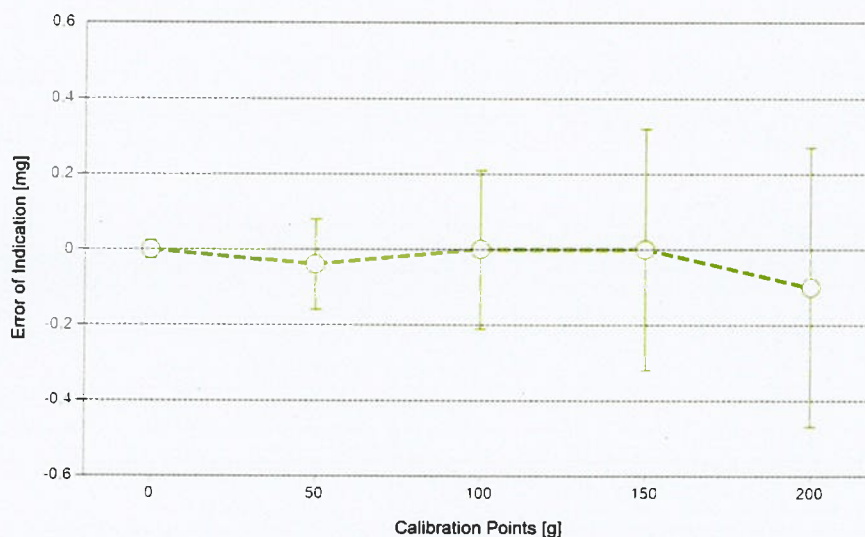
COPY

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.024 mg	2
2	0.05001 g	0.05000 g	-0.00001 g	0.027 mg	2
3	0.10000 g	0.09999 g	-0.00001 g	0.028 mg	2
4	0.49999 g	0.49999 g	0.00000 g	0.033 mg	2
5	0.99999 g	1.00001 g	0.00002 g	0.036 mg	2
6	5.00002 g	5.00003 g	0.00001 g	0.051 mg	2
7	10.00001 g	9.99999 g	-0.00002 g	0.063 mg	2
8 ¹	50.00003 g	49.99999 g	-0.00004 g	0.12 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.21 mg	2
10	150.0000 g	150.0000 g	0.0000 g	0.32 mg	2
11	200.0001 g	200.0000 g	-0.0001 g	0.37 mg	2

¹The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



○ As Found

◆ As Left

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

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

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

COPY

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.:	WS22	Date of Issue:	06-Apr-2023
Certificate Number:	18589	Calibration Due Date:	03-Oct-2024

Thermo Hygrometer

Equipment No.:	IN284	Date of Issue:	16-Jan-2024
Certificate Number:	SG-H-00080/67	Calibration Due Date:	14-Jan-2025

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory

End of Accredited Section

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

COPY

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

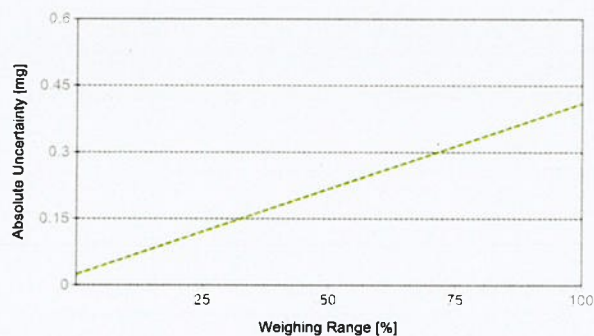
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.00001 g	81 g	$U_1 = 0.025 \text{ mg} + 0.00476 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00478 \text{ mg/g} \cdot R$	N/A

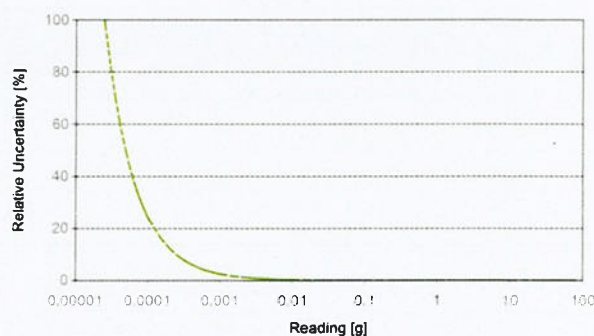
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.00220 g	0.025 mg	1.1%	N/A	N/A
0.02200 g	0.025 mg	0.11%	N/A	N/A
0.22000 g	0.026 mg	0.012%	N/A	N/A
2.20000 g	0.035 mg	0.0016%	N/A	N/A
220.0000 g	1.1 mg	0.00051%	N/A	N/A



As Found



As Left

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

COPY

Thermo Reactor

Model : RD125

Serial No. : 0220/003514



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T241379I02

"Substitute for Calibration Certificate Number T241379I01"

Page 1 of 4

Certificate of Calibration

Equipment : Thermoreactor

Manufacturer : Lovibond

Model : RD125

Serial No. : 0220/003514

Customer Code : KB-LAB-63/004


ID No. : T2603A5

Customer : Eastern Thai Consulting 1992 Co.,Ltd.
129 Moo.1 Nonsi,
Kabinburi, Prachinburi 25110

Customer Location : Laboratory Room

Date of Receipt : 17 July 2024

Calibrated By : Atiphong Rongrat (Technician)

Approved By :  Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 27 AUG 2024

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

COPY

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 units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Certificate No. T241379I02

Page 2 of 4

Calibration Report

Equipment : Thermoreactor
Date of Calibration : 25 July 2024
Environment : Temperature : 27.4-28.9 °C
Line Voltage : 222.7-227.8 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 30 Minute At 150 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment

() after adjustment

Approved By.

**COPY**

Certificate No T241379I02

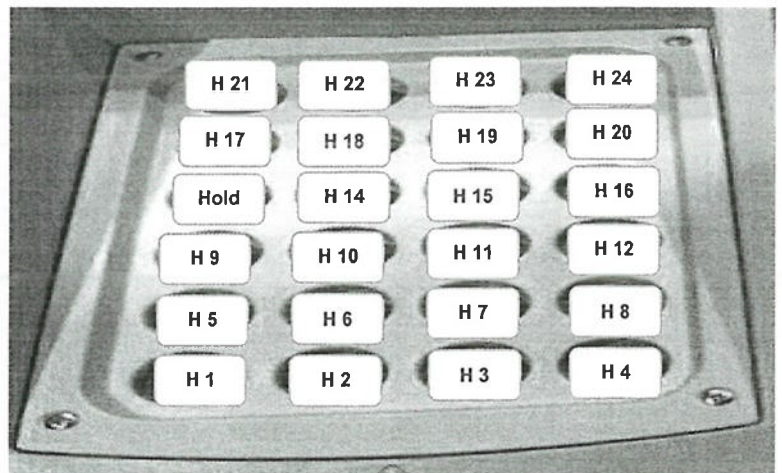
Page 3 of 4

Calibration Report

Row 6	H 21		H 22		H 23		H 24
Row 5	H 17		H 18		H 19		H 20
Row 4	HOLD		H 14		H 15		H 16
Row 3	H 9		H 10		H 11		H 12
Row 2	H 5		H 6		H 7		H 8
Row 1	H 1		H 2		H 3		H 4

H: STANDARD THERMOCOUPLE TYPE T

H1	=	TN241	H9	=	TN249	H17	=	TN257
H2	=	TN242	H10	=	TN250	H18	=	TN258
H3	=	TN243	H11	=	TN251	H19	=	TN259
H4	=	TN244	H12	=	TN252	H20	=	TN260
H5	=	TN245	H13	=	Hold	H21	=	TN241
H6	=	TN246	H14	=	TN254	H22	=	TN242
H7	=	TN247	H15	=	TN255	H23	=	TN243
H8	=	TN248	H16	=	TN256	H24	=	TN244



Approved By. 

COPY

Certificate No. **T241379I02**

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point			Average Standard Reading at each position (°C)									
			TN241	TN242	TN243	TN244	TN245	TN246	TN247	TN248	TN249	TN250
Point	Setting	Max	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
150	150.0	Min	150.23	149.91	150.53	149.99	150.89	150.09	150.14	150.64	149.96	150.31
		Average	150.08	149.82	150.45	149.88	150.80	150.06	150.07	150.58	149.93	150.24
			TN251	TN252	TN253	TN254	TN255	TN256	TN257	TN258	TN259	TN260
			H11	H12	H13	H14	H15	H16	H17	H18	H19	H20
		Max	150.23	150.77		150.82	150.31	150.45	150.84	150.84	150.33	150.22
		Min	150.12	150.62	HOLD	150.76	150.20	150.39	150.77	150.76	150.22	150.13
		Average	150.17	150.69		150.79	150.25	150.42	150.80	150.80	150.27	150.17
			TN241	TN242	TN243	TN244						
			H21	H22	H23	H24						
		Max	149.98	149.98	150.54	150.01						
		Min	149.91	149.92	150.48	149.95						
		Average	149.94	149.95	150.51	149.98						

Thermoreactor			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (± °C)	Uncertainty (± °C)
	Min , Max	Average		
150	-	150	0.20	1.20

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. _____



COPY

Chamber (Incubator)

Model : SRC-680SAD

Serial No. : 0508-00036



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T241193

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Incubator)

Manufacturer : SANDEN

Model : SRC-680SAD

Serial No. : 0508-00036

Customer Code : KB-LAB-48/035


ID No. : T2465A3

Customer : Eastern Thai Consulting 1992 Co.,Ltd.
129 Moo.1 Nonsi,
Kabinburi, Prachinburi 25110

Customer Location : Laboratory

Date of Receipt : 12 June 2024

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 24 JUN 2024

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

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 units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

COPY

Certificate No. T241193

Page 2 of 3

Calibration Report

Equipment : Chamber (Incubator)
Date of Calibration : 19 June 2024
Environment : Temperature : 28.5-29.5 °C
Line Voltage : 226.5-231.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	28-(CH1-10)	T240709	19 April 2025
DATA LOGGER	34970A	T149	T240709	19 April 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 22 Minute At 20 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

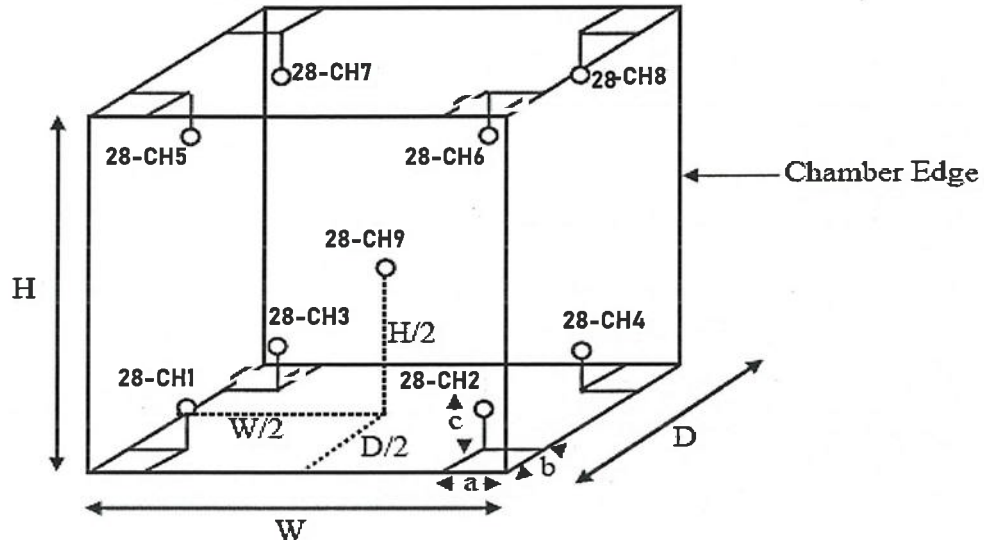
Approved By. 

COPY

Certificate No. T241193

Page 3 of 3

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 60 cm. , H (Height) = 146 cm. and D (Depth) = 64 cm.

Size of Installed Standard sensor number 28-CH1 to number 28-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 28-CH9 : W/2 = 60 cm./2 , H/2 = 146 cm./2 and D/2 = 64cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	28-CH1	28-CH2	28-CH3	28-CH4	28-CH5	28-CH6	28-CH7	28-CH8	28-CH9
20	20.20	20.13	20.05	19.78	19.93	19.83	19.99	19.97	19.77

Chamber (Incubator)			Temperature Distribution				
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average					
20.0	19.8 , 20.1	20.0	19.96	0.13	0.71	0.44	2.04

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

COPY

DO METER

Model : YSI5000

Serial No. : 16H102702

CERT.No.: HS-U072J

Certificate of Calibration

Calibration Date : 12 Oct 23
 Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
 129 Moo 1, Nonsi Subdistrict, Kabinburi
 District Prachinburi Province 25110

Avg Room Temp : 20 °C
 Avg Water Temp : 20 °C
 Air Pressure : 760.00 mmHg
 Salinity : 0 ppt

Model : YSI 5000
 S/N : 16H102702
 Probe : YSI 5010
 S/N : 22A00334
 ID NO. :
 Air Temp ref : S/N. F8065C26
 Barometric ref : S/N. F8065C26
 Water Temp ref : S/N. 11430
 Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.07	(PASS)	-
Mean Measurement	9.08	mg/l	-
Inaccuracy	0.01	mg/l	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature

(Kittipong Maekwong)

COPY



Laboratory Manager

(Natenapha Pisatkunchon)

pH Meter

Model : Seven2Go S2

Serial No : B805359649



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 24-057014

Sample Code : 24-23352-001

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri,
Kabinburi, Prachinburi 25110

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

Equipment : pH Meter

Manufacturer : METTLER TOLEDO

Model : Seven2GO S2

Serial No. : B805359649

ID No. : KB-LAB-61/001

Date of Receipt : 13 May 2024

Date of Calibration : 14 May 2024

Condition of Calibration

1. **Environment** Ambient temperature : 22.5 to 27.5 °C Relative humidity : 40.0 to 70.0 %RH
1.1 Start time : 24.4 °C ; End time : 24.2 °C 1.2 Start time : 60.3 %RH ; End time : 63.1 %RH

2. Calibration method

In house method WI-CL-019 : Direct measurement with standard voltage calibrator and direct measurement with 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	941725	PH216.L5	30 November 2025
3.4 Buffer Solution pH 6.986	941727	PH107.L5	06 November 2024
3.5 Buffer Solution pH 9.997	941726	PH220.L5	06 November 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 17034).
4.4 Buffer Solution No. 3.4 traceable to CPA chem (CPA RefN HARNED CELL LotN 61275737; CPA RefN HARNED CELL LotN 61273986 Accredited laboratory ISO/IEC 17025 and ISO 17034).

5. This result of calibration was found accurate as shown on date and place of calibration only.**6. Condition of calibration item : Normal**

Calibrated by Mr. Nuttaput Timula
Scientist

Approved by

(Mr. Somchai Neampunt)
Signed for Director

Issue date 20 May 2024

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

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

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

NSC-TISI-TIS17025
CALIBRATION 0152

REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 24-057014

Sample Code : 24-23352-001

Equipment : pH Meter Resolution : 0.01 pH ; 1 mV ; 0.1°C
Manufacturer : METTLER TOLEDO Model : Seven2GO S2
Serial No. : B805359649 ID No. : KB-LAB-61/001
Range : -2.00 pH to 20.00 pH ; ± 1999 mV ; -5.0°C to 105.0°C

Results of Calibration

Part 1. DC Voltage measurement

pH Meter Serial No. : B805359649

Nominal Value pH	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor k
		mV	pH		
0	414.113	414	-0.01	± 0.59	2.00
4	177.477	177	4.00	± 0.59	2.00
7	0.000	0	7.00	± 0.59	2.00
10	-177.477	-178	10.00	± 0.59	2.00
14	-414.113	-414	14.01	± 0.59	2.00

Part 2. Performance of Electrode system

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

Electrode Serial No. : 4100521

Three-Point Calibration at pH4, pH7 and pH10 Percent Slope : 98.7

Standard Buffer Solution pH (@ 25 °C)	Average indicator reading		Error Value pH	Uncertainty pH	Coverage factor k
	pH	mV			
4.008	4.00	184	-0.008	± 0.010	2.00
6.986	6.99	9	0.004	± 0.010	2.00
9.997	10.00	-166	0.003	± 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.



REPORT OF CALIBRATION

Certificate No. : 24-057014

Sample Code : 24-23352-001

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO Model : Seven2Go S2
Serial No. : B805359649 ID No. : KB-LAB-61/001
Resolution : 0.1 °C Range : -5.0 °C to 105.0 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO Model : InLab Expert Go-ISM
Serial No. : 4100521 ID No. : N/A

Condition of Calibration

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

2. Calibration method

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

3. Reference standard instrument

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

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

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

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

6. Condition of Calibration item : Normal

Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration			Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C	Correction value °C		
10	10.001	120	10.1	- 0.099	± 0.13	2.00
30	30.000	120	30.1	- 0.100	± 0.13	2.00
50	50.010	120	50.1	- 0.090	± 0.16	2.05

Notes

- Calibration results without adjustment

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

- End of report -

WATER BATH

Model : WNB45

Serial No. : L719.0236

CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 23-117650

Sample Code : 23-43253-001

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri,
Kabinburi, Prachinburi 25110

Location of Calibration : Eastern Thai Consulting 1992 Co., Ltd.
(Laboratory)

Equipment : Liquid bath (Water bath)

Manufacturer : Memmert

Model : WNB 45

Serial No. : L719.0236

ID No. : KB-LAB-63/017

Date of Receipt : 05 October 2023

Date of Calibration : 05 October 2023

Condition of Calibration

1. Environment	1.1 Ambient temperature	: Maximum	32.7 °C	; Minimum	30.4 °C
	1.2 Relative humidity	: Maximum	72.0 %	; Minimum	66.7 %
	1.3 Line voltage supplied	: Maximum	229.5 VAC	; Minimum	224.3 VAC

2. Calibration method

In-house method WI-CL-023 based on ASTM E 715-80: 2001.

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-Pt100)	LB-DA-11 (RTD-214 to RTD-218)	22-126916	07 December 2023

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

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

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

6. Condition of calibration item : Normal

Calibrated by

Mr. Nophanon Anusak
Scientist

Approved by

(Mr. Somchai Neampunt)
Signed for Director

Issue date

09 October 2023

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

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

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

REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 23-117650

Sample Code : 23-43253-001

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)					Uncertainty ± (°C)	Coverage factor <i>k</i>
			# 1	# 2	# 3	# 4	# 5 ^{Ref.}		
85	85.7	85.7	84.796	84.852	84.908	84.865	84.834	0.16	2.00
95	95.0	95.0	94.076	94.131	94.182	94.138	94.101	0.18	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.066	0.170	0.212
95	0.093	0.182	0.234

Notes

- UUC* = Unit Under Calibration



REPORT OF CALIBRATION

Page 3 of 3

Certificate No. : 23-117650

Sample Code : 23-43253-001

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 Place five calibrated temperature sensors in the unloaded water bath with diffuser plate in place and at lowest position and water level approximately 38 mm from the top.
 - 1.2 Locate one sensor in each of the four corners of the bath approximately 50 mm from each wall and midway between the diffuser plate and the water surface.
 - 1.3 Locate the fifth sensor within 25 mm of the geometric center of the bath.
2. The quoted uncertainty includes "Stability of bath and loading effect in bath at 20% of uniformity".
3. 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.
4. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
5. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
6. UUC* reading - the average reading of indicating device that forms the integral part of the bath.
7. Controlled circulation or stirrer moter setting : N/A
8. Cooling system : N/A
9. Calibration results without adjustment.

