



ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ

---



**List of Instruments Certification for Air & Noise Quality Analysis**

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Ambient</b>									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Tisch Environmental, Inc.	TE-5025A 3393	Jirunatee Associates Co., Ltd.	CL-004-65	26 Jul 22	25 Jul 24	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	23P1403	9 May 23	8 May 24	-
3	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23P1857	2 Jun 23	1 Jun 24	-
4	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM <sub>10</sub> )	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1201	5 Jun 23	5 Jun 24	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-67174-356	UAE Consultant Co., Ltd.	01112023	1 Nov 23	31 Oct 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Environmental Instrument	42C 42C-78933-390	UAE Consultant Co., Ltd.	13112023	13 Nov 23	12 Nov 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920005	UAE Consultant Co., Ltd.	13112023	13 Nov 23	12 Nov 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1182920006	UAE Consultant Co., Ltd.	01112023	1 Nov 23	31 Oct 24	-
9	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
10	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1182920015	UAE Consultant Co., Ltd.	09112023	9 Nov 23	8 Nov 24	-
11	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	42i 1182920016	UAE Consultant Co., Ltd.	03112023	3 Nov 23	2 Nov 24	-
12	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540065	UAE Consultant Co., Ltd.	03112023	3 Nov 23	2 Nov 24	-
13	Sulphur Dioxide Analyzer	Sulphur Dioxide	Thermo Scientific	43i 1180540066	UAE Consultant Co., Ltd.	09112023	9 Nov 23	8 Nov 24	-
14	Standard Gases (Mixture)	Sulphur Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-

**List of Instruments Certification for Air & Noise Quality Analysis**

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Ambient</b>									
15	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	01dB	CAL31 82795	Innovative Instrument Co., Ltd.	23-ACT-109	27 Jun 23	26 Jun 24	-
16	Sound Level Meter	L <sub>Aeq</sub> 24 hrs, L <sub>A90</sub> , L <sub>Amax</sub> , L <sub>Adn</sub> ระดับเสียงรบกวน	Larson Davis	LxT1 0007301	Larson Davis-A PCB Piezotronics Div.	2023003657	22 Mar 23	21 Mar 24	-
17	Sound Level Meter	L <sub>Aeq</sub> 24 hrs, L <sub>A90</sub> , L <sub>Amax</sub> , L <sub>Adn</sub> ระดับเสียงรบกวน	Larson Davis	LxT1 0007302	Larson Davis-A PCB Piezotronics Div.	2023003659	22 Mar 23	21 Mar 24	-
18	Sound Level Meter	L <sub>Aeq</sub> 24 hrs, L <sub>A90</sub> , L <sub>Amax</sub> , L <sub>Adn</sub> ระดับเสียงรบกวน	Larson Davis	LxT1 0007303	Larson Davis-A PCB Piezotronics Div.	2023003660	22 Mar 23	21 Mar 24	-

**List of Instruments Certification for Water Quality Analysis**

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
<b>Water</b>									
1	pH Meter	pH	YSI	pH100A JC03354	Technology Promotion Association (Thailand-Japan)	23CH1487	22 Dec 23	21 Dec 24	-
2	DO Meter	DO	YSI	Pro 20i 18H110495	Technology Promotion Association (Thailand-Japan)	23TW174	26 Jul 23	25 Jul 24	-
3	Conductivity Meter	Conductivity	YSI	Pro30 17A102921	Technology Promotion Association (Thailand-Japan)	23CH1228	28 Sep 23	27 Sep 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020022	Innovative Instrument Co.,Ltd.	23-TPM-370	7 Aug 23	6 Aug 24	-
2	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020025	Innovative Instrument Co.,Ltd.	23-TPM-253	12 May 23	11 May 24	-
3	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 32 TPT030008	Innovative Instrument Co.,Ltd.	23-TPM-502	2 Nov 23	1 Nov 24	-
4	Primary Flow Calibrator	Calibrate personal pump	TSI,Inc	4146 41461922007	Innovative Instrument Co., Ltd.	23-AFM-221 Rev.1	25 Oct 23	24 Oct 24	-
5	Dial Thermo-Hygrometer	Total Dust Respirable Dust	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	23H1200	6 Jun 23	5 Jun 24	-
6	Digital Thermo - Hygrometer	Total Dust Respirable Dust	Digicon	TH-02 395034175	Technology Promotion Association (Thailand-Japan)	23H1101	24 May 23	23 May 24	-
7	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV36 107224	Innovative Instrument Co.,Ltd.	23-ACT-117	4 Aug 23	3 Aug 24	-
8	Sound Level Meter	$L_{Aeq} \ 8 \ hrs^p \ L_{Amax}$	Rion, Japan	NL-42 01010779	Sithiporn Associates Co., Ltd.	ACL23146	9 May 23	8 May 24	-
9	Sound Level Meter	$L_{Aeq} \ 8 \ hrs^p \ L_{Amax}$	Rion, Japan	NL-42 01010780	Sithiporn Associates Co., Ltd.	ACL23119	11 Apr 23	10 Apr 24	-
10	Sound Level Meter	$L_{Aeq} \ 8 \ hrs^p \ L_{Amax}$	Rion, Japan	NL-42 00409178	Sithiporn Associates Co., Ltd.	ACL23131	26 Apr 23	25 Apr 24	-
11	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143231	Innovative Instrument Co.,Ltd.	23-NDM-185	7 Aug 23	6 Aug 24	-
12	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143225	Innovative Instrument Co.,Ltd.	23-NDM-179	7 Aug 23	6 Aug 24	-