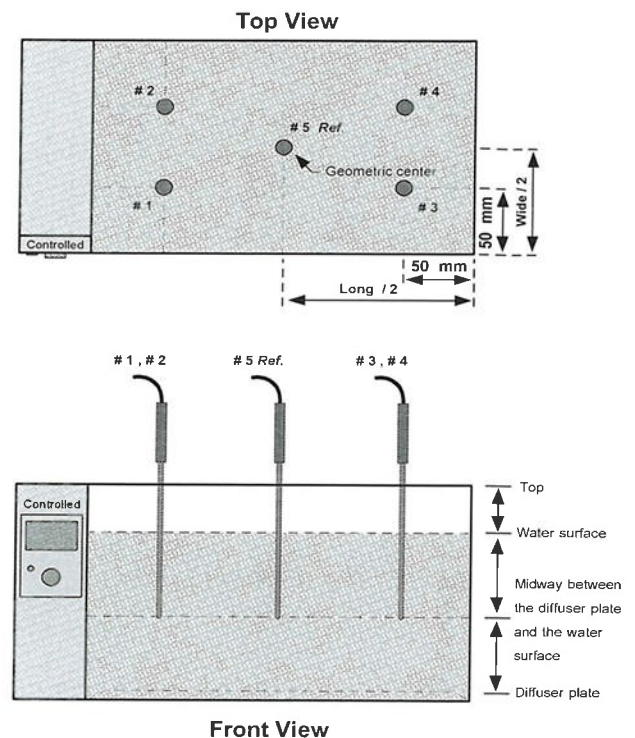
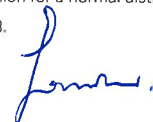


Figure: Example of sensor
installation Positions

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

Chamber (Refrigerator)

Model : SCR-1320SAD

Serial No. : 0508-00065



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand .

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T240565

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : SRC-1320SAD

Serial No. : 0508-00065

Customer Code : KB-LAB-48/034

ID No. : T8421A2

Customer : Eastern Thai Consulting 1992 Co.,Ltd.
129 Moo.1 Nonsi,
Kabinburi, Prachinburi 25110

Customer Location : Laboratory

Date of Receipt : 13 March 2024

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : Bonchai /Bonchai Suriyawong (Site Calibration Manager)

Date of Issue : 25 MAR 2024

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

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 units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

COPY

Certificate No. T240565

Page 2 of 3

Calibration Report

Equipment : Chamber (Refrigerator)
Date of Calibration : 21-22 March 2024
Environment : Temperature : 29.6-33.7 °C
Line Voltage : 224.9-232.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	28-(CH1-10)	T230543	10 April 2024
DATA LOGGER	34970A	T149	T230543	10 April 2024

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 14 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

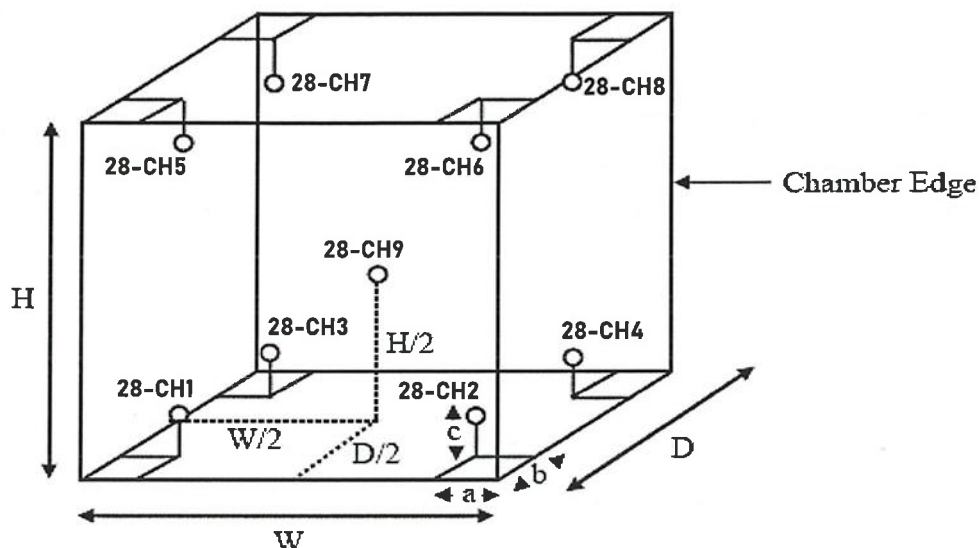
Approved By. 

COPY

Certificate No. T240565

Page 3 of 3

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 100 cm. , H (Height) = 135 cm. and D (Depth) = 45 cm.

Size of Installed Standard sensor number 28-CH1 to number 28-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 28-CH9 : W/2 = 100 cm./2 , H/2 = 135 cm./2 and D/2 = 45cm./2

Measurement Results

Average Standard Reading at each position (°C)									
Calibration Point	28-CH1	28-CH2	28-CH3	28-CH4	28-CH5	28-CH6	28-CH7	28-CH8	28-CH9
3	3.17	3.08	3.17	2.79	3.09	3.30	2.60	2.74	3.16

Chamber (Refrigerator)			Temperature Distribution				
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
3.0	2.9 , 3.8	3.1	3.01	0.86	1.02	1.28	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

COPY

pH METER

Model : SevenCompact

Serial No. : B824972289



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 24-108219

Sample Code : 24-43250-001

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri, Kabinburi,
Prachinburi 25110

Location of Calibration : Eastern Thai Consulting 1992 Co., Ltd.
(Calibration laboratory)

Equipment : pH Meter

Manufacturer : METTLER TOLEDO **Model** : SevenCompact S220

Serial No. : B824972289 **ID No.** : KB-LAB-61/003

Date of Receipt : 26 August 2024 **Date of Calibration** : 26 August 2024

Condition of Calibration

1. **Environment** Ambient temperature : 15.0 to 35.0 °C Relative humidity : 35.0 to 80.0 %RH
1.1 Start time : 24.5 °C ; End time : 25.8 °C 1.2 Start time : 76.8 %RH ; End time : 79.5 %RH

2. Calibration method

In house method WI-CL-019 : Direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM).

3. Reference standard / Certified reference material

Instrument	ID No.	Certificate No.	Due Date
3.1 Voltage Calibrator	LB-DPC-01	LF24-0280	25 June 2025
3.2 Digital Thermometer	LB-DPC-01	24-096498	11 August 2025
Certified Reference Material	Lot. No.	Ref No.	Expire Date
3.3 Buffer Solution pH 4.008	991689	PH216.L5	03 May 2026
3.4 Buffer Solution pH 6.999	C03142	S11M004	12 February 2026
3.5 Buffer Solution pH 9.997	980686	PH220.L5	25 April 2025

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

- 4.1 Instrument No. 3.1 through Measuretronix Limited.
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 17034).
4.4 Buffer Solution No. 3.4 traceable to HACH (Certified Reference Material from DFM and PTB Certificate Nr. CRM-P1118 and Certificate Nr. PTB-PHOB-555/30620/22. According to DIN EN ISO 17034:2017).

5. This result of calibration was found accurate as shown on date and place of calibration only.**6. Condition of calibration item : Normal**

COPY

Calibrated by Mr. Nuttaput Timula
Scientist

Approved by (Mr. Somchai Neampunt)
Signed for Director

Issue date 27 August 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) .

NSC-TISI-TIS17025
CALIBRATION 0152

Page 2 of 3

REPORT OF CALIBRATION

Certificate No. : 24-108219

Sample Code : 24-43250-001

Equipment : pH Meter Resolution : 0.001 pH ; 0.1 mV ; 0.1°C
Manufacturer : METTLER TOLEDO Model : SevenCompact S220
Serial No. : B824972289 ID No. : KB-LAB-61/003
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. : B824972289

Nominal Value pH	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor k
		mV	pH		
0	414.113	414.0	0.00	± 0.083	2.00
4	177.477	177.5	4.00	± 0.083	2.00
7	0.000	0.0	7.00	± 0.083	2.00
10	177.477	-177.5	10.00	± 0.083	2.00
14	-414.113	-414.0	14.00	± 0.083	2.00

Part 2. Performance of Electrode system

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

Electrode Serial No. : 4293264

Three-Point Calibration at pH4 and pH7 Percent Slope : 99.4 , at pH7 and pH10 Percent Slope : 98.7

Standard Buffer Solution pH (@ 25 °C)	Average indicator reading		Error Value pH	Uncertainty pH	Coverage factor k
	pH	mV			
4.008	4.00	181.2	-0.008	± 0.0083	2.00
6.999	6.99	4.8	-0.009	± 0.0083	2.00
9.997	9.99	-170.4	-0.007	± 0.0083	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.

COPY



REPORT OF CALIBRATION

Certificate No. : 24-108219

Sample Code : 24-43250-001

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO Model : SevenCompact S220
Serial No. : B824972289 ID No. : KB-LAB-61/003
Resolution : 0.1 °C Range : -30.0 °C to 130.0 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM
Serial No. : 4293264 ID No. : N/A

Condition of Calibration

1. Environment
- 1.1 Ambient temperature : 25.2 °C ± 0.1 °C
1.2 Relative humidity : 66.3 % ± 7.2 %

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-366	24-096498	11 August 2025
3.2 Thermometer Readout	753	LB-DPC-01	24-096498	11 August 2025

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

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

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

6. Condition of Calibration item : Normal

Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration			Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C	Correction value °C		
23	22.98	100	22.8	+ 0.18	± 0.14	2.00
25	24.98	100	24.8	+ 0.18	± 0.14	2.00
27	27.00	100	26.8	+ 0.20	± 0.14	2.00

Notes

- Calibration results without adjustment

COPY

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 -

Digital Thermohygro Meter

Model : 303C

Serial No : 200603202

CERTIFICATE OF CALIBRATION

Page 1 of 2

Certificate No. : 23-126873

Sample Code : 23-46990-001

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri,
Kabinburi, Prachinburi 25110

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

Equipment : Digital thermo-hygrometer

Manufacturer : Jedto **Model** : 303C

Serial No. : 200603202 **ID No.** : KB-LAB-63/025

Date of Receipt : 27 October 2023 **Date of Calibration** : 30-31 October 2023

Condition of Calibration

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

2. Calibration method

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

3. Reference standard instrument

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

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

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

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

6. Condition of calibration item : Normal

Calibrated by Miss Pornsuda Lohabal
Scientist

Approved by

(Mr. Somchai Neampunt)
Signed for Director

Issue date 01 November 2023

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

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

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



REPORT OF CALIBRATION

Certificate No. : 23-126873

Sample Code : 23-46990-001

Results of Calibration

Temperature measurement

Resolution : 0.1 °C

Range : -50 °C to 70 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.00	19.9	+ 0.10	± 0.39
25	50	25.00	24.8	+ 0.20	± 0.39
30	50	30.00	29.6	+ 0.40	± 0.39

Humidity measurement

Resolution : 1 %RH

Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.01	45.13	39	+ 6.13	± 1.3
60	25.00	60.06	51	+ 9.06	± 1.5
75	25.01	75.15	67	+ 8.15	± 1.7

Notes

- Calibration results without adjustment.

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

- End of Report -



Conductivity Meter

Model : SevenCompact

Serial No : C038084210



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 24CH120

Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : SevenCompact
Serial No. : C038084210
ID No. : KB-LAB-64/001
Condition As-Received: Used Item
Received Date : 23 January 2024
Calibration Date : 24 January 2024
Reference : 2401-0720DSC-1
Submitted by : Eastern Thai Consulting 1992 Co.,Ltd.
129 Moo.1 Nonsi ,
Kabinburi , Prachinburi 25110
Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure: In -house method :
- CP-CH6 : based on direct measurement by
using certified reference material (CRM)

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

- () Saithip Meangmai
() Warakorn Lerngagtrakul
(✓) Ponpan Paipim

Issue Date : 25 January 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

COPY



Cert.No.: 24CH120

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	1963878	130RC095	2311051	05 Sep 2024

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
1413.0 $\mu\text{S/cm}$	CPA Chem	931955	30 Sep 2024

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}\text{C}$

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 5820300339

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 $\mu\text{S/cm}$	1371 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00

Remark

- UUC* = Unit Under Calibration

- Cell constant = 0.548696 cm^{-1}

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

-o0o-

COPY

R2

HOT AIR OVEN

Model : UF110

Serial No. : B420.0827

CERTIFICATE OF CALIBRATION

Certificate No. : 23-117652

Sample Code : 23-433253-003

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri,
Kabinburi, Prachinburi 25110

Location of Calibration : Eastern Thai Consulting 1992 Co., Ltd.
(Laboratory)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert **Model** : UF 110

Serial No. : B420.0827 **ID No.** : KB-LAB-63/008

Date of Receipt : 05 October 2023 **Date of Calibration** : 05 October 2023

Condition of Calibration

1. Environment	1.1 Ambient temperature	: Maximum	32.7 °C	; Minimum	30.4 °C
	1.2 Relative humidity	: Maximum	72.0 %	; Minimum	66.7 %
	1.3 Line voltage supplied	: Maximum	224.6 VAC	; Minimum	221.6 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-12 (RTD-168 to RTD-176)	23-043820	03 May 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. Nophanon Anusak
Scientist

Approved by

(Mr. Somchai Neampunt)
Signed for Director

Issue date 09 October 2023

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

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

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



REPORT OF CALIBRATION

Certificate No. : 23-117652

Sample Code : 23-433253-003

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor <i>k</i>
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{Ref}		
85	85.0	85.0	85.00	84.50	85.16	84.99	85.12	85.10	85.09	84.76	85.11	0.26	2.00
104	104.0	104.0	103.98	103.48	104.19	103.90	104.10	104.10	104.20	103.52	104.11	0.47	2.00
150	150.0	150.0	149.71	149.02	150.14	149.57	149.87	149.92	150.24	149.01	149.92	0.53	2.00
180	180.0	180.0	179.59	178.78	180.09	179.59	179.74	179.83	180.29	178.71	179.82	0.57	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.10	0.64	0.77
104	0.26	0.68	1.14
150	0.25	1.04	1.73
180	0.28	1.23	1.95

Notes

- UUC* = Unit Under Calibration



REPORT OF CALIBRATION

Certificate No. : 23-117652

Sample Code : 23-433253-003

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 56 cm ; D = 40 cm ; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes" Stability of chamber and loading effect in chamber at 20% of uniformity ".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

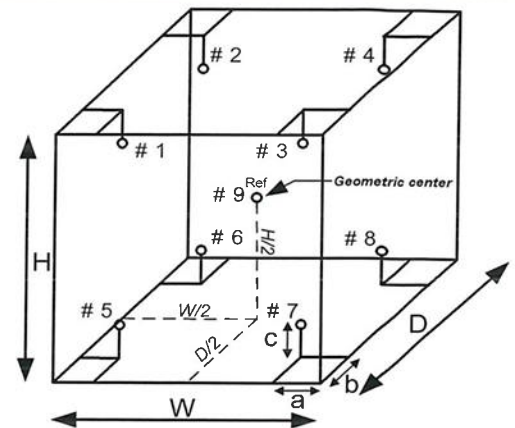


Figure: Example of sensor
installation Positions

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

- End of Report -

COPY

Dissolved Oxygen and BOD

Model : HI98193

Serial No : 03500057101

Certificate No. : HIT-2422-0732

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : Dissolved Oxygen and BOD Meter

Meter Model : HI98193 **Serial No. :** 03500057101

Probe Model : HI764073 **Serial No. :** KC1N42MCK

Manufacturer : Hanna Instruments **Made in :** Romania

Condition As-Received : Used Product **Reference :** RE240897

Customer name : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo. 1, Nonsi Kabinburi, Kabinburi,
Prachinburi 25110

Received date : 27 May 2024

Calibrate date : 28 May 2024

Issue date : 30 May 2024


Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) % RH

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-11 by using certified reference material (CRM).

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Channarong Soinak

Approved by : 
Mr. Anan Suwanchaisakul

Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **
approval of the head of Hanna Instrument (Thailand)

Condition of this calibration result

1. Reference Standard Instruments : This certification is traceable to the international unit of thru Technology Promotion Association (Thailand-Japan).

Instruments	Model	Serial No.	Certificate No.
Thermometer with sensor	HI98509	39643D	23T1453
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41

2. Reference Standard Materials : DO Calibration standard traceable thru Hanna Instrument Ltd.

Zero Oxygen Solution	Model No.	Mean Value	Ref. No.	Lot Number	Exp. date
HI7040L	HI7040L	$0.0 \pm 0.1 @ 25^{\circ}\text{C}$	27C32	S0028/23	March 2028

Calibration Result

Inspection the accuracy of the Dissolved Oxygen (DO) Meter by using the following certificate reference material value.

Unit Under Calibration	CRM Standard DO	Actual value Reading	Error value Reading	Uncertainty of Measurement (\pm)
DO Electrode S/N KC1N42MCK	0.0 mg/L	0.00 mg/L	0.00 mg/L	N/A
	8.3 mg/L	8.26 mg/L	-0.04 mg/L	0.33 mg/L

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

**** End of certificate ****

COPY

ATOMIC ABSORPTIONSPECTROPHOTOMETER

Modle : PinAAcle 900F

Serial No : PFBS22080801

PinAAcle 900F Preventive Maintenance Report

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

Instrument Location: 683 Moo 11 Sukhapibarn 8 Rd.,
Nongkham, Siracha, Chonburi 20230,


Instrument Serial No.: PFBS22080801

Date: 25-Apr-2024

COPY

PinAAcle 900F Preventive Maintenance (PM)

Company Name:	Eastern Thai Consulting 1992 Co., Ltd.		
Address (Instrument Location):	683 Moo 11 Sukhapibarn 8 Rd., Nongkham, Siracha, Chonburi 20230,		
Serial Number:	PFBS22080801	PM Number:	1OF2W
Customer Name (if applicable):	K.Nunnaphat	Telephone Number:	038 481 197
Customer Support Engineer Name:	K.Piyawit	Service Order Number:	WO-02754301
Date PM Performed: (DD-MMM-YYYY)	Apr 25, 2024	Next PM Due Date: (DD-MMM-YYYY)	Oct 25, 2024
Standard Labor Hours to Complete PM :		5 hours	

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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

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

Update the PM sticker and instrument logbook as required.

Copyright Information

This document contains proprietary information that is protected by copyright. All rights are reserved.

No part of this publication may be reproduced in any form whatsoever or translated into any language without the prior, written permission of PerkinElmer, Inc.

Copyright © 2013 PerkinElmer, Inc.

Trademarks

Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law. PerkinElmer is a registered trademark of PerkinElmer, Inc. All other trademarks and registered trademarks not owned by PerkinElmer, Inc. or its subsidiaries that are depicted herein are the property of their respective owners. **Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no Warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.**

PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900F	PFBS22080801	Syngistix V.5.0.1.2029

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	30-Apr-2025

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

COPY

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MGO-056
N1013002	1.0A Neutral density filter	1	MG2-258
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190

COPY

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

 COPY

7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	1.0154	1.0065	Passed
0.2 A ND Filter	± 5% from Cert.	0.1806	0.1769	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

COPY

8.4 D₂ Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0001	Passed

8.5 AA-BG Baseline Noise with Copper

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

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

8.6 AA-BG Baseline Noise with Arsenic

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

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

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3366	Passed

10. Review:

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

COPY

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Piyawit S.

Date:

25-Apr-2024

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

25-Apr-2024

(DD-MMM-YYYY)

COPY

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0062815

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04NI99E15ACX8C
Cylinder Number: EB0062815
Laboratory: 124 - Riverton (SAP) - NJ
PGVP Number: B52018
Gas Code: CO, NO, NOX, SO2, BALN

Reference Number: 82-401135335-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 660
Certification Date: Mar 13, 2018
Expiration Date: Mar 13, 2026

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)* document EPA 600/R-12/531, using the assay procedures and methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below.

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	50.65 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	Expiration Date
NTRM	16060607	CC42564	Jun 27, 2020
PRM	12367	APEX1098237	Jun 02, 2017
GWMS	0315201604	CC503368	Mar 15, 2019
NTRM	16011025	CC473218	Jun 07, 2022
NTRM	12060735	CC366192	Dec 14, 2026

The SRM, PRM or RGM noted above is only in reference to the GWMS 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

Triad Data Available Upon Request

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

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate as being certified. 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.



TESTING CERT No. 3082.05

Dana M. Morris
Approved for Release

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645



NSC-TS12-TS 17025
CALIBRATION 0394

Cert. No. : ACC23037
Pages : 1 of 3

Calibration Certificate

Equipment: SOUND CALIBRATOR
Manufacturer: RION
Model: NC-75
Serial No.: 34802645
ID No.:
Condition As Found: GOOD
Customer: EASTERN THAI CONSULTING 1992 CO., LTD.
SAHA GROUP INDUSTRIAL PARK, 683 MOO 11,
NONGKHAM, SIRACHA, CHONBURI 20230 THAILAND.

Location:
Ambient Temperature: (23.0 ± 3) °C
Pressure: (101.3 ± 3) kPa
Relative Humidity: (50.0 ± 20) %
Received Date: 06 SEPTEMBER 2023
Calibration Date: 12 OCTOBER 2023
Date of Issue: 16 OCTOBER 2023

Calibrated by: Nathakorn Pisutpaisan

Approved by: T. Petchurai
(Thanakul Petchurai)

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

COPY

Cert. No. : ACC23037
Job No. : VC66AC0097
Pages : 2 of 3

Calibration Procedure: CP-AC-03

Calibration Method:

This equipment was calibrated by based on IEC-60942-2003 Standard.
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration:

1. Reference Standard Instruments:

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/02/66	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/02/67	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 31/02/66	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0012-23	10-FEB-24

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

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

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

COPY

T. Petchurai

Continuation of Calibration Certificate

Cert No. : ACC23037

Job No. : VC66AC0097

Pages : 3 of 3

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

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

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

_____ End of Calibration Certificate _____

COPY

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, Sukhaphibam 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-52A (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 20µPa. Other dB levels are relative values.

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

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

Preconditioning:

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

Instruments and Program:

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

Equipment standards used:

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

Traceability

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

Sound Pressure Level: EEI, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand
Voltage: TPA, Thailand
Frequency: TPA, Thailand

This certificate of calibration is issued by Acoustic Laboratory (Thailand) (ALT). It also states that the laboratory has a satisfactory 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
Reference conditions: 23.0 °C
Measurement conditions: 101.1 ± 0.10 kPa 22.1 ± 1.0 °C

Relative humidity: 50 %RH
51.1 ± 2.0 %RH

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	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 Tolerance limit (dB)
63	-0.2	-0.2	±1.0
125	-0.1	0.0	±1.0
250	-0.1	-0.1	±1.0
500	-0.1	0.0	±1.0
1000	0.0	0.0	±0.7
2000	-0.1	0.0	±1.0
4000	0.0	0.0	±1.0
8000	0.1	0.1	±1.5-2.5
16000	-1.2	-1.2	±1.5-2.5

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



Certificate No.: S2402-0650

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
LAeq	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



Registration number U02564060234
6-37 Pochanvit Soi 42, Sai Yai, 10250 Bangkok, Thailand
Tel: 00102-1296780 Email: info@altbkk.com
www.altbkk.com



Certificate No.: S2402-0650

6. Level linearity on the reference level range

6.1 Measured at 31.5 Hz

Anticipated value (dB)	Measured value (dB)	Deviated value	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



Registration number U02564060235
6-37 Pochanvit Soi 42, Sai Yai, 10250 Bangkok, Thailand
Tel: 00102-1296780 Email: info@altbkk.com
www.altbkk.com



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



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





Certificate No.: S2402-0650

7. Tone burst response

Time weightings	Tone burst duration, Tb (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
SEL	0.25	108.9	-0.1	+1.0,-3.0
	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	0.1	±1.5
139.5	139.6		

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



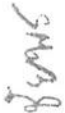
Certificate No.: S2402-0650

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	0.13 dB
4. Frequency and time weightings at 1 kHz	0.13 dB
5. Long term stability test	0.10 dB
6. Level linearity on the reference level range	0.14 dB
7. Tone burst response	0.14 dB
8. 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. Pitupong Sarapho)

Date of calibration : 2024-03-08

Date of issue : 2024-03-08

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

SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 01120953

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-52A / Microphone UC-59 / Preamplifier NH-25
Serial No.: 01120953 / 22355 / 22342
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 : 11 JANUARY 2024
Calibration Date : 16 - 17 JANUARY 2024
Date of Issue : 18 JANUARY 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :
7. Petchu.
(Thanakul Petchurai)

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

COPY

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-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL.BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL.BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL.BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KA	34560495	AA-3002-23	14-FEB-24

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

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

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

COPY
7. Petchu.

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	0.3	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

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	94.0	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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

Frequency Weighting	Measured value (dB)
A - weight	9.9
C - weight	14.8
Flat	20.7

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	0.1	0.1	0.1
8000	0.1	0.2	0.2
Acceptance Limits			
± 1.0			
± 0.7			
+ 1.5, - 2.5			

COPY

COPY

T. Retheh

T. Retheh

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	0.1
250	0.1	0.0	0.0
500	0.1	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
16000	0.0	-1.2	-1.1

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
L eq	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	± 0.1

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	±0.8
136.0	136.1	0.1	±0.8
135.0	135.1	0.1	±0.8
134.0	134.1	0.1	±0.8
133.0	133.0	0.0	±0.8
132.0	132.0	0.0	±0.8
131.0	131.0	0.0	±0.8
129.0	129.0	0.0	±0.8
124.0	124.0	0.0	±0.8
119.0	119.0	0.0	±0.8
114.0	114.0	0.0	±0.8
109.0	109.0	0.0	±0.8
104.0	104.1	0.1	±0.8
99.0	99.0	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	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	44.0	0.0	±0.8
39.0	39.0	0.0	±0.8
34.0	34.0	0.0	±0.8
30.0	30.0	0.0	±0.8
29.0	29.0	0.0	±0.8
28.0	28.0	0.0	±0.8
27.0	27.0	0.0	±0.8
26.0	26.0	0.0	±0.8
25.0	24.9	-0.1	±0.8

COPY
T. Retich.

Cert. No. : ACL24046
Job No. : VC67AC0042
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±0.8

9. Tone burst response

Time Weighting	Tone burst duration, T _b (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.0 ; -3.0
	2	8	117.0	116.9	-0.1	1.0 ; -1.5
	200	800	134.0	134.0	0.0	±0.5
Slow	2	8	108.0	108.0	0.0	1.0 ; -3.0
	200	800	127.6	127.6	0.0	±0.5
SEL	0.25	1	99.0	98.8	-0.2	1.0 ; -3.0
	2	8	108.0	107.9	-0.1	1.0 ; -1.5
	200	800	128.0	128.0	0.0	±0.5

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	±2.0
One	136.4	135.3	-1.1	±2.0

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	±1.0
Positive half cycle	135.4	135.1	-0.3	±1.0
Negative half cycle	135.4	135.1	-0.3	±1.0

11. Overload indication

Measured value (dB)	Deviated Value (dB)		Acceptance Limits (dB)
	Positive one-half cycle	Negative one-half cycle	
89.6	89.7	0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.1

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

End of Calibration Certificate

COPY
T. Retcha.

COPY
T. Retcha.

SOUND LEVEL METER

MODEL : NL-52A

SERIAL No. : 00230989

Certificate of Calibration

Certificate No.: S2402-0644

Customer:

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

Date of calibration:

2024-03-04

Date of issue:

2024-03-05

Instrument Calibrated:

Sound Level Meter

Manufacturer:

Rion

Model:

NL-52A (Meter), UC-59 (Microphone), NH-25 (Preamplifier)

Serial no:

00230989 (Meter), 22337 (Microphone), 22425 (Preamplifier)

Calibration and verification performed:

Acoustical levels are stated relative to 20µPa. 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 Nori 1256 S/N125626542
- Combined Pressure, Humidity and Temperature Transmitter PTU300 S/NM2520568

Traceability

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

Sound Pressure Level: 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 without prior full

Page 1 of 8

Certificate No.: S2402-0644

Environmental conditions:

Reference conditions: Pressure: 101.325 kPa

Measurement conditions: 101.21 ± 0.10 kPa

Temperature: 23.0 °C

Relative humidity: 50 %RH

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	93.8	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	Measured value (dB)
A-Weighting	9.9
C-Weighting	14.0
Z-Weighting	19.3

3. Electrical signal test of frequency weighting at 93 dB

Frequency (Hz)	Deviation from various frequency weighting response curve			Tolerance limit (dB)
	A-Weighting (dB)	C-Weighting (dB)	Z-Weighting (dB)	
63.0	0.0	0.0	0.0	±1.0
125.0	0.0	0.1	0.0	±1.0
250.0	0.0	0.0	0.0	±1.0
500.0	0.0	0.1	0.1	±1.0
1000.0	0.0	0.0	0.0	±0.7
2000.0	-0.2	-0.1	-0.2	±1.0
4000.0	-0.3	-0.3	-0.3	±1.0
8000.0	0.1	0.1	0.0	±1.5-2.5
16000.0	-1.6	-1.7	-0.5	±1.5-2.5

Date of calibration : 2024-03-04

Date of issue : 2024-03-05

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	94.0	0.0	± 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)
27:31	94.0	94.0	0.0	± 0.1

Date of calibration : 2024-03-04
Date of issue : 2024-03-05

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	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 : 2024-03-04
Date of issue : 2024-03-05



Certificate No.: S2402-0644

6.2 Measured at 1 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptant limit (dB)
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
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	138.0	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	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	44.0	0.0	±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 : 2024-03-04
Date of issue : 2024-03-05



Certificate No.: S2402-0644

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	132.9	0.0	±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	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	53.9	-0.1	±0.8
49.0	49.0	0.0	±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	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 : 2024-03-04
Date of issue : 2024-03-05



7. Tone burst response

Time weightings	Tone burst duration, T _b (ms)	Measured value (dB)	Deviated value (dB)	Tolerance limit (dB)
Fast	200	135.0	0.0	±0.5
	2	118.0	0.0	+1.0, -1.5
	0.25	109.0	0.0	+1.0, -3.0
SEL	200	129.0	0.0	±0.5
	2	109.0	0.0	+1.0, -1.5
	0.25	100.0	0.0	+1.0, -3.0

8. Overload indication

Measured value (dB)		Deviated value (dB)	Tolerance limit (dB)
Positive one half cycle	Negative one half cycle	0	±1.5
139.1	139.1		

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 : 2024-03-04
Date of issue : 2024-03-05


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

Approved By: 
(Mr. Pitupong Sarapho)

Date of calibration : 2024-03-04
Date of issue : 2024-03-05

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

Area Heat Stress Monitor

Model : QUESTEMP 34

Serial No. : TEU080014



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



CALIBRATION CERTIFICATE

Customer

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

Equipment

: Area Heat Stress Monitor

Manufacturer

: TSI

Model

: QUESTEMP 34

Serial No.

: TEU080014

ID No./Tag No.

: NO.13

Date Received

: 28-Jun-24

Date Calibrated

: 28-Jun-24

Calibrated by

: Apiwat Pearnungroth

Calibration Method or Calibration Procedure Used

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter

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:

Saranyuth T.
(Saranyuth Tochua)



Page 1 of 2

COPY

Certificate No. : L202406394-0001

Environment : Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15)%RH

STD	UUC Reading (°C)	UUC Error (°C)	Measurement	MPE (±°C)	Pass / Fail
Reading (°C)	Before Adjusted	After Adjusted	Uncertainty (±°C)		Simple Acceptance
37.98	WET 38.0	-	0.35	0.5	Pass
37.98	DRY 38.0	-	0.35	0.5	Pass
37.98	GLOBE 38.0	-	0.35	0.5	Pass
44.99	WET 45.0	-	0.35	0.5	Pass
44.99	DRY 44.9	-	0.35	0.5	Pass
44.99	GLOBE 45.0	-	0.35	0.5	Pass

STD = Standard

Pass = $|\text{error}| \leq |\text{MPE}|$

UUC = Unit Under Calibration

Fail = $|\text{error}| > |\text{MPE}|$

Description of UUC :

Range 0 to 100 °C

Resolution

0.1 °C

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

MIT Certificate No. L202310317-0003 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 06-Nov-24

End of Certificate

Page 2 of 2

COPY

Area Heat Stress Monitor

Model : QUESTEMP 34

Serial No. : TEU080015



CALIBRATION CERTIFICATE

Certificate No. : L202406394-0003

Date Issued : 01-Jul-24

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

Equipment : Area Heat Stress Monitor

Manufacturer : TSI

Model : QUESTEMP 34

Serial No. : TEU080015

ID No./Tag No. :

Date Received : NO.14

Date Calibrated : 28-Jun-24

Calibrated by : 28-Jun-24


Calibration Method or Calibration Procedure Used : Apiwat Peanrungrath

In-house method : CP-19 by comparing against Standard Digital Humidity / Temperature Meter


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

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

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

Approved by:  (Sarayuth Tochua)

Page 1 of 2



COPY

Certificate No. : L202406394-0003

Environment : Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15)%RH

STD Reading (°C)	Before Adjusted	After Adjusted	UUC Error (°C)	Measurement Uncertainty (±°C)	MPE (±°C)	Pass / Fail
37.98	WET 38.1	-	0.12	0.35	0.5	Pass
37.98	DRY 38.2	-	0.22	0.35	0.5	Pass
37.98	GLOBE 37.8	-	-0.18	0.35	0.5	Pass
44.99	WET 45.1	-	0.11	0.35	0.5	Pass
44.99	DRY 45.2	-	0.21	0.35	0.5	Pass
44.99	GLOBE 44.8	-	-0.19	0.35	0.5	Pass

STD = Standard

UUC = Unit Under Calibration

Pass = |error| ≤ |MPE|

Fail = |error| > |MPE|

Description of UUC : Range

0 to 100 °C

Resolution

0.1 °C

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

MIT Certificate No. L202310317-0003 for Digital Thermometer with Probe (Fluke) Serial No. 5856603, Due 06-Nov-24

End of Certificate

SOUND LEVEL CALIBRATOR

MODEL : NC-75

SERIAL No. : 34802645



Cert. No. : ACC23037
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-75
Serial No.: 34802643
ID No.:

Condition As Found : GOOD

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

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

Received Date : 06 SEPTEMBER 2023
Calibration Date : 12 OCTOBER 2023
Date of Issue : 16 OCTOBER 2023

Calibrated by : Natchakorn Pisutpaisan

Approved by : T. Petchurai
(Thanakul Petchurai)

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

COPY

Continuation of Calibration Certificate

Cert. No. : ACC23037
Job No. : VC66AC0097
Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0066	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 30/0067	13-FEB-24
Digital Multimeter	33461A	MY60024273	EEL-BP 31/0068	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24
Audio Analyzer	AVR-3360A	V744B6069	EF-0013-23	10-FEB-24

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

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

3.1 National Institute of Metrology (Thailand).

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

COPY

T. Petchurai

Continuation of Calibration Certificate

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

Result of calibration :

1. Sound pressure level

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

2. Frequency

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

3. Total distortion

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

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

End of Calibration Certificate

COPY

7. P. R. M.

SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322752

Cert. No. : ACL24139
Pages : 1 of 8

Calibration Certificate

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

Condition As Found : GOOD

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

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai

(Thanakul Petchurai)

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

Cert. No. : ACL24139
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).

T. Petchurai
(Thanakul Petchurai)

COPY

T. Petchurai

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

COPY

T. Petch.

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	17.0
Flat	22.7

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	0.2
1000	0.0	0.0	0.0
8000	0.8	0.9	0.9

COPY

T. 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	-0.1	-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	0.1
4000	0.0	0.1	0.0
8000	0.1	0.1	0.1

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 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	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.8	-0.2	± 1.1

COPY

T. Petcha

COPY

T. Petcha

Cert. No. : ACL24139
Job No. : VC67AC0083
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (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	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

Cert. No. : ACL24139
Job No. : VC67AC0083
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle	0.0	±1.5
89.5	89.5		

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

COPY

COPY

T. Petch...

T. Petch...

SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322745

Cert. No. : ACL24134
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00322745 / 196468 / 15477
ID No.: -

Condition As Found : GOOD

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.
SALIA 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)

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

COPY

Cert. No. : ACL24134
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).

COPY


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

COPY

Y. Petcha-

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.3
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighing response curve (dB)		
	Flat	C-weight	A-weight
125	0.0	0.0	0.0
1000	-0.1	-0.1	-0.1
8000	0.8	0.9	0.9

COPY

Y. Petcha-

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
1/3 Oct	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	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	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

COPIES

Le tén.

Cert. No. : ACL24134
 Job No. : VC67AC0083
 Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.2	-0.2	±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	89.6	0.1
89.5			
			±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

COPY

COPY

G. Ketchu

G. Ketchu

SOUND LEVEL METER

MODEL : NL-21

SERIAL No. : 01209912

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL23340
Pages : 1 of 9

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-21/ Microphone UC-52 / Preamplifier NH-21
Serial No.: 01209912 / 177387 / 34624
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 : 16 OCTOBER 2023
Calibration Date : 06-07 NOVEMBER 2023
Date of Issue : 08 NOVEMBER 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : 
(Thanakul Petchurai)

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

COPY

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23340
Job No. : VC67AC0012
Pages : 2 of 9

Calibration Procedure : CP-AC-02

Calibration Method :

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

COPY



Continuation of Calibration Certificate

Cert. No. : ACL23340
Job No. : VC67AC0012
Pages : 3 of 9

Summary of Measurement Result :

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

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

COPY

7. Retan.

Continuation of Calibration Certificate

Cert. No. : ACL23340
Job No. : VC67AC0012
Pages : 4 of 9

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)
22.2

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

Frequency Weighting	Measured value (dB)
A - weight	21.9
C - weight	23.5
Flat	26.8

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	-0.6	-0.5	-0.5
			±1.5
			±1.0
			±5.0

COPY

7. Retan.

Continuation of Calibration Certificate

Cert. No. : ACL23340
Job No. : VC67AC0012
Pages : 5 of 9

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 Limits
63	-0.2	0.0	±2.0
125	-0.2	0.0	±1.5
250	-0.1	0.0	±1.5
500	-0.1	0.0	±1.5
1000	0.0	0.0	±1.0
2000	0.1	0.1	±2.0
4000	0.1	0.1	±3.0
8000	0.0	0.3	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.1	0.1	± 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

Continuation of Calibration Certificate

Cert. No. : ACL23340
Job No. : VC67AC0012
Pages : 6 of 9

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
135.0	134.9	-0.1	± 1.1
134.0	133.9	-0.1	± 1.1
133.0	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	128.9	-0.1	± 1.1
124.0	123.9	-0.1	± 1.1
119.0	118.9	-0.1	± 1.1
114.0	113.9	-0.1	± 1.1
109.0	108.9	-0.1	± 1.1
104.0	103.9	-0.1	± 1.1
99.0	98.9	-0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	88.9	-0.1	± 1.1
84.0	83.9	-0.1	± 1.1
79.0	78.9	-0.1	± 1.1
74.0	73.9	-0.1	± 1.1
69.0	68.9	-0.1	± 1.1
64.0	63.9	-0.1	± 1.1
59.0	58.9	-0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1

COPY

COPY

Y. Petcha

Y. Petcha

Continuation of Calibration Certificate

Cert. No. : ACL23340
Job No. : VC67AC0012
Pages : 7 of 9

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.5
120	94.0	94.0	0.0	±0.5
110	94.0	94.0	0.0	±0.5
100	94.0	94.0	0.0	±0.5
90	94.0	94.1	0.1	±0.5