## CERTIFICATE OF CALIBRATION

Certificate No. : CL-004-65

**MEASUREMENT ITEM**  
**MANUFACTURER**  
**MODEL/TYPE**  
**SERIAL NUMBER**  
**ID NUMBER**  
**CONDITION AS-RECEIVED**  
**CUSTOMER**

: Top Load Orifice  
: Tich Environmental, Inc.  
: TE-5025A  
: 3393  
: UAE EFM.064/2560  
: Used Item  
: United Analyst and Engineering Consultant Co.,Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,  
Bangkok 10260

**RECEIVED DATE**  
**MEASUREMENT DATE**  
**ISSUE DATE**

: 15 Jul 2022  
: 25 Jul 2022  
: 26 Jul 2022

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature :  $23.0 \pm 3.0$  °C  
Relative Humidity :  $55.0 \pm 15.0$  %RH  
Atmospheric Pressure :  $1010 \pm 10$  hPa

**CALIBRATION CONDITION:**  
Preconditioning  
Measurement Condition

: 24 hours at ambient conditions.  
: The average values during measurement are 24.7 °C and 52.1 %RH.

### TABULATION OF RESULTS:

The table on next page give the measured values.

**Calibration procedure:**  
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model GGS/IMC/M2-dp. The WH-CL-004 was used as a calibration guideline.

**Traceability:**  
This certificate provides a traceability of The measurement to recognized the national standards and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211501

**Uncertainty of Measurement:**  
The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM "Evaluation of measurement measurement"

Calibrated by:

☐ Mr. Sorawit Thachalad  
☒ Miss Jitraporn Lertsomphol

Approved signatory:

Mr. Parnya Booncharoen  
Calibration Department Manager

Continuation of Certificate of Calibration Number CL-004-65

Page 2 of 2 Pages

### MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25 °C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [°a] °C	Temperature [°m] °C	Ap_meter mmHg	Ap_Orifice InH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.699	756.468	24.680	23.730	55.667	1.705	1.303	0.647
2	1.001	756.479	24.910	24.180	61.363	3.454	1.855	0.918
3	1.114	756.494	24.550	23.970	41.751	4.535	2.136	1.051
4	1.166	756.510	24.470	23.900	30.652	5.138	2.264	1.118
5	1.416	756.534	24.400	24.150	30.200	7.619	2.757	1.357

Slope (m): 2.04689

Intercept (b): -0.02301

Correlation coefficient (r): 0.99987

Uncertainty (k=2): 0.010 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m <sup>3</sup> /min	Pressure [Pa] mmHg	Temperature [°a] °C	Temperature [°m] °C	Ap_meter mmHg	Ap_Orifice InH <sub>2</sub> O	γ	Standard Flow [Q <sub>s</sub> ] m <sup>3</sup> /min
1	0.699	756.468	24.680	23.730	55.667	1.705	0.819	0.649
2	1.001	756.479	24.910	24.180	61.363	3.454	1.167	0.922
3	1.114	756.494	24.550	23.970	41.751	4.535	1.336	1.054
4	1.166	756.510	24.470	23.900	30.652	5.138	1.422	1.121
5	1.416	756.534	24.400	24.150	30.200	7.619	1.731	1.360

Slope (m): 1.28208

Intercept (b): -0.01449

Correlation coefficient (r): 0.99987

Uncertainty (k=2): 0.011 m<sup>3</sup>/min

\*\*\*End of Certificate of Calibration\*\*\*





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARNY ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484

## Certificate of Calibration

Certificate No. : 23P1403  
Page : 1 of 2

Equipment : U-Tube Manometer  
Manufacturer : Dwyer  
Model : 1221-36-W/M  
Serial No. :  
ID No. : UAE EFM.181/2561  
Condition As-Received: Used Item  
Received Date: 26 April 2023  
Calibration Date: 09 May 2023

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.