Level linearity on each level range

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	43.0	43.2	0.2	±0.5
120	33.0	32.8	-0.2	±0.5

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

Continuation of Calibration Certificate

Cert. No. : ACL23340
Job No. : VC67AC0012
Pages : 8 of 9

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.0	-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	133.0	0.0	±2.0
Positive half cycle	135.4	135.1	-0.3	±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		
89.4	89.3		
		-0.1	±1.5

COPY

COPY

T. Petch

T. Petch

SITHIPORN SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACL23340
Job No. : VC67AC0012
Pages : 9 of 9

12. High level stability

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

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

_____ End of Calibration Certificate _____

COPY

Y. ReTe

SOUND LEVEL METER

MODEL : NL-42A

SERIAL No. : 00322755

Certificate of Calibration

Certificate No.: S2402-0651-01

Customer:

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

Date of calibration:

2024-03-04
2024-03-26
2024-03-26

Date of issue:

Sound Level Meter
Rion

Instrument Calibrated:

Manufacturer:
Model:
Serial no:

NL-42A (Meter), UC-59 (Microphone), NH-25 (Preamplifier)
00322755 (Meter), 21960 (Microphone), 22336 (Preamplifier)

Calibration and verification performed:

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

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

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

Preconditioning:

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

Instruments and Program:

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

Equipment standards used:

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

Traceability

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

Sound Pressure Level: EEI, Thailand
Reference Pressure, Humidity and Temperature: TPA, Thailand
Voltage: TPA, Thailand
Frequency: TPA, Thailand

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

COPI

Certificate No.: S2402-0651-01

Environmental conditions:

Pressure: 101.325 kPa
Reference conditions: 23.0 °C
Measurement conditions: 100.87 \pm 0.10 kPa 23.5 \pm 1.0 °C

Relative humidity: 50 %RH
57.0 \pm 2.0 %RH

1. Indication at the calibration check frequency

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

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

2. Self-generated noise

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

3. Electrical signal test of frequency weighting at 91 dB

Frequency (Hz)	Deviation from various frequency weighting response curve		
	A-Weighting (dB)	C-Weighting (dB)	Z-Weighting (dB)
63	0.0	0.0	0.0
125	0.1	0.1	0.0
250	0.0	0.0	0.0
500	0.1	0.1	0.1
1000	0.0	0.0	0.0
2000	-0.1	-0.1	-0.2
4000	-0.3	-0.3	-0.3
8000	0.1	0.1	0.0

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

COPI

4. Frequency and time weighting at 1 kHz

4.1 Frequency weighting at 1 kHz

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

4.2 Time weighting at 1 kHz

Time weightings	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
Fast	94.0	0.0	±0.3
Slow	94.0	0.0	±0.3
L _{Aeq}	94.0	0.0	±0.3

5. Long term stability

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

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

COPY

6. Level linearity on the reference level range

6.1 Measured at 31.5 Hz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
84.0	84.0	0.0	±1.1
89.0	89.0	0.0	±1.1
92.6	92.6	0.0	±1.1
93.6	93.6	0.0	±1.1
94.6	94.6	0.0	±1.1
95.6	95.6	0.0	±1.1
96.6	96.6	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.1	±1.1
40.0	39.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
38.0	38.0	0.0	±1.1
37.0	37.0	0.0	±1.1
36.0	36.0	0.0	±1.1

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

COPY

6.2 Measured at 1 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
132.0	132.0	0.0	±1.1
133.0	133.0	0.0	±1.1
134.0	134.0	0.0	±1.1
135.0	135.0	0.0	±1.1
136.0	136.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
40.0	40.0	0.0	±1.1
39.0	38.9	-0.1	±1.1
38.0	38.0	0.0	±1.1
37.0	36.9	-0.1	±1.1
36.0	35.9	-0.1	±1.1

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

COPY

6.3 Measured at 8 kHz

Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit (dB)
94.0	94.0	0.0	±1.1
99.0	99.0	0.0	±1.1
104.0	104.0	0.0	±1.1
109.0	109.0	0.0	±1.1
114.0	114.0	0.0	±1.1
119.0	119.0	0.0	±1.1
124.0	124.0	0.0	±1.1
129.0	129.0	0.0	±1.1
130.9	130.9	0.0	±1.1
131.9	131.9	0.0	±1.1
132.9	132.8	-0.1	±1.1
133.9	133.9	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	78.9	-0.1	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	63.9	-0.1	±1.1
59.0	59.0	0.0	±1.1
54.0	53.9	-0.1	±1.1
49.0	48.9	-0.1	±1.1
44.0	43.9	-0.1	±1.1
40.0	39.9	-0.1	±1.1
39.0	38.9	-0.1	±1.1
38.0	37.9	-0.1	±1.1
37.0	36.9	-0.1	±1.1
36.0	35.9	-0.1	±1.1

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

COPY

7. Tone burst response

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

8. Peak C sound level

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

9. Overload indication

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

10. High level stability

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

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

COPY

Uncertainty of measurement

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

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

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

Replacement Calibration Certificate for calibration certificate number S2402-0651

Calibrated By:  (Mr. Athakorn Sumpphan)
Approved By:  (Mr. Pitupong Sarapho)

Date of calibration : 2024-03-04

2024-03-26

Date of issue : 2024-03-26

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

COPY

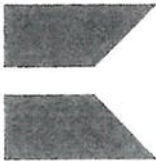
NOISE DOSI METER

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:

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: CB1500 Sriracha, Chonburi 20230
Firmware version: 5.4

Test summary

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

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE-952	93892
Environmental Monitor	Cornet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

Notes

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

CERTIFICATE OF CALIBRATION

Environmental conditions

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

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

Test results summary

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

Certificate Number:
206866

Page 2 of 2

COPY

COPY

NOISE DOSI METER

MODEL : CR:110A

SERIAL No. : CB1499

CERTIFICATE OF CALIBRATION

ISSUED BY

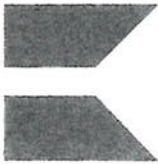
Cirrus Research plc

DATE OF ISSUE

19 January 2024

CERTIFICATE NUMBER

206881



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

Page 1 of 2

Approved signatory

N.Smith

Electronically signed:

Dosimeter : IEC 61252-1993+A1:2000

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:110A
Serial number: CB1499
Firmware version: 5.4

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

Test summary

Date of calibration: 19 January 2024

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

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

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

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	SIGLENT	SDG1032X	SDG1XDDQ6R6309
Attenuator	Cirrus Research	ZE:952	93892
Environmental Monitor	Comet	T7510	16966334
doseBadge Reader	Cirrus Research plc	RC:110A	40088

Notes

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:

206877

Page

2 of 2

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

ANALYTICAL BALANCE (DU)

Model : XS205DU

Serial No. : 1126323724

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

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

CERTIFICATE OF CALIBRATION

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

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

Equipment : ELECTRONIC BALANCE

Manufacturer : METTLER TOLEDO

Model : XS205DU

Serial No. : 1126323724

ID No. : LABE 05/1

Date of Receipt : 22 December 2023

Date of Calibration : 22 December 2023

Calibrated by : Mr. Somwang Sangdee
Scientist

Issue date : 25 December 2023

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

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

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

REPORT OF CALIBRATION

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

Result of Calibration

1. Test weight and repeatability of reading

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

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

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

COPY

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

REPORT OF CALIBRATION

Result of Calibration

2. Sensitivity or value of a scale division

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

Unit : g

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

3. Departure of indication from nominal value, Linearity

Unit : g

Nominal Value	Standard Value	Average Reading of Indicator	Correction Value	Expanded Uncertainty	Coverage Factor (k)
Unload	0.0000000	0.00000	0.00000	0.000012	2.05
0.01	0.0100025	0.01000	0.00000	0.000012	2.05
0.1	0.1000019	0.10001	-0.00001	0.000013	2.03
1	1.0000125	1.00001	0.00000	0.000015	2.02
5	5.0000208	5.00004	-0.00002	0.000021	2.00
10	10.0000004	10.00008	-0.00008	0.000026	2.00
20	20.0000030	20.00011	-0.00008	0.000036	2.00
50	50.0000014	50.00014	-0.00013	0.000068	2.00
100	100.0000042	100.00001	-0.00001	0.000016	2.00
150	150.0000056	150.00001	0.00000	0.000022	2.00
200	200.0000041	200.00002	-0.00002	0.000027	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.

Signature
COPY

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

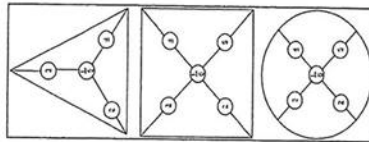
REPORT OF CALIBRATION

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	100.00001
	2	50.00022	100.00001
	3	50.00008	100.00001
200	4	50.00002	100.00000
	5	50.00016	100.00002
	6	50.00014	100.00001
Maximum difference		0.00013	0.00001



Condition of Calibration

- Calibration Method : WI-CL-004 base on UKAS LAB 14: 2019
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibration item: Normal
- This certification is traceable to the International System of Unit maintained at : -
Through the reference standard laboratory of Asia Medical and Agricultural Laboratory and Research Center Public Company Limited (Instrument number 1).
- Reference standard instrument :
Instrument
1) STANDARD WEIGHT 1 mg to 1 kg

Class ID.No. Certificate No. Due Date

EZ LB-WE-79 23-105642 10 September 2024

- End of Report -

Signature
COPY

COPY


ATOMIC ABSORPTION SPECTROPHOTOMETER

Model : PinAAcle 900F

Serial No. : PFBS22080801

PinAAcle 900F Preventive Maintenance (PM)

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

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

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

General Instructions:
The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.
Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.
The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.
Update the PM sticker and instrument logbook as required.

Copyright Information
This document contains proprietary information that is protected by copyright. All rights are reserved.
No part of this publication may be reproduced in any form whatsoever or translated into any language without the prior written permission of PerkinElmer, Inc.
Copyright © 2013 PerkinElmer, Inc.

Trademarks
Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law. PerkinElmer is a registered trademark of PerkinElmer, Inc. All other trademarks and registered trademarks not owned by PerkinElmer, Inc. or its subsidiaries that are depicted herein are the property of their respective owners. Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no Warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.
PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

Component List

Component / Specific Model	Serial #	Configuration Notes
FIAS100		

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	NA
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	NA
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	NA
N9301714	Replacement Acetylene Filter Cartridge	NA
TH001022	Replacement Air Filter Cartridge	NA

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

Additional Reagents and Standards Required for PM (Customer Support Solution)			
Part Number (if applicable)	Description	Quantity	Batch/Lot # Expiration Date (MM/YY)
N/A	DI Water	250 ml	AR AR
N/A	0.5% HNO ₃	250 ml	AR AR

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

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

COPY

COPY

7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 555.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	±5% from Cert.	1.0531	1.0230	Pass
0.2 A ND Filter	±5% from Cert.	0.1806	0.1783	Pass

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

8.4 D, Background Compensation with Copper

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

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

8.5 AA-BG Baseline Noise with Copper

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

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

8.6 AA-BG Baseline Noise with Arsenic

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

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

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

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

10. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

COPY

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

Equipment : Analog Barometer

Manufacturer : Barigo
Model : -
Serial No. : -
ID No./Tag No. : BM001/41
Date Received : 03-May-24
Date Calibrated : 06-May-24
Calibrated by : Mr. Saruth Srichutikul

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.
 This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

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

COPY

Certificate No : L202405022-0013

Environment : Ambient Temperature : (25 ± 2)°C
 Relative Humidity : (50 ± 15)%RH

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

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

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

MPE = Maximum Permissible Error

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

Description of UUC :

Range	950 - 1080	mbar Absolute
Calibration Range	990 - 1030	mbar Absolute
Scale Interval	1	mbar

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P230097 for Reference Pressure Monitor Serial No. 1598, Due 09-Nov-24

End of Certificate



COPY

CERTIFICATE OF ANALYSIS

EPA PROTOCOL GAS

Cylinder No. : EB0145030

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E03N199E15AC0U4
Cylinder Number: EB0145030
Laboratory: 124 - Plumsteadville - PA
PGVP Number: A12021
Gas Code: CH4,PPN,BALN
Reference Number: 160-40224242-1
Cylinder Volume: 144.4 CF
Cylinder Pressure: 2015 PSIG
Valve Outlet: 350
Certification Date: Oct 15, 2021

Expiration Date: Oct 15, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 000/R-12/031, using the assay procedures listed. Analytical Methodology does not require correction for analytical initial failure. This cylinder has a label 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			
ANALYTICAL DATES				
				10/15/2021
				10/15/2021
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
REFM	08011503	K002564	246.7 PPM METHANE/AIR	+/- 0.6%
REFM	200602-06	6162660Y	243.3 PPM PROPANE/AIR	+/- 0.5%
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Analytical Principle	
Nicolet IS50 FTIR AUP2110295 CH4			FTIR	
Nicolet IS50 FTIR AUP2110295 C3H8			FTIR	
			Last Multipoint Calibration	
			Oct 13, 2021	
			Oct 14, 2021	

Triad Data Available Upon Request

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



COPY

Michael A. Huber
Approved for Release

DRY GAS METER MC572V

Serial No. : 0504003

Certificate Of Calibration

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

Meter Console Information

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

Calibration Condition

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

Factors/Conversion

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

Reference Equipment

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

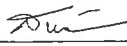
Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
a	P _{mbst}	V _{mbst}	V _{ref}	T _{mbst}	T _{ref}	V _{mbst}	V _{ref}	T _{mbst}	T _{ref}
15.00	13.0	144.5926	144.7699	26	27	60.06607	60.24392	29	28
10.00	25.0	144.8168	144.9795	27	27	60.29098	60.45472	27	27
8.00	50.0	145.0164	145.2002	28	28	60.49135	60.67317	29	27
7.00	80.0	145.2238	145.4291	28	28	60.69691	60.90186	29	28
5.00	120.0	145.4909	145.6692	28	29	60.96349	61.14145	27	26

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	VH@ (mm H ₂ O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
V _{std} (m ³)	Q _{std} (m ³ /min)	V _{ref} (m ³)	Q _{ref} (m ³ /min)	(Y)	(ΔY)	Q _{std} (m ³ /min)	ΔH _B	ΔΔH _B
0.173	0.012	0.173	0.012	0.997	0.003	0.012	43.309	-0.858
0.159	0.016	0.160	0.016	1.004	0.011	0.016	43.381	-0.787
0.179	0.022	0.176	0.022	0.984	-0.009	0.022	45.447	1.280
0.201	0.029	0.199	0.028	0.989	-0.005	0.028	44.202	0.035
0.175	0.035	0.174	0.035	0.994	0.000	0.035	44.497	0.330
				0.993	= Y Avg			
							44.167	= ΔH@ Avg

Pass/Fail Result: Pass

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

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

Approved By: 
(Patpasu Chaisana)
Service Manager

Date: 22-Apr-24

COPY

TEMPERATURE DISPLAY CALIBRATION

Meter Console Information		Calibration Conditions		Reference Equipment	
Console Model	MC572V	Cal Date	22-Apr-24	Temp Meter Model	Fluke 714B
Console serial	0504003	Due Date	23-Apr-25	Serial No	60590035
Temp Indicator Model	785-KF	Cal Report No	WDS-SV6704001	Cal Date	07-Apr-24
Temp Indicator Serial	JC05630	Ambient Temp (°C)	25	Temp Meter Model	Fluke 179
		Pressure (mm Hg)	758	Serial No	58620112
		Humidity (%)	60	Cal Date	06-Feb-24

Temperature Sensor Calibration

Reference Point	Rel. Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference °C
#			
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	143.0	150.0	-1.0
5	260.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	593.0	0.0
9	815.0	815.0	0.0
10	1038.0	1038.0	0.0
Maximum			1.0

PASS

Note

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

DGM Out Temperature Sensor Calibration

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

PASS

Note

The temperatures of the thermocouple and reference thermometers shall agree to within ±2 °F (EPA Method 5, section 10.5)

Approved By:

(Patpasu Chaisana)
Service Manager

WDS
WISDOM SCIENCE

COPY

Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Nomenclature

P_b - Barometric Pressure
 DGM - Dry Gas Meter
 K_1 - Constant based on standard temp and press
 θ - Run time, in minutes
 P_m - ΔH (Meter Pressure, gauge)
 V_m - Volume collected by test meter, corrected for STP
 $Q_{m(std)}$ - Calculated flow rate of test meter
 K' - Critical orifice coefficient
 P_w - Measured pressure of reference meter
 T_w - Temperature measured in reference meter
 T_m - Temperature measured in test meter
 Y - Ratio of volume collected from test meter and orifice
 sc - Scaling Factor
 $Counts_{sc}$ - Number of pulse counts, standardized
 C_{total} - Number of raw pulse counts of a calibration run

Equations

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

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

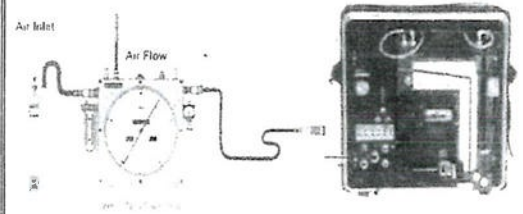
$$Counts_{std} = K_1 \frac{C_{total} * (P_{bw} + \frac{P_{w(std)}}{13.6})}{T_m}$$

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

$$K_1 = \frac{T_{std}}{P_{std}} \quad Y = \frac{V_{m(std)}}{V_{w(std)}}$$

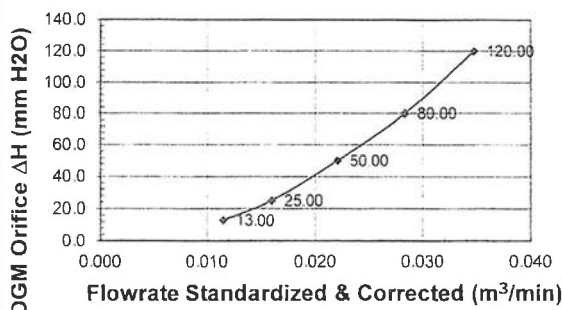
$$Meter \Delta H_{sc} = \frac{P_{std} * 0.0011626 * P_{bw} * (\frac{1}{T_{std}} - \frac{1}{T_w})}{T_w} * (\frac{T_w}{T_{std}} - \theta)$$

Calibration Train



Calibration Graphs

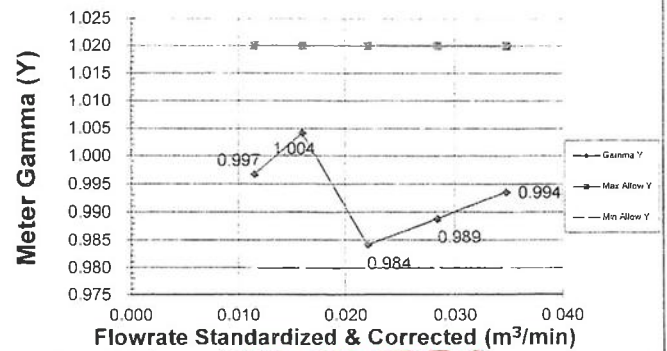
Meter Pressure vs Flowrate



Console Serial: 0504003

Console Model: MC572V

Meter Gamma vs Flowrate



Console Serial: 0504003

Console Model: MC572V

DRY GAS METER XC-572-OV

Serial No. : A2204323



WISDOM SCIENCE

Certificate Of Calibration

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

Meter Console Information

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

Calibration Condition

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

Factors/Conversion

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

Reference Equipment

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

UUT Meter (DGM)

Run Time (minutes)	DGM Orifice (mm H ₂ O)	Volume		Outlet Temp		Volume		Outlet Temp	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final
15.00	13.0	194.6567	194.8274	26	27	61.39400	61.56423	28	27
10.00	25.0	195.0941	195.2514	28	28	61.82541	61.98088	29	28
8.00	50.0	195.2786	195.4572	28	28	62.00769	62.18342	28	27
7.00	80.0	195.4877	195.6846	28	29	62.21353	62.40746	28	27
5.00	120.0	195.7085	195.8796	29	29	62.43108	62.60020	26	27

Standardized Data

Test Meter		Reference Meter		Correction Factor		Calibration Results		
Std Volume	Std Flow Rate	Std Volume	Std Flow Rate	"Gamma"	Variation	Flow Rate	ΔH@ (mm H ₂ O)	Variation
V _{measured} (m ³)	Q _{measured} m ³ /min	V _{measured} (m ³)	Q _{measured} m ³ /min	(Y)	(ΔY)	Q _{measured} (m ³ /min)	ΔH ₂₅	ΔΔH ₂₅
0.167	0.011	0.166	0.011	0.994	0.008	0.011	47.022	-1.348
0.153	0.015	0.151	0.015	0.986	0.000	0.015	48.311	-0.059
0.174	0.022	0.171	0.021	0.981	-0.005	0.021	48.458	0.089
0.192	0.027	0.189	0.027	0.981	-0.004	0.027	48.869	0.499
0.167	0.033	0.165	0.033	0.986	0.000	0.033	49.189	0.819
				0.985	= Y Avg	48.370	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 ΔH₂₅, orifice pressure differential that equates to 0.75cm (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

WISDOM SCIENCE

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

Date: 22-May-24

COPY

Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Nomenclature

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

Equations

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

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

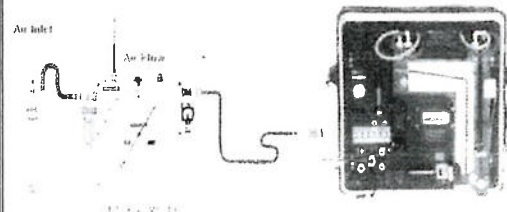
$$Counts_{Std} = K_1 \frac{V_{total} * (P_{bar} + \frac{P_{w(ave)}}{1.315})}{T_m}$$

$$Q_{m(Std)} = \frac{V_{m(Std)}}{t} \quad Y = \frac{V_{w(Std)}}{Counts_{Std}}$$

$$K_1 = \frac{T_{Std}}{P_{Std}} \quad Y = \frac{V_{m(Std)}}{Counts_{Std}}$$

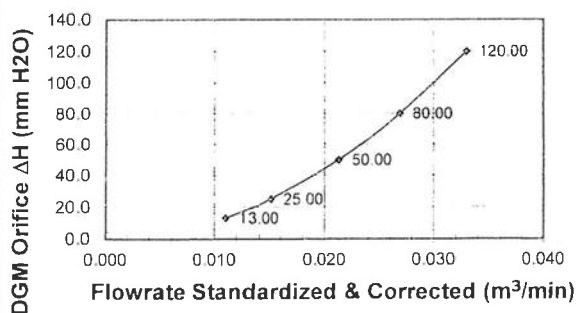
$$Metric \Delta H_{25} = \frac{P_{w(Std)} + 0.00116(16.01 + P_{w(Std)})}{T_w} \left(\frac{P_w}{1.315} \right)$$

Calibration Train



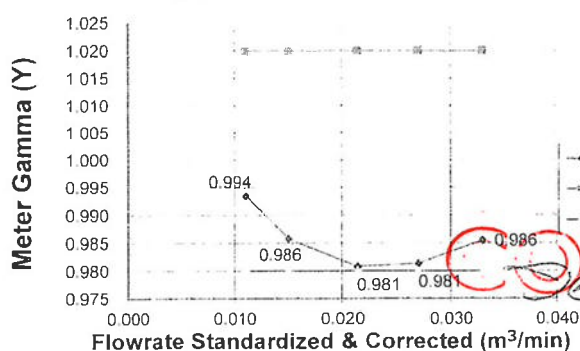
Calibration Graphs

Meter Pressure vs Flowrate



Console Serial: A2204323 Console Model: XC-572-

Meter Gamma vs Flowrate



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

TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model	XC-572-OV
Console serial	A2204323
Temp Indicator Model	765-KF
Temp Indicator Serial	JC05630

Calibration Conditions

Cal Date	22-May-24
Due Date	22-May-25
Cal Report No	WDS-SV8704013
Ambient Temp (°C)	25
Pressure (mm Hg)	758
Humidity (%)	60

Reference Equipment

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

Temperature Sensor Calibration

Reference Point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
1	-18.0	-17.0	1.0
2	38.0	37.0	1.0
3	93.0	93.0	0.0
4	149.0	150.0	-1.0
5	280.0	259.0	1.0
6	371.0	372.0	-1.0
7	482.0	482.0	0.0
8	593.0	593.0	0.0
9	816.0	815.0	1.0
10	1038.0	1038.0	0.0
Maximum ¹			1.0

Note

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

PASS

DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature	Thermocouple Display Temperature	Temperature Difference
#	°C	°C	°C
Ice	0.0	1.0	-1.0
Ambient	27.5	27.0	0.5
Heat	108.6	109.0	-0.4

Difference Range

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

PASS

Note

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

Approved By :

Palpasu Chaisana
(Palpasu Chaisana)
Service Manager

WISDOM
SCIENCE

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

COPY

DRY GAS METER XC-572-V

Serial No. : 1110070

Certificate Of Calibration

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

Meter Console Information

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

Calibration Condition

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

Factors/Conversion

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

Reference Equipment

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

UUT Meter (DGM)						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
θ	P _{mg}	V _{mi}	V _{mf}	T _{mi}	T _{mf}	V _{mi}	V _{mf}	T _{mi}	T _{mf}
15.00	13.0	239.7603	239.9212	27	27	63.63889	63.79843	27	27
10.00	25.0	239.9406	240.0979	27	27	63.81777	63.97353	27	27
8.00	50.0	240.1147	240.2952	27	28	63.99028	64.16968	26	26
7.00	80.0	240.3308	240.5352	28	28	64.20536	64.40956	26	26
5.00	120.0	240.5641	240.7422	29	29	64.43852	64.61730	26	26

Standardized Data				Calibration Results				
Test Meter		Reference Meter		Correction Factor		Flow Rate	ΔH@ (mm H ₂ O)	
Std. Volume	Std. Flow Rate	Std. Volume	Std. Flow Rate	"Gamma"	Variation	Std & Corr	0.0212 SCMM	Variation
V _{m(std)} (m ³)	Q _{m(std)} m ³ /min	V _{w(std)} (m ³)	Q _{w(std)} m ³ /min	(Y)	(ΔY)	Q _{m(std)corr}	ΔH _g	ΔΔH _g
0.157	0.010	0.155	0.010	0.991	-0.003	0.010	53.303	6.250
0.154	0.015	0.152	0.015	0.989	-0.005	0.015	47.860	0.807
0.176	0.022	0.175	0.022	0.993	-0.001	0.022	46.233	-0.820
0.200	0.029	0.199	0.028	0.997	0.003	0.028	43.895	-3.158
0.174	0.035	0.175	0.035	1.001	0.007	0.035	43.973	-3.080
				0.994	= Y Avg.		47.053	= ΔH@ Avg

Pass/Fail Result: **Pass**

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

Note: For ΔH_g, orifice pressure differential that equates to 0.75dcf (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 Chalsana
(Patpasu Chalsana)
Service Manager

WISDOM
SCIENCE

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

Date: 28-Jun-24

COPY

Certificate of Calibration - Supplemental

METHOD 5 PRE-TEST CONSOLE CALIBRATION

Nomenclature

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

Equations

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

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

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

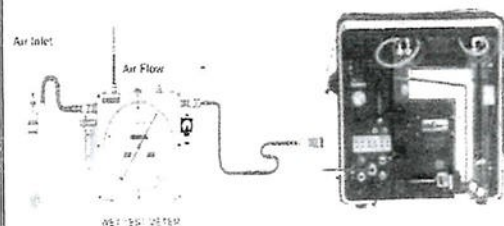
$$Q_{w(std)} = \frac{V_{w(std)}}{t}$$

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

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

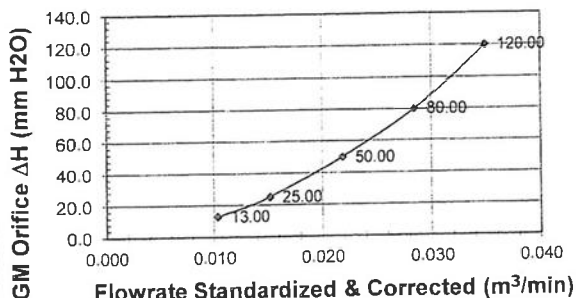
$$Delta H_g = \frac{P_{m(std)} - 0.0011606 * P_{std} * \frac{T_{std}}{13.6}}{T_w - T_m} * \left(\frac{T_w - \theta}{T_w - P_w} \right)$$

Calibration Train

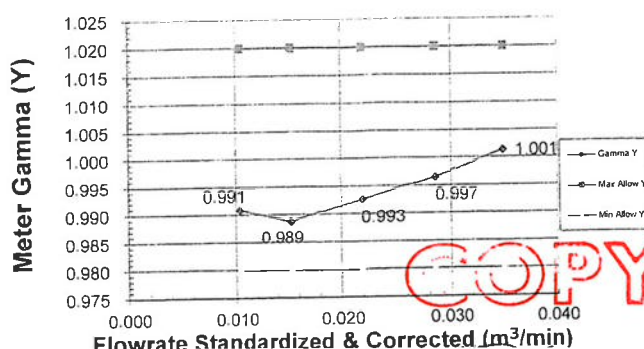


Calibration Graphs

Meter Pressure vs Flowrate



Meter Gamma vs Flowrate



COPY



WISDOM SCIENCE

TEMPERATURE DISPLAY CALIBRATION

Meter Console Information

Console Model : XC-572-V
Console serial : 1110070
Temp Indicator Model : ID-83
Temp Indicator Serial : -

Calibration Conditions

Cal Date : 28-Jun-24
Due Date : 28-Jun-25
Cal Report No : WDS-SV6708007
Ambient Temp (°C) : 25
Pressure (mm Hg) : 758
Humidity (%) : 60

Reference Equipment

Temp. Meter Model : Fluke 714B
Serial No : 60580035
Cal. Date : 07-Apr-24
Temp Meter Model : Fluke 179
Serial No : 58620112
Cal. Date : 08-Feb-24

Temperature Sensor Calibration

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

Note

¹ For valid test results, the maximum difference between temperature readings should $\leq 1.0^{\circ}\text{C}$ (EPA Method 5, Section 6.1.1.B).
Perform all TC Channel calibrations. Except meter (DGM) channel

PASS

DGM Out Temperature Sensor Calibration

Temperature point	Ref Thermometer Temperature °C	Thermocouple Display Temperature °C	Temperature Difference
#			°C
Ice	1.0	2.0	-1.0
Ambient	24.2	25.0	-0.8
Heat	110.5	111.0	-0.5
Difference Range			
Temp. Difference	$\pm 2^{\circ}\text{F}$ or $\pm 1.1^{\circ}\text{C}$		PASS

Note

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

Approved By :

Patpasu Chaisana
(Patpasu Chaisana)

Service Manager

**WISDOM
SCIENCE**

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

COPY

Flue gas Analyzer
Testo 350 NEW
Serial No. 63455616/0722



Where

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

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

Total pages of certificate : 2 Pages
Receiving no. : L-232625
Receiving date. : 10-Aug-23
Parameter of calibration : Gas Calibration(Oxygen 2.498,10.04,21.02 %vol, Carbon Monoxide 80.14,302,1003 ppm, Nitrogen Dioxide 80.96 ppm, Nitric Oxide 151.5 ppm, Sulphur Dioxide 100.8 ppm)
Condition of UUC. : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH
Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
Calibration procedure no.: This instrument was calibrated by comparison with Standard gas mixture according to calibration work instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of 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

Kwanchoek

Mr. Kwanchai Khamdoun
Calibration Technician

D. Wuttik

Mrs. Nongluck Wongsettee
Technical Manager

COPY

Where



Certificate No.: G 660489

Standard References (Table 1)

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

Measured room conditions

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

Calibration conditions

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

Calibration Results (Without adjustment) (Table 2)

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

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

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

End of Report

COPY

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182

CERTIFICATE OF CALIBRATION

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhapibarn 8 Rd., Nongkham,

Siracha, Chonburi 20230

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

(Hot Lab)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Serial No. : G511.01B2

Date of Receipt : 22 December 2023

Condition of Calibration

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

2. Calibration method

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

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data Acquisition With Sensor (RTD-P100)	LB-DA-08 (RTD-248 to RTD-256)	23-084070	06 August 2024

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

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

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

6. Condition of calibration item : Normal

Calibrated by : Mr. Pisek Into

Scientist

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)

REPORT OF CALIBRATION

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

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

2. Characterization results

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

Notes

UUC* = Unit Under Calibration

Signature

Signature

REPORT OF CALIBRATION

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

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 56 cm ; D = 40 cm ; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC: reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

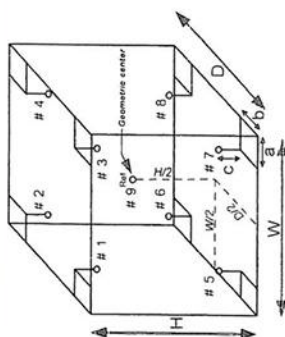


Figure: Example of sensor installation Positions

- End of Report -

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

COPY

UV/VIS SPECTROPHOTOMETER

Model : UV-1800

Serial No. : A11635101643 CD



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



Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-14624
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11635101643 CD
ID No. LABE 03/2
Date of receipt 22 April 2024
Date of calibration 22 April 2024
Date of issue 29 April 2024
Customer name Eastern Thai Consulting 1992 Co., Ltd.
Address 683 Moo 11, Sukkaphibarn 8 Rd., Nongkham, Sriracha, Chonburi 20230

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

Equipment condition Good Operation

Calibration Location Analysis Department

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

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

Calibrated by Mr. Poomjai Korsawatvorakul

Approved by

Mr. Sonthi Temboonsakdi
Service Manager

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



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



Certificate of Calibration

Number of Page(s) 2 of 3

Certificate No. BSCC-UV-146/24

Calibration Results:

1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
287.71	287.75	0.04	0.18
445.82	445.69	0.07	0.18
536.52	536.50	-0.02	0.18
741.02	741.01	-0.01	0.18
879.41	879.33	-0.08	0.18

2. Photometric Accuracy (UV)

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

*CNR = Customer not request

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



Bara Scientific
So-4 m of Success
Bara Scientific Co., Ltd.
968 U Chu Liang Building Floor7 Rama4 Road
Silom Bangkok Thailand 10500
Tel : 02-6324300 Fax : 02-6376466-7
www.barascientific.com



Certificate of Calibration

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

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0042
	0.5715	0.5729	0.0014	0.0042
	0.7087	0.7087	0.0000	0.0042
	1.0987	1.1005	0.0018	0.0042
440.0	0.0000	0.0000	0.0000	0.0042
	0.5561	0.5578	0.0017	0.0042
	0.6968	0.6969	0.0001	0.0042
	1.0757	1.0774	0.0017	0.0042
465.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
546.1	0.0000	0.0000	0.0000	0.0042
	0.5193	0.5213	0.0020	0.0042
	0.6937	0.6940	0.0003	0.0042
	1.0411	1.0428	0.0017	0.0042
590.0	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
	CNR	CNR	CNR	CNR
635.0	0.0000	0.0000	0.0000	0.0042
	0.5605	0.5624	0.0019	0.0042
	0.7579	0.7583	0.0004	0.0042
	1.1131	1.1138	0.0007	0.0042

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC)	
	Wavelength (nm)	Absorbance (A)
201.33±0.11nm	200.80	2.0111

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

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

End of Certificate

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

COPY

ANALYTICAL BALANCE

Model : MS204TS/00

Serial No. : B904136539

Mettler-Toledo (Thailand) Ltd.
845/4 - 845/5 Lasalle Rd., Bangna Tai Sub-District
Bangna District, Bangkok 10260
+66 2723 0382
MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: EASTERN THAI CONSULTING 1992 CO., LTD.
Address: 683 Moo 11, Sukhaphiban 8 Rd., Nong Kham
City: Sriracha
Zip / Postal: 20230
State / Province: Chonburi
Order Number: 0332860048
Contact: Sasiporn N.

Weighing Device

Manufacturer: Mettler Toledo
Model: MS204TS/00
Serial No.: B904136539
Building: Laboratory
Floor: 1
Room: Balance
Instrument Type: Weighing Instrument
Asset Number: LABE 05/4
Terminal Model: N/A
Terminal Serial No.: N/A
Terminal Asset No.: N/A

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)
Mettler Toledo Work Instruction: CPW002/20

This calibration certificate contains measurements for As Found and As Left calibrations.

The sensitivity/span of the weighing instrument was adjusted before As Found and As Left calibrations with a built-in weight.

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

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

As Found Calibration Date: 05-Feb-2024
As Left Calibration Date: 05-Feb-2024
Issue Date: 05-Feb-2024
Calibrator: Sathaporn T.
Sathaporn Tabson
Approved Signatory: P. Tabson
Technical Manager / Head of Calibration Center

COPY

Measurement Results

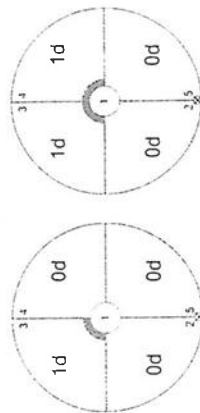
Repeatability

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

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

Eccentricity

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



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

COPY

Error of Indication

As Found

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

As Left

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.0000 g	0.0000 g	0.0000 g	0.11 mg	2
2	0.0100 g	0.0100 g	0.0000 g	0.13 mg	2
3	0.0500 g	0.0500 g	0.0000 g	0.13 mg	2
4	0.1000 g	0.1000 g	0.0000 g	0.13 mg	2
5	1.0000 g	1.0001 g	0.0001 g	0.13 mg	2
6	5.0000 g	5.0000 g	0.0000 g	0.13 mg	2
7	10.0000 g	10.0001 g	0.0001 g	0.14 mg	2
8	50.0000 g	50.0001 g	0.0001 g	0.15 mg	2
9	100.0000 g	100.0001 g	0.0001 g	0.20 mg	2
10	149.9999 g	150.0000 g	0.0001 g	0.31 mg	2
11	199.9998 g	199.9999 g	0.0001 g	0.35 mg	2

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

As Found

◆ As Left



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

Calibration Points [g]

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

COPY

Measurement Uncertainty of the Weighing Instrument in Use

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

Temperature coefficient for the evaluation of the measurement uncertainty in use: $1.5 \cdot 10^{-4} / K$

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

Linearization of Uncertainty Equation

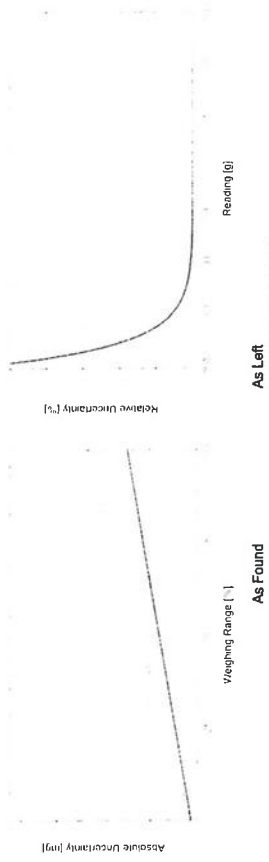
Range	d	Max	As Found		As Left	
			Net Indication	Relative Uncertainty (%)	Net Indication	Relative Uncertainty (%)
1	0.0001 g	220 g	0.0220 g	0.59%	0.13 mg	0.59%

$$U_1 = 0.13 \text{ mg} + 0.0101 \text{ mg/g} \cdot R$$

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

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

As Found		As Left	
Net Indication	Relative Uncertainty (%)	Net Indication	Relative Uncertainty (%)
0.0220 g	0.59%	0.13 mg	0.59%
0.2200 g	0.060%	0.13 mg	0.060%
2.2000 g	0.0069%	0.14 mg	0.0065%
22.0000 g	0.0016%	0.27 mg	0.0012%
220.0000 g	0.0011%	1.5 mg	0.00068%



COPY

GWP®
Certificate



As Found



As Left



The weighing device meets the given process requirements.