Reference: 2304-0703WSC  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1010 mbar  
81 Soi Udonsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments  
Standard according to in-house calibration procedure CP-P04, using " DKD-R 6-1 ; Calibration of Pressure  
Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments :

1) Pressure Calibrator  
Model : PC106P  
Serial No. : 1189  
Certificate No. : MP-0137-22  
Due Date : 24 Aug 2023  
2. This result of calibration was made on requested at the point specified by customer.  
3. Scale and conversion factor is 1 kPa = 4.0146293 inH<sub>2</sub>O  
4. This instrument was used clean air as pressure media.

5. This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.

6. This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.

7. The certificate is valid only to the item calibrated on date and place of calibration.

8. This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suwit Aussaree  
Issue Date : 11 May 2023

Approved Sign

[ ] Pramises Prachaput  
[ ] Sura Suwannasri  
[ ] Attapol Panurach

เอกสารไม่ควบคุม  
B 0314243



Cert.No.: 23P1403  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Pressure Measurement  
Increasing Pressure  
Range: 0 inH<sub>2</sub>O to 36 inH<sub>2</sub>O  
Scale Interval: 0.1 inH<sub>2</sub>O (The Fifth Estimate )

Applied Pressure (inH <sub>2</sub> O)	UUC Indication		Error (inH <sub>2</sub> O)
	High-port side (inH <sub>2</sub> O)	Low-port side (inH <sub>2</sub> O)	
0.00	0.00	0.00	0.00
2.00	1.00	-1.00	0.00
4.00	2.00	-2.00	0.00
6.00	3.00	-3.00	0.00
8.00	4.00	-4.02	0.02
10.00	5.00	-5.02	0.02
12.00	6.00	-6.02	0.02
14.00	6.98	-7.00	-0.02
16.00	7.98	-8.00	-0.02
18.00	8.98	-9.00	-0.02
20.00	9.98	-10.00	-0.02
22.00	11.00	-11.02	0.02
24.00	12.00	-12.02	0.02
26.00	13.00	-13.04	0.04
28.00	14.00	-14.04	0.04
30.00	15.00	-15.02	0.02
32.00	16.00	-16.02	0.02
34.00	16.96	-17.00	-0.04
35.80	17.96	-18.00	0.16

The uncertainty of measurement was ± 0.11 inH<sub>2</sub>O

\* UUC = Unit Under Calibration

\* ΔP = High-port side - Low-port side

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

-000-

เอกสารไม่ควบคุม  
a 1160342



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



NSC-TIS-71571525  
CALIBRATION 0008

## Certificate of Calibration

Certificate No. : 23P1857  
Page : 1 of 2

Equipment : Aneroid Barometer  
Manufacturer : Barigo  
Model : -  
Serial No. : -  
ID No. : UAE ANV.151/2550  
Condition As-Received: Used Item  
Received Date: 26 May 2023  
Calibration Date: 02 June 2023

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

Reference: 2305-0919WSC  
Ambient Temperature: ( 23 ± 2 ) °C  
Relative Humidity: ( 50 ± 15 ) %  
Atmospheric Pressure: 1007 mbar

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.

### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP1142	1422505046	MP-0094-23	03 May 2024

2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.

3. This result of calibration was made on requested at the point specified by customer.

4. This result of calibration instrument was in absolute pressure.

5. This instrument was used clean air as pressure media.

6. The certificate is valid only to the item calibrated on date and place of calibration.

7. This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew  
Issue Date : 08 June 2023

Approved Signatory :

Altapoi Panurach

เอกสารไม่ควบคุม  
B 0316957



Cert.No.: 23P1857  
Page: 2 of 2

Result of calibration:- Without adjustment  
Function:- Absolute Pressure Measurement  
Range: 960 hPa to 1030 hPa  
Scale Interval: 1 hPa ( The Fifth Estimate )

### Increasing Pressure

Applied Pressure (hPa)	960.27	971.66	982.37	994.32	1001.76	1010.97	1020.99	1030.52
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	-0.27	-1.66	-2.37	-4.32	-1.76	-0.97	-0.99	-0.52

### Decreasing Pressure

Applied Pressure (hPa)	1030.52	1021.07	1011.30	1001.83	992.38	982.43	971.77	960.50
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-0.52	-1.07	-1.30	-1.83	-2.38	-2.43	-1.77	-0.50