The weighing device meets the given process requirements.

Tests Performed:

As Found



As Left

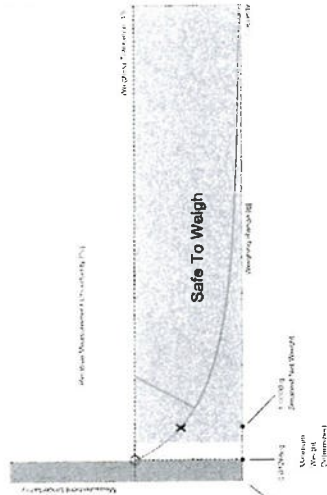
Process Requirements

Weighing Tolerance: 1 %

Smallest Net Weight: 1.0000 g

Safety Factor: 2

Safe Weighing Range



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

COPY

Minimum Weight

As Found Minimum Weight Table

Minimum weights for different weighing tolerances and safety factors					
Safety Factor					
Tolerance	1	2	3	5	10
0.1%	0.13300 g	0.26873 g	0.40728 g	0.69320 g	1.46405 g
0.2%	0.06616 g	0.13300 g	0.20051 g	0.33764 g	0.69320 g
0.5%	0.02638 g	0.05288 g	0.07947 g	0.13300 g	0.26873 g
1%	0.01318 g	0.02638 g	0.03962 g	0.06616 g	0.13300 g
2%	0.00659 g	0.01318 g	0.01978 g	0.03300 g	0.06616 g
5%	0.00263 g	0.00527 g	0.00790 g	0.01318 g	0.02638 g

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

As Left Minimum Weight Table

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

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

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

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

Notes on minimum weight values in above table:

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

COPY

Measurement Results

Results Summary

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

✓ = Passed

✗ = Failed

NA = Safety Factor not met

Repeatability

Test Load: 100 g

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

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

Eccentricity

Test Load: 100 g

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

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

COPY

Error of Indication

As Found

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

As Left

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

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

COPY

BAROMETER

Equipment : Analog Barometer

ID No. / Tag No. : BM001/41

CALIBRATION CERTIFICATE



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

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

Equipment : Analog Barometer

Manufacturer : Barigo

Model : -

Serial No. : -

ID No./Tag No. : BM001/41

Date Received : 03-May-24

Date Calibrated : 06-May-24

Calibrated by : Mr. Saruth Srichutikul

Calibration Method or Calibration Procedure Used

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

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

Result of Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by a coverage factor $k = 2$, providing a level confidence approximately 95 percent.
This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

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



Page 1 of 2
COPY

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 = $1.19 \text{ kg/m}^3 @ 20^{\circ}\text{C}$, 1 bar
Mounting Position : Vertical
Reference Level : at center of its dial
Conversion Factor : Multiply by $1.0 \text{ E}+02$ - Pa unit

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

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

IRPC Certificate No. CL1-P230097 for Reference Pressure Monitor Serial No. L598. Due 09-Nov-24

End of Certificate

Page 2 of 2
COPY

Hot Air Oven

Model : UFE 500

Serial No. : G511.0182

CERTIFICATE OF CALIBRATION

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

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

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert

Model : UFE 500

ID No. : LABE 17/4

Date of Receipt : 22 December 2023

Date of Calibration : 22 December 2023

Condition of Calibration

1. Environment : 1.1 Ambient temperature : Maximum 30.9 °C : Minimum 29.6 °C

: 1.2 Relative humidity : Maximum 54.5 % : Minimum 46.8 %

: 1.3 Line voltage supplied : Maximum 227.6 VAC : Minimum 224.2 VAC

2. Calibration method

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

3. Reference standard instrument

Instrument : ID No. : Certificate No. : Due Date

Data Acquisition With Sensor : LB-DA-08 (RTD-248 to RTD-256) : 23-084070 : 06 August 2024

(RTD-P100)

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

[Signature]

(Mr. Somchai Neampunt)

Signed for Director

[Signature]

Calibrated by : Mr. Pisek Into : Approved by : (Mr. Somchai Neampunt)

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.

Results of Calibration

Resolution : 0.5 °C

1. Reporting of Temperature

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

2. Characterization results

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

Notes

UUC* = Unit Under Calibration

[Signature]

[Signature]

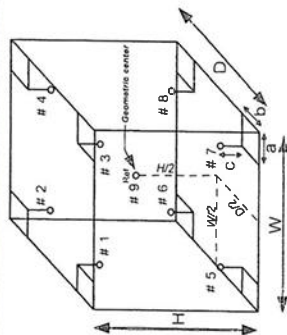


REPORT OF CALIBRATION

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 56 cm ; D = 40 cm ; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes "Stability of chamber and loading effect in chamber at 20% of uniformity".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.

Figure a: 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 UMAS M31003

- End of Report -


COPY

ICP-OES/Avio550

Serial No. : M81S2210101

ICP-OES/Avio550 Preventive Maintenance (PM)

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

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

Scope

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

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.
Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

Copyright Information

This document contains proprietary information that is protected by copyright. All rights are reserved. No part of this publication may be reproduced in any form whatsoever or translated into any language without the prior, written permission of PerkinElmer, Inc. Copyright © 2013 PerkinElmer, Inc.

Trademarks

Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law. PerkinElmer is a registered trademark of PerkinElmer, Inc. All other trademarks and registered trademarks not owned by PerkinElmer, Inc. or its subsidiaries that are depicted herein are the property of their respective owners.
Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.
PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

Component List

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

Parts Lists

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

Additional Reagents and Standards Required for PM

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

COPY

COPY

Procedure Checklist

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

1. General:

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

2. Mechanical:

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

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

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

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

3. Electronical

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

RF Generator:

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

Spectrometer:

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

4. Optical:

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

5. PM Performance Tests:

- ☒ Perform View Align.

Test Spectral Resolution:

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

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

Test Precision:

- ☒ Test for reproducibility of a set of measurement.

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

COPY

COPY

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

Test Axial BEC Cd:

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

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

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

Test Radial BEC Mn:

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

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

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

6. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

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

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Date:

25-Apr-2024
(DD-MMN-YYYY)

Authorized Customer Representative:

Date:

25-Apr-2024
(DD-MMN-YYYY)

COPY

ORIFICE TRANSFER STANDARD CERTIFICATION

WORKSHEET TE-5025A

ROOTSMETER S/N 0438320

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVELAND, OH
44102
513.467.9000
877.283.7810 Toll Free
513.467.9009 Fax



ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

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

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

DATA TABULATION

(x axis) Qstd		(y axis)	(x axis) Qa		(y axis)
Vstd			Va		
0.9832	0.7337	1.4054	0.9957	0.7430	0.891
0.9791	1.0296	1.9875	0.9915	1.0426	1.2603
0.9770	1.1481	2.2221	0.9894	1.1626	1.4090
0.9760	1.2006	2.3305	0.9884	1.2157	1.4778
0.9707	1.4510	2.8107	0.9830	1.4694	1.7823
Qstd slope (m) = 1.96262			Qa slope (m) = 1.23896		
intercept (b) = -0.03249			intercept (b) = -0.02060		
coefficient (r) = 0.99993			coefficient (r) = 0.99993		
y axis = SQRT(H2O(Pa/760) (298/Ta))			y axis = SQRT(H2O(Ta/Pa))		

CALCULATIONS

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

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

For subsequent flow rate calculations:

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

COPY

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	49.629	-0.4	3.3
24.40	101.16	100	100.73	0.7	2.8
24.30	101.13	200	198.30	-1.7	5.6
24.30	101.10	300	298.14	-1.9	8.4
24.40	101.06	400	397.45	-3	11
24.20	101.00	500	496.93	-3.1	7.1

Note

STD : Standard UUC : Unit Under Calibration

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

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

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

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

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

End of Certificate

Certificate of Calibration

Certificate No : 24-AFM-023

Request No : Req-2024-0095

Customer : Eastern Thai Consulting 1992 Co., Ltd.

Name : Eastern Thai Consulting 1992 Co., Ltd.

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

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : Bios

Model : Defender 510-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 ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 11 January 2024

Calibration Date : 30 January 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 1943.01

Note :

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

Calibration By :  Mr. Noppadon Luangart

Approved By :  Mr. Pasit Mathavorn

Service Calibration Engineer

Calibration Engineer Supervisor

Issue Date : 30 January 2024

COPY

Certificate No : 24-AFM-022

Request No : Req-2024-1094

Certificate No : 24-AFM-022

Request No : Req-2024-1094

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 :

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

where

Q : Flow Rate

P : Absolute Pressure

T : Absolute Temperature

Meas : Measurement Condition

ref : Standard Condition

• Indicates non accredited

End of Certificate

Certificate of Calibration

Customer

Name : Eastern Thai Consulting 1992 Co., Ltd.

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

Unit Under Calibration Details

Measurement Item : Primary Flow Calibrator

Manufacturer : MesuLabs

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	08000057	Qciborn	27 February 2024
Pressure meter	CPG2400	41000KDUJ651882	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 Mahavorn

Calibration Engineer Supervisor

Issue Date : 30 January 2024

COPY

THERMO-HYGROMETER

Model : 608-H1

Serial No. : 45106737



CERTIFICATE OF CALIBRATION

Page 1 of 2
Certificate No. : 24-062442
Sample Code : 24-25546-002

Customer : EASTERN THAI CONSULTING 1992 CO., LTD.

683 Moo 11, Sukhaphibarn 8 Rd., Nongkham,

Sriacha, Chonburi 20230

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

Equipment : Digital thermo-hygrometer

Manufacturer : testo Model : 608-H1

Serial No. : 45106737 ID No. : LABE 09/7

Date of Receipt : 23 May 2024 Date of Calibration : 27-28 May 2024

Condition of Calibration

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

2. Calibration method

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

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

3. Reference standard Instrument

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

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

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

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

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

6. Condition of calibration item : Normal

Calibrated by : Miss Pornsuda Lohabel

Scientist

30 May 2024

(Mr. Somchai Neamput)

Signed for Director

COPY

Issue date

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).

381 Soi Ladprao 122, Ladprao Road

Phialapha, 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



REPORT OF CALIBRATION

Page 2 of 2
Certificate No. : 24-062442
Sample Code : 24-25546-002

Results of Calibration

Temperature measurement

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

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

Humidity measurement

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

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

Notes

Calibration results without adjustment.

The result expanded uncertainty of measurement, U, is stated as the standard uncertainty 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 M2003.

- End of Report -

COPY

TEL 02-516-2422

FAX 02-516-6949

Rev 09

381 Soi Ladprao 122, Ladprao Road

Phialapha, Wang Thonglang, Bangkok 10310

FM CL 016

CONTACT@AMARC.CO.TH

WWW.AMARC.CO.TH

Effective Date 15/10/21

Analytical Balances

Model : XS205DU

Serial No : B814654693

Mettler-Toledo (Thailand) Ltd.

846/4 - 846/5 Lasalle Rd., Bangna Tai Sub-District

Bangna District, Bangkok 10260


+662 723 0382

MT-TH.ServiceSupport@mt.com



Accuracy Calibration Certificate

Customer

Company: Eastern Thai Consulting 1992 Co., Ltd.
Address: 129 Moo 1, Nonsi
City: Kabin Buri **Contact:** Tassawan Chansamrong
Zip / Postal: 25110
State / Province: Prachinburi
Order Number: 
0 3 3 3 0 5 7 4 7 2

Weighing Device

Manufacturer: Mettler Toledo **Instrument Type:** Weighing Instrument
Model: XS205DU **Asset Number:** KB-LAB-61/002
Serial No.: B814654693 **Terminal Model:** SAT
Building: Office Laboratory **Terminal Serial No.:** B814654693
Floor: 1 **Terminal Asset No.:** N/A
Room: Laboratory

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

Procedure

Calibration Guideline: EURAMET cg-18 v. 4.0 (11/2015)

METTLER TOLEDO Work Instruction: CP/W002/20

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

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

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

As Found	Temperature		Humidity	
	Start: 23.2 °C	End: 22.8 °C	Start: 60.8 %	End: 65.0 %

As Found Calibration Date: 23-Mar-2024
As Left Calibration Date: N/A
Issue Date: 24-Mar-2024

Calibrator: Naruephon C.
Naruephon Chonprasertsuk

Approved Signatory: Surachai P.
Technical Manager / Head of Calibration Center

COPY

Measurement Results

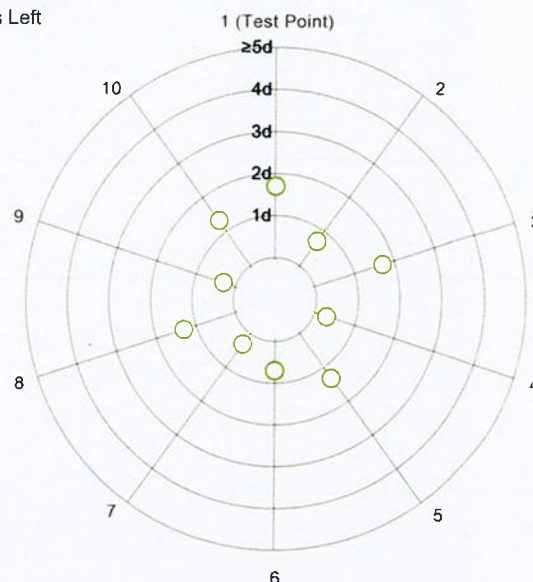
Repeatability

Test Load: 70 g

	As Found	As Left
1	69.99996 g	N/A
2	69.99997 g	N/A
3	69.99996 g	N/A
4	69.99998 g	N/A
5	69.99999 g	N/A
6	69.99997 g	N/A
7	69.99998 g	N/A
8	69.99999 g	N/A
9	69.99998 g	N/A
10	69.99999 g	N/A

Standard Deviation	0.000012 g	N/A
--------------------	------------	-----

○ As Found
◆ As Left



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

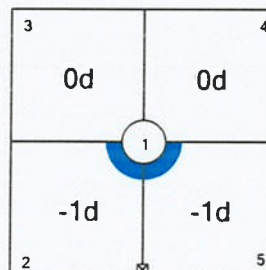
The results of this graph are based upon the absolute values of the differences from the mean value.

Eccentricity

Test Load: 100 g

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

Maximum Deviation	0.0001 g	N/A
-------------------	----------	-----



As Found

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

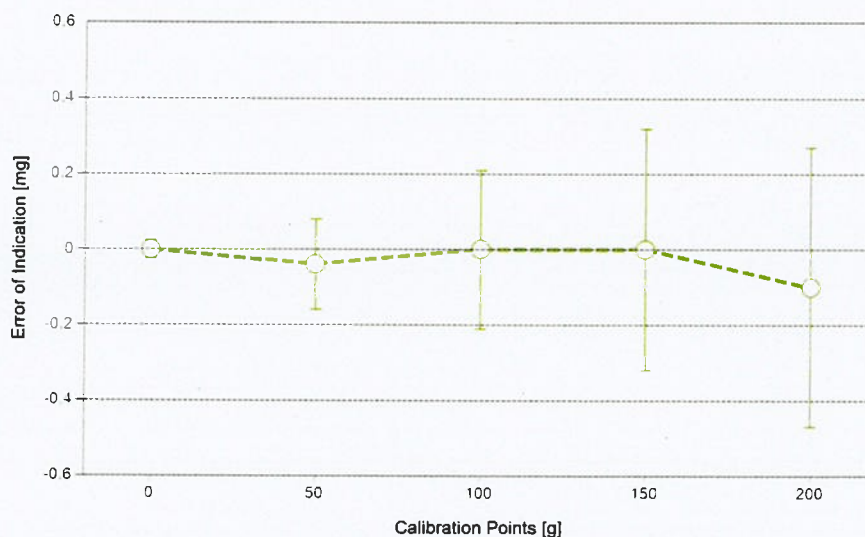
COPY

Error of Indication

As Found

	Reference Value	Indication	Error of Indication	Expanded Uncertainty	k
1	0.00000 g	0.00000 g	0.00000 g	0.024 mg	2
2	0.05001 g	0.05000 g	-0.00001 g	0.027 mg	2
3	0.10000 g	0.09999 g	-0.00001 g	0.028 mg	2
4	0.49999 g	0.49999 g	0.00000 g	0.033 mg	2
5	0.99999 g	1.00001 g	0.00002 g	0.036 mg	2
6	5.00002 g	5.00003 g	0.00001 g	0.051 mg	2
7	10.00001 g	9.99999 g	-0.00002 g	0.063 mg	2
8 ¹	50.00003 g	49.99999 g	-0.00004 g	0.12 mg	2
9	100.0000 g	100.0000 g	0.0000 g	0.21 mg	2
10	150.0000 g	150.0000 g	0.0000 g	0.32 mg	2
11	200.0001 g	200.0000 g	-0.0001 g	0.37 mg	2

¹The calculated uncertainty was replaced by the CMC (Calibration and Measurement Capabilities) value because the calculated uncertainty was smaller than the CMC value.



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

The user is responsible for maintaining environmental conditions and the settings of the weighing instrument when it was calibrated. The results of this calibration certificate relate only to the calibrated item.

COPY

Test Equipment

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

Weight Set 1: OIML E2

Weight Set No.:	WS22	Date of Issue:	06-Apr-2023
Certificate Number:	18589	Calibration Due Date:	03-Oct-2024

Thermo Hygrometer

Equipment No.:	IN284	Date of Issue:	16-Jan-2024
Certificate Number:	SG-H-00080/67	Calibration Due Date:	14-Jan-2025

Remarks

FACT adjustment functionality activated
Equipment condition: Good
Next calibration according to customer's procedure
Calibration data not decide by calibration laboratory

End of Accredited Section

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

COPY

Measurement Uncertainty of the Weighing Instrument in Use

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

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

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

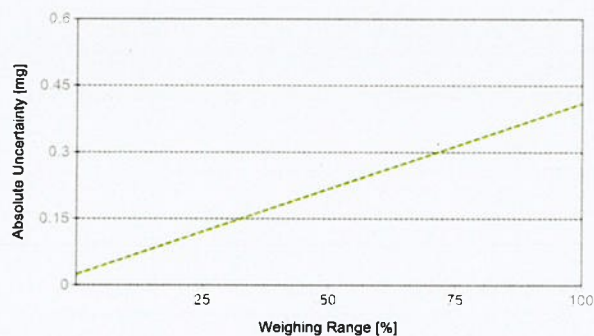
Linearization of Uncertainty Equation

	Range		As Found	As Left
	d	Max		
1	0.00001 g	81 g	$U_1 = 0.025 \text{ mg} + 0.00476 \text{ mg/g} \cdot R$	N/A
2	0.0001 g	220 g	$U_2 = 0.06 \text{ mg} + 0.00478 \text{ mg/g} \cdot R$	N/A

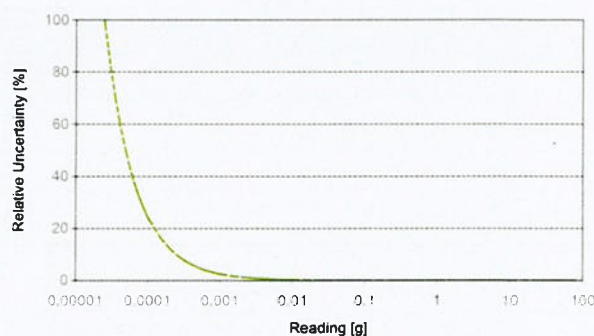
To optimize the stability of the linearization, besides of the zero load only increasing measurement points with a test load of 5% of the measurement range or larger are taken for the calculation of the linear equation.

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

Net Indication	As Found		As Left	
0.00220 g	0.025 mg	1.1%	N/A	N/A
0.02200 g	0.025 mg	0.11%	N/A	N/A
0.22000 g	0.026 mg	0.012%	N/A	N/A
2.20000 g	0.035 mg	0.0016%	N/A	N/A
220.0000 g	1.1 mg	0.00051%	N/A	N/A



As Found



As Left

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

COPY

Thermo Reactor

Model : RD125

Serial No. : 0220/003514



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T241379I02

"Substitute for Calibration Certificate Number T241379I01"

Page 1 of 4

Certificate of Calibration

Equipment : Thermoreactor

Manufacturer : Lovibond

Model : RD125

Serial No. : 0220/003514

Customer Code : KB-LAB-63/004


ID No. : T2603A5

Customer : Eastern Thai Consulting 1992 Co.,Ltd.
129 Moo.1 Nonsi,
Kabinburi, Prachinburi 25110

Customer Location : Laboratory Room

Date of Receipt : 17 July 2024

Calibrated By : Atiphong Rongrat (Technician)

Approved By :  Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 27 AUG 2024

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

COPY

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 units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Calibration Report

Equipment : Thermoreactor
Date of Calibration : 25 July 2024
Environment : Temperature : 27.4-28.9 °C
Line Voltage : 222.7-227.8 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 20 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN241-TN250	T240401	16 March 2025
TC	TYPE T	TN251-TN260	T240401	16 March 2025
DATA LOGGER	34970A	T193	T240401	16 March 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 30 Minute At 150 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment

() after adjustment

Approved By. _____



COPY

Certificate No T241379I02

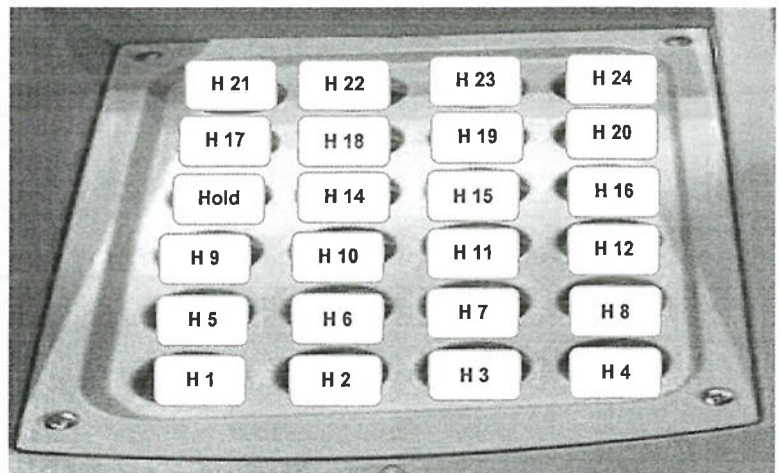
Page 3 of 4

Calibration Report

Row 6	H 21		H 22		H 23		H 24
Row 5	H 17		H 18		H 19		H 20
Row 4	HOLD		H 14		H 15		H 16
Row 3	H 9		H 10		H 11		H 12
Row 2	H 5		H 6		H 7		H 8
Row 1	H 1		H 2		H 3		H 4

H: STANDARD THERMOCOUPLE TYPE T

H1	=	TN241	H9	=	TN249	H17	=	TN257
H2	=	TN242	H10	=	TN250	H18	=	TN258
H3	=	TN243	H11	=	TN251	H19	=	TN259
H4	=	TN244	H12	=	TN252	H20	=	TN260
H5	=	TN245	H13	=	Hold	H21	=	TN241
H6	=	TN246	H14	=	TN254	H22	=	TN242
H7	=	TN247	H15	=	TN255	H23	=	TN243
H8	=	TN248	H16	=	TN256	H24	=	TN244



Approved By. 

COPY

Certificate No. **T241379I02**

Page 4 of 4

Calibration Report

Measurement Results

			Average Standard Reading at each position (° C)										
Calibration Point			TN241	TN242	TN243	TN244	TN245	TN246	TN247	TN248	TN249	TN250	
			H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	
Point	Setting	Max	150.23	149.91	150.53	149.99	150.89	150.09	150.14	150.64	149.96	150.31	
150	150.0	Min	149.93	149.70	150.37	149.75	150.73	150.03	150.01	150.52	150.16	150.16	
			Average	150.08	149.82	150.45	149.88	150.80	150.06	150.07	150.58	149.93	150.24
				TN251	TN252	TN253	TN254	TN255	TN256	TN257	TN258	TN259	TN260
				H11	H12	H13	H14	H15	H16	H17	H18	H19	H20
			Max	150.23	150.77		150.82	150.31	150.45	150.84	150.84	150.33	150.22
			Min	150.12	150.62	HOLD	150.76	150.20	150.39	150.77	150.76	150.22	150.13
			Average	150.17	150.69		150.79	150.25	150.42	150.80	150.80	150.27	150.17
				TN241	TN242	TN243	TN244						
				H21	H22	H23	H24						
			Max	149.98	149.98	150.54	150.01						
			Min	149.91	149.92	150.48	149.95						
			Average	149.94	149.95	150.51	149.98						

Thermoreactor			Temperature Distribution	
Setting (° C)	Reading (° C)		Stability (± ° C)	Uncertainty (± ° C)
	Min , Max	Average		
150	-	150	0.20	1.20

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. _____



COPY

Chamber (Incubator)

Model : SRC-680SAD

Serial No. : 0508-00036



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T241193

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Incubator)

Manufacturer : SANDEN

Model : SRC-680SAD

Serial No. : 0508-00036

Customer Code : KB-LAB-48/035


ID No. : T2465A3

Customer : Eastern Thai Consulting 1992 Co.,Ltd.
129 Moo.1 Nonsi,
Kabinburi, Prachinburi 25110

Customer Location : Laboratory

Date of Receipt : 12 June 2024

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 24 JUN 2024

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

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 units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.


COPY

Certificate No. T241193

Page 2 of 3

Calibration Report

Equipment : Chamber (Incubator)
Date of Calibration : 19 June 2024
Environment : Temperature : 28.5-29.5 °C
Line Voltage : 226.5-231.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	28-(CH1-10)	T240709	19 April 2025
DATA LOGGER	34970A	T149	T240709	19 April 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 22 Minute At 20 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

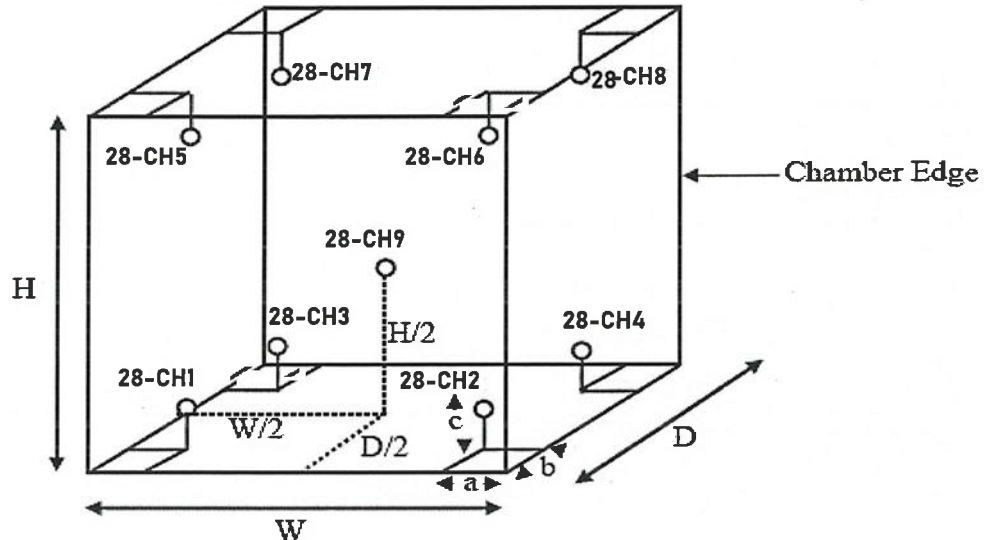
Approved By. 

COPY

Certificate No. T241193

Page 3 of 3

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 60 cm. , H (Height) = 146 cm. and D (Depth) = 64 cm.

Size of Installed Standard sensor number 28-CH1 to number 28-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 28-CH9 : W/2 = 60 cm./2 , H/2 = 146 cm./2 and D/2 = 64cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	28-CH1	28-CH2	28-CH3	28-CH4	28-CH5	28-CH6	28-CH7	28-CH8	28-CH9
20	20.20	20.13	20.05	19.78	19.93	19.83	19.99	19.97	19.77

Chamber (Incubator)			Temperature Distribution				
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
	Min , Max	Average					
20.0	19.8 , 20.1	20.0	19.96	0.13	0.71	0.44	2.04

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

COPY

DO METER

Model : YSI5000

Serial No. : 16H102702

CERT.No.: HS-V071J

Calibration Date : 4 Oct 24
 Submitted by : Eastern Thai Consulting 1992 Co., Ltd.
 129 Moo 1, Nonsi Subdistrict, Kabinburi
 District Prachinburi Province 25110

Avg Room Temp : 20 °C
 Avg Water Temp : 20 °C
 Air Pressure : 760.00 mmHg
 Salinity : 0 ppt

Model : YSI 5000
 S/N : 16H102702
 Probe : YSI 5010
 S/N : 22A100334
 ID NO. : -
 Air Temp ref : S/N. F8065C26
 Barometric ref : S/N. F8065C26
 Water Temp ref : -
 ID NO. HS001
 Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.09	mg/l	-	-
Inaccuracy	0.00	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature
 (Kittipong Maekwong)

COPY



Laboratory Manager
 (Supreecha Sumaritam)

pH Meter

Model : Seven2Go S2

Serial No : B805359649



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 24-057014

Sample Code : 24-23352-001

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri,
Kabinburi, Prachinburi 25110

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

Equipment : pH Meter

Manufacturer : METTLER TOLEDO

Model : Seven2GO S2

Serial No. : B805359649

ID No. : KB-LAB-61/001

Date of Receipt : 13 May 2024

Date of Calibration : 14 May 2024

Condition of Calibration

1. **Environment** Ambient temperature : 22.5 to 27.5 °C Relative humidity : 40.0 to 70.0 %RH
1.1 Start time : 24.4 °C ; End time : 24.2 °C 1.2 Start time : 60.3 %RH ; End time : 63.1 %RH

2. Calibration method

In house method WI-CL-019 : Direct measurement with standard voltage calibrator and direct measurement with 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	941725	PH216.L5	30 November 2025
3.4 Buffer Solution pH 6.986	941727	PH107.L5	06 November 2024
3.5 Buffer Solution pH 9.997	941726	PH220.L5	06 November 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 17034).
4.4 Buffer Solution No. 3.4 traceable to CPA chem (CPA RefN HARNED CELL LotN 61275737; CPA RefN HARNED CELL LotN 61273986 Accredited laboratory ISO/IEC 17025 and ISO 17034).

5. This result of calibration was found accurate as shown on date and place of calibration only.**6. Condition of calibration item : Normal**

Calibrated by Mr. Nuttaput Timula
Scientist

Approved by

(Mr. Somchai Neampunt)
Signed for Director

Issue date 20 May 2024

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

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

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



REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 24-057014

Sample Code : 24-23352-001

Equipment : pH Meter Resolution : 0.01 pH ; 1 mV ; 0.1°C
Manufacturer : METTLER TOLEDO Model : Seven2GO S2
Serial No. : B805359649 ID No. : KB-LAB-61/001
Range : -2.00 pH to 20.00 pH ; ± 1999 mV ; -5.0°C to 105.0°C

Results of Calibration

Part 1. DC Voltage measurement

pH Meter Serial No. : B805359649

Nominal Value pH	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor <i>k</i>
		mV	pH		
0	414.113	414	-0.01	± 0.59	2.00
4	177.477	177	4.00	± 0.59	2.00
7	0.000	0	7.00	± 0.59	2.00
10	-177.477	-178	10.00	± 0.59	2.00
14	-414.113	-414	14.01	± 0.59	2.00

Part 2. Performance of Electrode system

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

Electrode Serial No. : 4100521

Three-Point Calibration at pH4, pH7 and pH10 Percent Slope : 98.7

Standard Buffer Solution pH (@ 25 °C)	Average indicator reading		Error Value pH	Uncertainty pH	Coverage factor <i>k</i>
	pH	mV			
4.008	4.00	184	-0.008	± 0.010	2.00
6.986	6.99	9	0.004	± 0.010	2.00
9.997	10.00	-166	0.003	± 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.



REPORT OF CALIBRATION

Certificate No. : 24-057014

Sample Code : 24-23352-001

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO Model : Seven2Go S2
Serial No. : B805359649 ID No. : KB-LAB-61/001
Resolution : 0.1 °C Range : -5.0 °C to 105.0 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO Model : InLab Expert Go-ISM
Serial No. : 4100521 ID No. : N/A

Condition of Calibration

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

2. Calibration method

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

3. Reference standard instrument

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

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

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

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

6. Condition of Calibration item : Normal

Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration			Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C	Correction value °C		
10	10.001	120	10.1	- 0.099	± 0.13	2.00
30	30.000	120	30.1	- 0.100	± 0.13	2.00
50	50.010	120	50.1	- 0.090	± 0.16	2.05

Notes

- Calibration results without adjustment

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

- End of report -

WATER BATH

Model : WNB45

Serial No. : L719.0236

CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 24-128424

Sample Code : 24-51593-001

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri,
Kabinburi, Prachinburi 25110

Location of Calibration : Eastern Thai Consulting 1992 Co., Ltd.
(Laboratory)

Equipment : Liquid bath (Water bath)

Manufacturer : Memmert

Model : WNB 45

Serial No. : L719.0236

ID No. : KB-LAB-63/017

Date of Receipt : 03 October 2024

Date of Calibration : 03 October 2024

Condition of Calibration

- | | | | | | |
|----------------|---------------------------|-----------|-----------|-----------|-----------|
| 1. Environment | 1.1 Ambient temperature | : Maximum | 31.9 °C | ; Minimum | 30.3 °C |
| | 1.2 Relative humidity | : Maximum | 74.4 % | ; Minimum | 63.0 % |
| | 1.3 Line voltage supplied | : Maximum | 223.8 VAC | ; Minimum | 218.8 VAC |

2. Calibration method

In-house method WI-CL-023 based on ASTM E 715-80 (Reapproved 2022).

3. Reference standard instrument

Instrument	ID No.	Certificate No.	Due Date
Data acquisition with sensor (RTD-Pt100)	LB-DA-10 (RTD-220 to RTD-224)	24-025104	28 February 2025

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

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

5. This result of calibration was found accurate as shown on date and place of calibration only.**6. Condition of calibration item** : Normal

Calibrated by Mr. Sarut Sa-nguansin
Scientist

Approved by

(Mr. Somchai Neampunt)
Signed for Director

Issue date 04 October 2024

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

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

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

REPORT OF CALIBRATION

Page 2 of 3

Certificate No. : 24-128424

Sample Code : 24-51593-001

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 ^{Ref.}		
85	85.9	85.9	85.067	85.120	85.046	85.068	85.094	0.17	2.00
95	95.0	95.0	93.941	93.919	93.908	93.881	93.919	0.17	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.087	0.156	0.202
95	0.078	0.144	0.237

Notes

- UUC* = Unit Under Calibration



COPY

REPORT OF CALIBRATION

Page 3 of 3

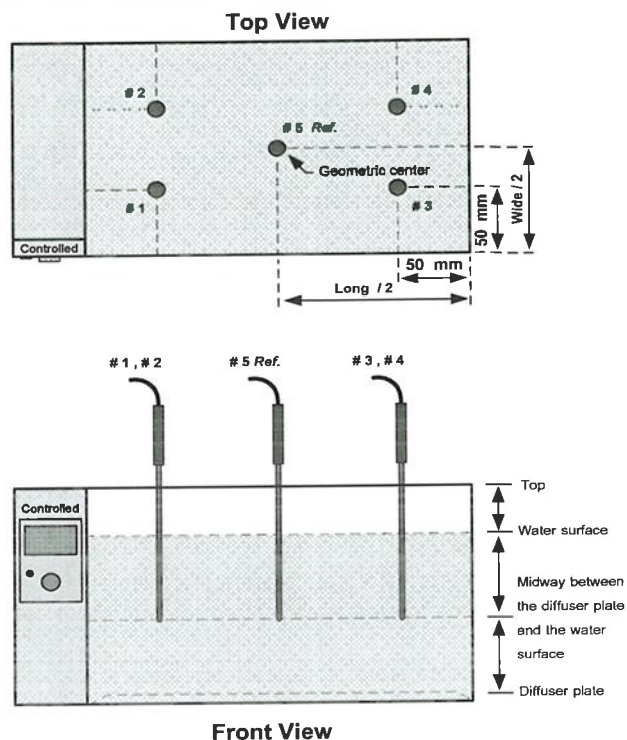
Certificate No. : 24-128424

Sample Code : 24-51593-001

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 Place five calibrated temperature sensors in the unloaded water bath with diffuser plate in place and at lowest position and water level approximately 38 mm from the top.
 - 1.2 Locate one sensor in each of the four corners of the bath approximately 50 mm from each wall and midway between the diffuser plate and the water surface.
 - 1.3 Locate the fifth sensor within 25 mm of the geometric center of the bath.
2. The quoted uncertainty includes "Stability of bath and loading effect in bath at 20% of uniformity".
3. 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.
4. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
5. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
6. UUC* reading - the average reading of indicating device that forms the integral part of the bath.
7. Controlled circulation or stirrer moter setting : N/A
8. Cooling system : N/A
9. 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

Chamber (Refrigerator)

Model : SCR-1320SAD

Serial No. : 0508-00065



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand .

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T240565

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Refrigerator)

Manufacturer : Sanden Intercool

Model : SRC-1320SAD

Serial No. : 0508-00065

Customer Code : KB-LAB-48/034


ID No. : T8421A2

Customer : Eastern Thai Consulting 1992 Co.,Ltd.
129 Moo.1 Nonsi,
Kabinburi, Prachinburi 25110

Customer Location : Laboratory

Date of Receipt : 13 March 2024

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  /Bonchai Suriyawong (Site Calibration Manager)

Date of Issue : 25 MAR 2024

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

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 units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

COPY

Certificate No. T240565

Page 2 of 3

Calibration Report

Equipment : Chamber (Refrigerator)
Date of Calibration : 21-22 March 2024
Environment : Temperature : 29.6-33.7 °C
Line Voltage : 224.9-232.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	28-(CH1-10)	T230543	10 April 2024
DATA LOGGER	34970A	T149	T230543	10 April 2024

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 14 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

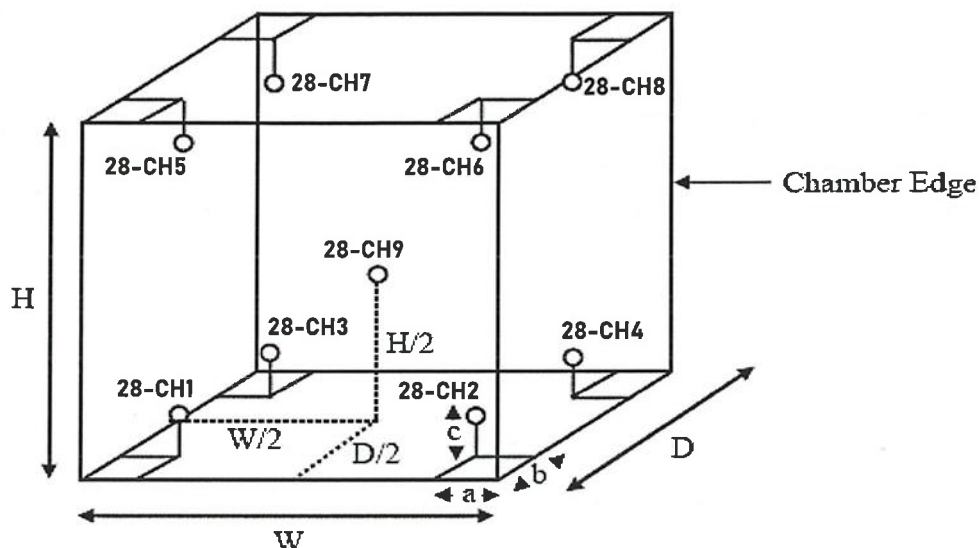
Approved By. 