The uncertainty of measurement was ± 0.30 hPa

\* UUC = Unit Under Calibration

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

-o0o-

เอกสารไม่ควบคุม  
a 1165501





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



## Certificate of Calibration

Certificate No. : 23H1201  
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer  
Manufacturer: Barigo  
Model :  
Serial No.:  
ID No.: UAE.EMA2.014/2555  
Condition As-Received: Used Item  
Received Date: 26 May 2023  
Calibration Date: 30 May 2023  
Reference: to 06 June 2023  
2305-0919WSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison  
with standard chilled mirror sensor for humidity measurement function and comparison with standard  
temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	231305	15 Mar 2024

2. The certificate is valid only to the item calibrated on date and place of calibration.

3. This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Standards and Technology (NIST) , The United States of America

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Somchai Dumwor  
Issue Date : 07 June 2023

Approved Signatory :

[ ] Ch  
[ ] Pornthippa Tameyakul  
[ ] Viporn Tantiyawutti

เอกสารไม่ควบคุม  
B 0316275



Cert. No.: 23H1201  
Page.: 2 of 2

Result of Calibration:-  
Function: Humidity Measurement

Before Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	55	14.9	1.6
25.0	60.0	66	6.0	1.7
25.0	80.0	78	-2.0	1.9

Result of Calibration:-  
Function: Humidity Measurement

After Adjustment

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	46	5.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	72	-8.0	1.9

Result of Calibration:-  
Function: Temperature Measurement

Without Adjustment

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.0	-0.944	0.72

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied  
by coverage factor k = 2.00, providing confidence level approximately 95%.

-o0o-

**MULTI-POINT GAS TEST REPORT**

**Test Date** : Nov 1, 2023

**Equipment** : Gas Analyzer (NO<sub>2</sub>)  
**Manufacturer** : Thermo Environmental Instruments

**Model** : 42C  
**Serial Number** : 42C- 67174-356

**Standard Gas Concentration**

Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 21, 2024

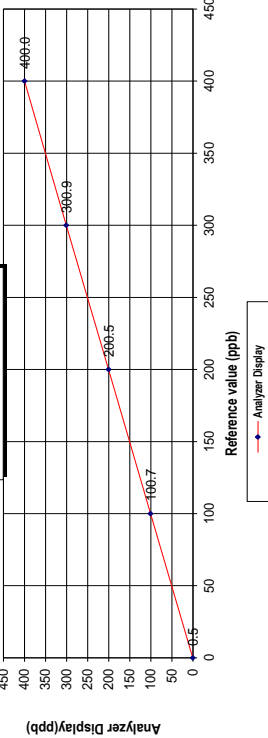
**Dilutor Detail**

Manufacturer : Thermo Scientific  
Model : 1461  
Serial Number : 1180540071

**Multi-point gas test data**

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1	Zero	0.0	0.50	0.50	0.50
Level 2	20.00%	100.0	0.70	0.70	0.70
Level 3	40.00%	200.0	0.50	0.25	0.25
Level 4	60.00%	300.9	0.90	0.30	0.30
Level 5	80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range		500.0 ppb	Average Difference (%)		0.35

**Multi-Point Gas Test Chart**



13 / Nov / 2023

Calculate by

side (CO) 984.8  
EB0143262  
e. Jun 21, 2024

Multi-

Approve by

13 / Nov / 2023

# MULTI-POINT GAS TEST REPORT

Test Date : Nov 13, 2023

**Equipment:**

42i

**Model :**

**Manufacturer :** Thermo Scientific

1182920005

**Serial Number :**

### **Standard Gas Concentration**

Sulphur Dioxide (SO<sub>2</sub>)

**Manufacturer :**

Thermo Scientific

Nitric Oxide (NO)

Model :

146i

Methane ( $\text{CH}_4$ )

Serial Number :

1180540071

Carbon Monoxide (CO)

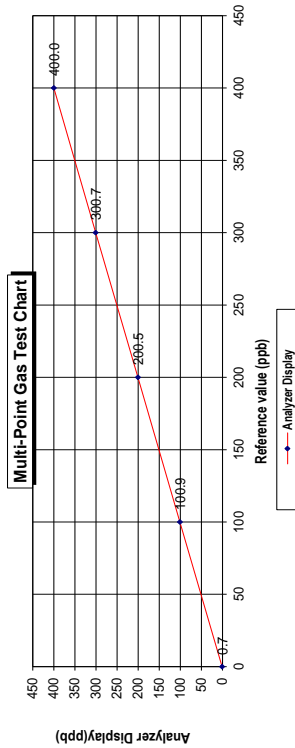
Cylinder No.:

Expiration Date :

### Multi-point gas test data

Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1	Zero	0.0			
Level 2	20.00%	100.0	0.70	0.70	0.70
Level 3	40.00%	200.0	0.90	0.89	0.89
Level 4	60.00%	300.5	0.50	0.25	0.25
Level 5	80.00%	300.7	0.70	0.23	0.23
Remark : Measuring Range		400.0	0.00	0.00	0.00
		500.0 ppb	Average Difference (%)		0.41

Remark : Measuring Range  
:Acceptable Limit + 5%



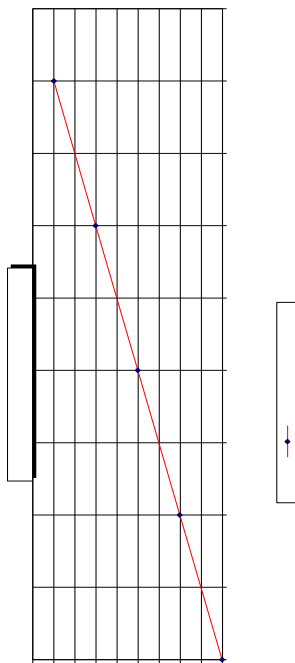
**Calculate by**

01 / Nov / 2023

Multi-

Approve by \_\_\_\_\_

01 / Nov / 2023





Airgas Specialty Gases  
Airgas USA, LLC  
690 United Drive  
Durham, NC 27713  
Airgas.com

## CERTIFICATE OF ANALYSIS

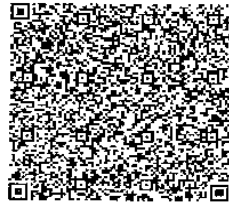
### Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3  
Cylinder Number: EB0143262  
Laboratory: 124 - Durham (SAP) - NC  
PGVP Number: B22021  
Gas Code: CO, NO, NOX, SO<sub>2</sub>, BALN  
Reference Number: 122-402135167-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: Jun 21, 2021  
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-20/01, using the assay procedures listed. Analytical methodology does not include a correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant interferences noted. Do not use this cylinder below 100 psig. Use 0.2 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.95 PPM	G1	+/- 1.4% NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.88 PPM	G1	+/- 1.0% NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				
CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC700058	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D665025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423830102	CC306681	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16911043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.6%	Jun 17, 2022
NTRM	14050119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 15, 2025
The SRM, PRM or RSM noted above is only in reference to the GMS used in the assay and not part of the analysis.					
ANALYTICAL EQUIPMENT					
Instrument Make/Model	Last Multipoint Calibration				
Nicolet 6700 AHR0801333 CO	Jun 03, 2021				
Nicolet 6700 AHR0801333 NO	Jun 03, 2021				
Nicolet 6700 AHR0801333 NO2	Jun 03, 2021				
Nicolet 6700 AHR0801333 SO2	Jun 03, 2021				

Triad Data Available Upon Request  
NOTES: PO #5221002807  
GROSS WT: 28.40kg  
NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

Release

CERT 3092.01  
เอกสารไม่ควบคุม

United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260  
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

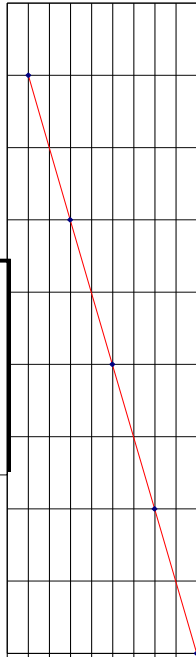


side (CO) 984.8  
EB0143262  
e : Jun 24, 2024  
Calculate by  
9 / 11 / 66

Multi-

Approve by

9 / Nov / 2023



MULTI-POINT GAS TEST REPORT

Test Date : Nov 3, 2023

Equipment : Gas Analyzer (SO<sub>2</sub>) Model : 43i  
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920016

Standard Gas Concentration

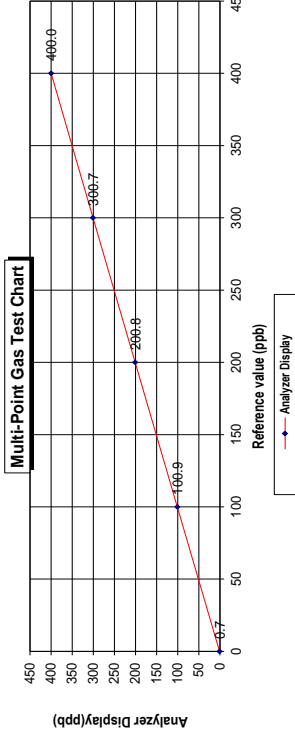
Sulphur Dioxide (SO<sub>2</sub>) 44.68 PPM  
Nitric Oxide (NO) 45.94 PPM  
Methane (CH<sub>4</sub>) - PPM  
Carbon Monoxide (CO) 984.8 PPM  
Cylinder No. : EB0143262  
Expiration Date : Jun 24, 2024