COPY

Certificate No. T240565

Page 3 of 3

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 100 cm. , H (Height) = 135 cm. and D (Depth) = 45 cm.

Size of Installed Standard sensor number 28-CH1 to number 28-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.

Size of Installed Standard sensor number 28-CH9 : W/2 = 100 cm./2 , H/2 = 135 cm./2 and D/2 = 45cm./2

Measurement Results

Average Standard Reading at each position (°C)									
Calibration Point	28-CH1	28-CH2	28-CH3	28-CH4	28-CH5	28-CH6	28-CH7	28-CH8	28-CH9
3	3.17	3.08	3.17	2.79	3.09	3.30	2.60	2.74	3.16

Chamber (Refrigerator)			Temperature Distribution				
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
3.0	2.9 , 3.8	3.1	3.01	0.86	1.02	1.28	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

COPY

pH METER

Model : SevenCompact

Serial No. : B824972289



CERTIFICATE OF CALIBRATION

Page 1 of 3

Certificate No. : 24-108219

Sample Code : 24-43250-001

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri, Kabinburi,
Prachinburi 25110

Location of Calibration : Eastern Thai Consulting 1992 Co., Ltd.
(Calibration laboratory)

Equipment : pH Meter

Manufacturer : METTLER TOLEDO **Model** : SevenCompact S220

Serial No. : B824972289 **ID No.** : KB-LAB-61/003

Date of Receipt : 26 August 2024 **Date of Calibration** : 26 August 2024

Condition of Calibration

1. **Environment** Ambient temperature : 15.0 to 35.0 °C Relative humidity : 35.0 to 80.0 %RH
1.1 Start time : 24.5 °C ; End time : 25.8 °C 1.2 Start time : 76.8 %RH ; End time : 79.5 %RH

2. Calibration method

In house method WI-CL-019 : Direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM).

3. Reference standard / Certified reference material

Instrument	ID No.	Certificate No.	Due Date
3.1 Voltage Calibrator	LB-DPC-01	LF24-0280	25 June 2025
3.2 Digital Thermometer	LB-DPC-01	24-096498	11 August 2025
Certified Reference Material	Lot. No.	Ref No.	Expire Date
3.3 Buffer Solution pH 4.008	991689	PH216.L5	03 May 2026
3.4 Buffer Solution pH 6.999	C03142	S11M004	12 February 2026
3.5 Buffer Solution pH 9.997	980686	PH220.L5	25 April 2025

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

- 4.1 Instrument No. 3.1 through Measuretronix Limited.
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 17034).
4.4 Buffer Solution No. 3.4 traceable to HACH (Certified Reference Material from DFM and PTB Certificate Nr. CRM-P1118 and Certificate Nr. PTB-PHOB-555/30620/22. According to DIN EN ISO 17034:2017).

5. This result of calibration was found accurate as shown on date and place of calibration only.**6. Condition of calibration item : Normal**

COPY

Calibrated by Mr. Nuttaput Timula
Scientist

Approved by (Mr. Somchai Neampunt)
Signed for Director

Issue date 27 August 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) .

NSC-TISI-TIS17025
CALIBRATION 0152

Page 2 of 3

REPORT OF CALIBRATION

Certificate No. : 24-108219

Sample Code : 24-43250-001

Equipment : pH Meter Resolution : 0.001 pH ; 0.1 mV ; 0.1°C
Manufacturer : METTLER TOLEDO Model : SevenCompact S220
Serial No. : B824972289 ID No. : KB-LAB-61/003
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. : B824972289

Nominal Value pH	Applied DC Voltage mV	Average indicator reading		Uncertainty mV	Coverage factor k
		mV	pH		
0	414.113	414.0	0.00	± 0.083	2.00
4	177.477	177.5	4.00	± 0.083	2.00
7	0.000	0.0	7.00	± 0.083	2.00
10	177.477	-177.5	10.00	± 0.083	2.00
14	-414.113	-414.0	14.00	± 0.083	2.00

Part 2. Performance of Electrode system

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

Electrode Serial No. : 4293264

Three-Point Calibration at pH4 and pH7 Percent Slope : 99.4 , at pH7 and pH10 Percent Slope : 98.7

Standard Buffer Solution pH (@ 25 °C)	Average indicator reading		Error Value pH	Uncertainty pH	Coverage factor k
	pH	mV			
4.008	4.00	181.2	-0.008	± 0.0083	2.00
6.999	6.99	4.8	-0.009	± 0.0083	2.00
9.997	9.99	-170.4	-0.007	± 0.0083	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.

COPY



REPORT OF CALIBRATION

Certificate No. : 24-108219

Sample Code : 24-43250-001

Equipment : pH Meter (Digital Thermometer with sensor)

Thermometer readout

Manufacturer : METTLER TOLEDO Model : SevenCompact S220
 Serial No. : B824972289 ID No. : KB-LAB-61/003
 Resolution : 0.1 °C Range : -30.0 °C to 130.0 °C

Thermometer sensor

Manufacturer : METTLER TOLEDO Model : InLab Expert Pro-ISM
 Serial No. : 4293264 ID No. : N/A

Condition of Calibration

1. Environment
 1.1 Ambient temperature : 25.2 °C ± 0.1 °C
 1.2 Relative humidity : 66.3 % ± 7.2 %

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-366	24-096498	11 August 2025
3.2 Thermometer Readout	753	LB-DPC-01	24-096498	11 August 2025

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

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

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

6. Condition of Calibration item : Normal

Results of Calibration

Calibration point °C	Average of standard reading °C	Unit under calibration			Expanded uncertainty °C	Coverage factor k
		Immersion depth mm	Average reading °C	Correction value °C		
23	22.98	100	22.8	+ 0.18	± 0.14	2.00
25	24.98	100	24.8	+ 0.18	± 0.14	2.00
27	27.00	100	26.8	+ 0.20	± 0.14	2.00

Notes

- Calibration results without adjustment

COPY

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 -

Digital Thermohygro Meter

Model : 303C

Serial No : 200603202

CERTIFICATE OF CALIBRATION

Page 1 of 2

Certificate No. : 24-129335

Sample Code : 24-52035-002

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri,
Kabinburi, Prachinburi 25110

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

Equipment : Digital thermo-hygrometer

Manufacturer : JEDTO **Model** : 303C

Serial No. : 200603202 **ID No.** : KB-LAB-63/025

Date of Receipt : 04 October 2024 **Date of Calibration** : 07 October 2024

Condition of Calibration

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

2. Calibration method

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

3. Reference standard instrument

Instrument	Model	ID No.	Certificate No.	Due Date
3.1 Chilled Mirror	Optidew Vision	LB-DP-02 & LB-DP-02 (DP)	TH-0097-24	09 July 2025
3.2 Digital Thermometer	Optidew Vision	LB-DP-02 & LB-DP-02 (Temp.)	24-106285	21 August 2025
3.3 Digital Thermometer	34972A	LB-DA-07 with RTD-89	24-106857	21 August 2025

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

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

5. This result of calibration was found accurate as shown on date and place of calibration only.**6. Condition of calibration item** : Normal

Calibrated by Miss Pornsuda Lohabal
Scientist

Approved by

(Mr. Somchai Neampunt)
Signed for Director

Issue date 09 October 2024

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

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

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

REPORT OF CALIBRATION

Page 2 of 2

Certificate No. : 24-129335

Sample Code : 24-52035-002

Results of Calibration

Temperature measurement

Resolution : 0.1 °C

Range : -50 °C to 70 °C

Calibration point °C	Average of standard reading		Unit under calibration		Expanded uncertainty °C
	Controlled humidity %RH	Temperature °C	Average reading °C	Correction value °C	
20	50	20.01	20.0	+ 0.01	± 0.39
25	50	25.01	24.9	+ 0.11	± 0.39
30	50	30.01	29.9	+ 0.11	± 0.39

Humidity measurement

Resolution : 1 %RH

Range : 10 %RH to 95 %RH

Calibration point %RH	Average of standard reading		Unit under calibration		Expanded uncertainty %RH
	Air temperature °C	Calculated humidity %RH	Average reading %RH	Correction value %RH	
45	25.00	45.18	37	+ 8.18	± 1.3
60	25.00	60.03	50	+ 10.03	± 1.5
75	25.00	75.20	64	+ 11.20	± 1.7

Notes

- Calibration results without adjustment.

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

- End of Report -


COPY

Conductivity Meter

Model : SevenCompact

Serial No : C038084210



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 24CH120

Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : SevenCompact
Serial No. : C038084210
ID No. : KB-LAB-64/001
Condition As-Received: Used Item
Received Date : 23 January 2024
Calibration Date : 24 January 2024
Reference : 2401-0720DSC-1
Submitted by : Eastern Thai Consulting 1992 Co.,Ltd.
129 Moo.1 Nonsi ,
Kabinburi , Prachinburi 25110
Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure: In -house method :
- CP-CH6 : based on direct measurement by
using certified reference material (CRM)

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

- () Saithip Meangmai
() Warakorn Lerngagtrakul
(☒) Ponpan Paipim

Issue Date : 25 January 2024

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

COPY



Cert.No.: 24CH120

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	1963878	130RC095	2311051	05 Sep 2024

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
1413.0 $\mu\text{S/cm}$	CPA Chem	931955	30 Sep 2024

- Control Conductivity calibration solution temperature by Water bath (25 ± 0.1) $^{\circ}\text{C}$

3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413.0 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 5820300339

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
1413.0 $\mu\text{S/cm}$	1371 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00

Remark

- UUC* = Unit Under Calibration

- Cell constant = 0.548696 cm^{-1}

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

-o0o-

COPY

R2

HOT AIR OVEN

Model : UF110

Serial No. : B420.0827

CERTIFICATE OF CALIBRATION

Certificate No. : 24-128426

Sample Code : 24-51593-002

Customer : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo 1, Suwannasorn Rd., Nonsri,
Kabinburi, Prachinburi 25110

Location of Calibration : Eastern Thai Consulting 1992 Co., Ltd.
(Laboratory)

Equipment : Temperature controlled enclosures (Hot air oven)

Manufacturer : Memmert **Model** : UF 110

Serial No. : B420.0827 **ID No.** : KB-LAB-63/008

Date of Receipt : 03 October 2024 **Date of Calibration** : 03 October 2024

Condition of Calibration

1. **Environment**
- | | |
|---------------------------|---|
| 1.1 Ambient temperature | : Maximum 31.9 °C ; Minimum 30.3 °C |
| 1.2 Relative humidity | : Maximum 74.4 % ; Minimum 63.0 % |
| 1.3 Line voltage supplied | : Maximum 224.0 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-11 (RTD-138 to RTD-146)	24-040191	07 April 2025

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

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

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

6. Condition of calibration item : Normal

COPY



Calibrated by Mr. Sarut Sa-nguansin
Scientist

Approved by (Mr. Somchai Neampunt)
Signed for Director

Issue date 04 October 2024

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

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

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

REPORT OF CALIBRATION

Certificate No. : 24-128426

Sample Code : 24-51593-002

Results of Calibration

Resolution : 0.1 °C

1. Reporting of Temperature

Calibration point (°C)	UUC* setting (°C)	UUC* reading (°C)	Measured temperature at each positions (°C)									Uncertainty ± (°C)	Coverage factor k
			# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9 ^{Ref}		
85	85.0	85.0	85.21	84.73	85.12	85.26	85.12	84.89	85.09	84.82	85.16	0.25	2.00
104	104.0	104.0	104.24	103.55	104.05	104.19	104.03	103.70	104.27	103.62	104.06	0.47	2.00
150	150.0	150.0	150.26	149.19	149.89	149.96	149.72	149.24	150.50	149.06	149.77	0.47	2.00
180	180.0	180.0	180.56	179.30	180.10	180.09	179.83	179.27	180.82	179.03	179.88	0.48	2.00

2. Characterization results

Calibration point (°C)	Stability ± (°C)	Uniformity (°C)	Overall variation (°C)
85	0.07	0.47	0.62
104	0.07	0.56	0.86
150	0.13	0.82	1.69
180	0.13	1.04	2.01

Notes

- UUC* = Unit Under Calibration




REPORT OF CALIBRATION

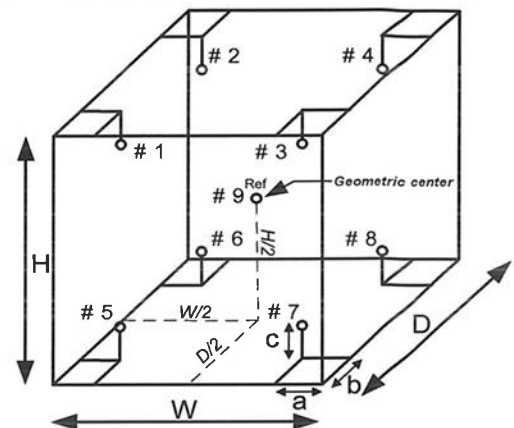
Certificate No. : 24-128426

Sample Code : 24-51593-002

Results of Calibration

Notes

1. Sensor installation locations
 - 1.1 All sensors at any corners or walls should be positioned 5 cm (a x b x c) from the wall.
 - 1.2 The reference sensor is preferably located of the geometric center of the chamber.
2. Interior dimensions approx of chamber :
W = 56 cm ; D = 40 cm ; H = 48 cm
3. Air valve or fresh air level : Off
4. Fan level : Open
5. The quoted uncertainty includes" Stability of chamber and loading effect in chamber at 20% of uniformity ".
6. Uniformity - the maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.
7. Stability - one-half of the greatest maximum difference of measured temperatures at any one sensor.
8. Overall variation - the difference of the maximum and the minimum measured temperatures throughout observation time.
9. UUC* reading - the average reading of indicating device that forms the integral part of the enclosure.
10. Calibration results without adjustment.



**Figure: Example of sensor
installation Positions**

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

- End of Report -



COPY

Dissolved Oxygen and BOD

Model : HI98193

Serial No : 03500057101

Certificate No. : HIT-2422-0732

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : Dissolved Oxygen and BOD Meter

Meter Model : HI98193 **Serial No. :** 03500057101

Probe Model : HI764073 **Serial No. :** KC1N42MCK

Manufacturer : Hanna Instruments **Made in :** Romania

Condition As-Received : Used Product **Reference :** RE240897

Customer name : Eastern Thai Consulting 1992 Co., Ltd.
129 Moo. 1, Nonsi Kabinburi, Kabinburi,
Prachinburi 25110

Received date : 27 May 2024

Calibrate date : 28 May 2024

Issue date : 30 May 2024


Ambient Temperature : (25 ± 2) °C

Relative Humidity : (50 ± 15) % RH

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house: calibration procedure
CP-11 by using certified reference material (CRM).

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Channarong Soinak

Approved by : 
Mr. Anan Suwanchaisakul

Authorized Signatory

 COPY **HANNA**
Instruments
(Thailand) Limited

This certificate was certified only for the instrument we calibrated.

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

**** This certificate may not be reproduced other than in full, except with the prior written ****
approval of the head of Hanna Instrument (Thailand)

Condition of this calibration result

1. Reference Standard Instruments : This certification is traceable to the international unit of thru Technology Promotion Association (Thailand-Japan).

Instruments	Model	Serial No.	Certificate No.
Thermometer with sensor	HI98509	39643D	23T1453
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41

2. Reference Standard Materials : DO Calibration standard traceable thru Hanna Instrument Ltd.

Zero Oxygen Solution	Model No.	Mean Value	Ref. No.	Lot Number	Exp. date
HI7040L	HI7040L	0.0 ± 0.1@25°C	27C32	S0028/23	March 2028

Calibration Result

Inspection the accuracy of the Dissolved Oxygen (DO) Meter by using the following certificate reference material value.

Unit Under Calibration	CRM Standard DO	Actual value Reading	Error value Reading	Uncertainty of Measurement (±)
DO Electrode S/N KC1N42MCK	0.0 mg/L	0.00 mg/L	0.00 mg/L	N/A
	8.3 mg/L	8.26 mg/L	-0.04 mg/L	0.33 mg/L

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

**** End of certificate ****

COPY

ATOMIC ABSORPTIONSPECTROPHOTOMETER

Modle : PinAAcle 900F

Serial No : PFBS22080801

PinAAcle 900F Preventive Maintenance Report

Company Name: Eastern Thai Consulting 1992 Ci.,Ltd.

Instrument Location: 683 Moo 11 Sukapibal 8 Rd. Nong Kham,
Si Racha, Chonburi 20230


Instrument Serial No.: PFBS22080801

Date: 25-Oct-2024

COPY

PinAAcle 900F Preventive Maintenance (PM)

Company Name:	Eastern Thai Consulting 1992 Ci.,Ltd.		
Address (Instrument Location):	683 Moo 11 Sukapibal 8 Rd. Nong Kham, Si Racha, Chonburi 20230		
Serial Number:	PFBS22080801	PM Number:	2 of 2
Customer Name (if applicable):		Telephone Number:	
Customer Support Engineer Name:	Khwanchai	Service Order Number:	WO-02963148
Date PM Performed: (DD-MMM-YYYY)	25-Oct-2024	Next PM Due Date: (DD-MMM-YYYY)	25-Apr-2025
Standard Labor Hours to Complete PM :		5 hours	

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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

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

Update the PM sticker and instrument logbook as required.

Copyright Information

This document contains proprietary information that is protected by copyright. All rights are reserved.

No part of this publication may be reproduced in any form whatsoever or translated into any language without the prior, written permission of PerkinElmer, Inc.

Copyright © 2013 PerkinElmer, Inc.

Trademarks

Registered names, trademarks, etc. used in this document, even when not specifically marked as such, are protected by law. PerkinElmer is a registered trademark of PerkinElmer, Inc. All other trademarks and registered trademarks not owned by PerkinElmer, Inc. or its subsidiaries that are depicted herein are the property of their respective owners. **Except as specifically set forth in its terms and conditions of sale, PerkinElmer makes no Warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.**

PerkinElmer shall not be liable for incidental or consequential damages in connection with the furnishing or use of this document.

Component List

Component / Specific Model	Serial #	Configuration Notes
FIAS100		

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	NA
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	NA
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	NA
N9301714	Replacement Acetylene Filter Cartridge	NA
TH001022	Replacement Air Filter Cartridge	NA

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	APR-2025

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

COPY

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

COPY

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

COPY

7. Flame Interlock Check:

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

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

8. After PM Performance tests:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	1.0531	1.0516	Pass
0.2 A ND Filter	± 5% from Cert.	0.1806	0.1791	Pass

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0013	Pass

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

COPY

8.4 D₂ Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	-0.0204	Pass

8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0003	Pass

8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0004	Pass

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	NA
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3874	Pass

10. Review:


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

COPY

Additional Comments

Additional Comments Regarding the PM
None

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.</i>	
<i>This PinAAcle 900F Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: 	Date: 25-Oct-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 25-Oct-2024 (DD-MMM-YYYY)