Dilutor Detail

Manufacturer : Thermo SCIENTIFIC  
Model : 146i  
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error ]
Level 1 Zero	0.0	0.70	0.70	0.70
Level 2 20.00%	100.0	0.90	0.89	0.89
Level 3 40.00%	200.0	0.80	0.40	0.40
Level 4 60.00%	300.0	0.70	0.23	0.23
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb		Average Difference (%)		
:Acceptable Limit ± 5%		0.44		



.....  
023.....

03 / Nov / 2023

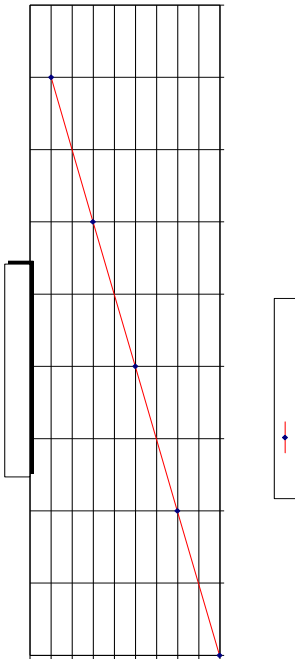
Calculate by

side (CO) 984.8  
EB0143262  
e. Jun 24, 2024

Multi-

Approve by

03 / Nov / 2023



**MULTI-POINT GAS TEST REPORT**

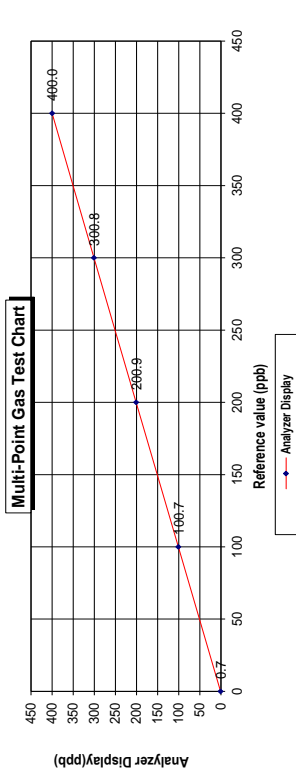
**Test Date** : Nov 9, 2023

<b>Equipment</b> :	Gas Analyzer (SO <sub>2</sub> )	<b>Model</b> :	431
<b>Manufacturer</b> :	Thermo SCIENTIFIC	<b>Serial Number</b> :	1180540066
<b>Standard Gas Concentration</b>			
Sulphur Dioxide (SO <sub>2</sub> )	44.68	PPM	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94	PPM	1461
Methane (CH <sub>4</sub> )	-	PPM	1180540071
Carbon Monoxide (CO)	984.8	PPM	
Cylinder No. :	EB0143262		
Expiration Date :	Jun 24, 2024		
<b>Dilutor Detail</b>			
Manufacturer :	PPM		
Model :	PPM		
Serial Number :	PPM		

**Multi-point gas test data**

Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	% Error ]
Level 1 Zero	0.0	0.70	0.70	0.70
Level 2 20.00%	100.0	100.7	0.70	0.70
Level 3 40.00%	200.0	200.9	0.90	0.45
Level 4 60.00%	300.0	300.8	0.80	0.27
Level 5 80.00%	400.0	400.0	0.00	0.00
Average Difference (%)				0.42

Remark : Measuring Range  
:Acceptable Limit  $\pm 5\%$



**CERTIFICATE OF ANALYSIS**  
**Grade of Product: EPA Protocol**

Part Number: E04N199E15A01D3  
Cylinder Number: EB0143262  
Laboratory: 124 - Durham (SAP) - NC  
PGVP Number: B22021  
Gas Code: CO,NO,NOX,SO2,BALN  
Reference Number: 122-402135167-1  
Cylinder Volume: 144.4 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: Jun 21, 2021  
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-12/031, using the assay procedures listed. Analytical methodology does not include a correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant interferences that affect the use of this calibration mixture. All calculations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig. i.e. 6.7 megapascals

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.95 PPM	G1	$\pm 1.4\%$ NIST Traceable	05/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	$\pm 1.0\%$ NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	06/14/2021
NITROGEN	Balance				

**CALIBRATION STANDARDS**

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CCT00068	49.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.0\%$	Feb 02, 2025
PRM	12386	DB65025	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.0\%$	Feb 20, 2020
GMIS	401423838102	CC506881	4.348 PPM NITROGEN DIOXIDE/AIR	$\pm 2.1$	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.6\%$	Jun 17, 2022
NTRM	14050119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.6\%$	Nov 15, 2025

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

**ANALYTICAL EQUIPMENT**

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the [redacted] gas. This concludes the test report.

CERT 3002-01

เอกสารไม่ควบคุม



Certificate of Calibration

**Customer**  
Name : UNITED ANALYST AND ENGINEERING  
Address : CONSULTANT CO.,LTD.  
: 81 Soi Udonsuk 41, Sukhumvit Road, Bangchak,  
Prakanong, Bangkok 10260

**Certificate No** : 23-ACT-109  
**Request No** : Req-2023-1406

Unit Under Calibration Details

Measurement item : Acoustic Calibrator  
Manufacturer : 01dB  
Model : CAL31  
Serial Number : 82795  
ID : UAE.EFM.113/2560

Class : 1  
Range : 94 dB / 1000 Hz  
Instrument Status : Used

Calibration Environment and Details

Temperature : ( 23 ±2 °C )  
Humidity : ( 50 ± 20 %RH )  
Barometric Pressure : (1013 ±10.0 hPa )  
Received Date : 26 June 2023  
Calibration Date : 27 June 2023  
Location of Calibration : LAB 1 Acoustic  
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEL	31 May 2024
THD Multimeter	2015	1047765	NIMT	31 January 2024

**Traceability** : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

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

**Calibrated By :** Mr. Noppadon Luangart  
Service Calibration Engineer

**Approval** [Signature]  
Calibration Engineer Supervisor

**Issue Date :** 27 June 2023

Certificate No : 23-ACT-109

Request No : Req-2023-1406

Calibration Results : Without Adjustment

Sound pressure level	Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)	Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
		Measured	Error			
94 dB / 1000 Hz		94.11	0.11	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Error (%)	Measured (%)	Error (%)		
94 dB / 1000 Hz	0.08		-	-	0.40	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

# Calibration Certificate

Certificate Number 2023003657

**Customer:**  
United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

<b>Model Number</b>	LxT1	<b>Procedure Number</b>	D0001.8384
<b>Serial Number</b>	0007301	<b>Technician</b>	Jacob Cannon
<b>Test Results</b>	<b>Pass</b>	<b>Calibration Date</b>	23 Mar 2023
<b>Initial Condition</b>	As Manufactured	<b>Calibration Due</b>	
<b>Description</b>	SoundTrack LxT Class 1	<b>Temperature</b>	23.56 °C ± 0.25 °C
	Class 1 Sound Level Meter	<b>Humidity</b>	49.4 %RH ± 2.0 %RH
	Firmware Revision: 2.404	<b>Static Pressure</b>	86.02 kPa ± 0.13 kPa

**Tested with:** Data reported in dB re 20 µPa.

Larson Davis CAL291, S/N 0108  
Larson Davis PRMLxT1, S/N 077636  
PCB 377B02, S/N 344263  
Larson Davis CAL200, S/N 9079

**Compliance Standards**  
Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-08-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 12" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



2023-3-23T16:57:14

Page 1 of 3

D0001.8406 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003657

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz, Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1, the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Description	Standards Used			
	Cal Date	Cal Due	Cal Standard	
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250	
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798	
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027	
Larson Davis Model 831	2023-02-22	2024-02-22	007182	
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185	
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635	
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783	

## Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

## Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.52	-52.44	-48.33	0.14	Pass

-- End of measurement results--

## Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.17	-0.20	-1.20	0.80	0.23	Pass
1000	0.18	0.00	-0.70	0.70	0.23	Pass
8000	-3.84	-3.00	-5.50	-1.50	0.32	Pass

-- End of measurement results--

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



2023-3-23T16:57:14

Page 2 of 3

D0001.8406 Rev G

เอกสารไม่ควบคุม

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement

Test Result [dB]

A-weighted

40.35

-- End of measurement results--

Signature: *Jacob Cannon*

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



เอกสารไม่ควบคุม

# Calibration Certificate

Certificate Number 2023003632

Customer:

United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

Model Number	LxT1	Procedure Number	D0001.8378
Serial Number	0007301	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	23 Mar 2023
Initial Condition	As Manufactured	Calibration Due	23.58 °C ± 0.25 °C
Description	SoundTrack LxT Class 1 Class 1 Sound Level Meter Firmware Revision: 2.404	Temperature	49.3 %RH ± 2.0 %RH
		Humidity	86.12 kPa ± 0.13 kPa
		Static Pressure	

**Evaluation Method** Tested electrically using Larson Davis PRLxT1 S/N 077636 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards** Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

- IEC 60651:2001 Type 1
- ANSI S1.4-2014 Class 1
- IEC 60804:2000 Type 1
- ANSI S1.4 (R2006) Type 1
- IEC 61252:2002
- ANSI S1.25 (R2007)
- IEC 61672:2013 Class 1
- ANSI S1.43 (R2007) Type 1
- IEC 61260:2001 Class 1
- ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ± in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



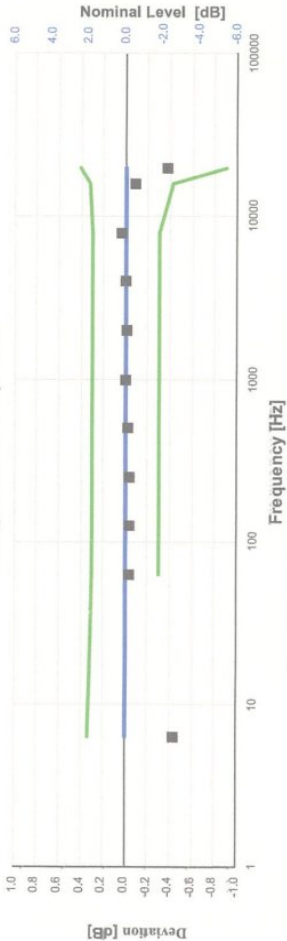
เอกสารไม่ควบคุม



Description	Standards Used	
	Cal Date	Cal Due
Hart Scientific 2636-H Temperature Probe	2021-08-25	2023-05-25
	006798	006798
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29
	007635	007635



Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.6; IEC 60851:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.44	-0.44	-1.11	0.33	0.15	Pass
63.10	-0.04	-0.04	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.28	0.03	0.03	-0.30	0.30	0.15	Pass
15,848.93	-0.09	-0.09	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass

-- End of measurement results--



A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
37.00	0.60	-0.70	0.70	0.16	Pass
38.00	0.51	-0.70	0.70	0.16	Pass
39.00	0.43	-0.70	0.70	0.16	Pass
40.00	0.31	-0.70	0.70	0.16	Pass
41.00	0.26	-0.70	0.70	0.16	Pass
42.00	0.14	-0.70	0.70	0.16	Pass
43.00	0.14	-0.70	0.70	0.16	Pass
44.00	0.06	-0.70	0.70	0.17	Pass
45.00	0.07	-0.70	0.70	0.16	Pass
46.00	0.06	-0.70	0.70	0.16	Pass
47.00	0.05	-0.70	0.70	0.16	Pass
48.00	0.02	-0.70	0.70	0.16	Pass
49.00	0.01	-0.70	0.70	0.16	Pass
54.00	-0.02	-0.70	0.70	0.16	Pass
59.00	-0.04	-0.70	0.70	0.16	Pass
64.00	-0.03	-0.70	0.70	0.16	Pass
69.00	-0.03	-0.70	0.70	0.16	Pass
74.00	-0.04	-0.70	0.70	0.16	Pass
79.00	-0.04	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.03	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	-0.07	-0.70	0.70	0.15	Pass
104.00	0.00	-0.70	0.70	0.15	Pass
109.00	0.00	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
124.00	-0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.00	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	-0.01	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass
139.00	-0.01	-0.70	0.70	0.15	Pass
140.00	0.01	-0.70	0.70	0.15	Pass
-- End of measurement results--					

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	134.70	135.26	0.15	Pass
		Positive Pulse	134.70	135.25	0.15	Pass
	30	Negative Pulse	133.75	135.26	0.15	Pass
		Positive Pulse	133.71	135.25	0.15	Pass
-- End of measurement results--						

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.14	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.16 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.14	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.18	± 1.50	0.15 ±	Pass
106.85	3	-0.14	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.07	± 1.50	0.15 ±	Pass
-- End of measurement results--					

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
126.85	3	-0.12	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	OVL	± 1.50	0.15 ±	Pass
116.85	3	-0.14	± 0.50	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
	10	-0.17	± 1.50	0.15 ±	Pass
106.85	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.12	± 1.00	0.15 ±	Pass
	10	-0.07	± 1.50	0.15 ±	Pass
-- End of measurement results--					

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.96	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.13	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass

-- End of measurement results--

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.07	36.00	Pass
C-weight Noise Floor	26.76	35.00	Pass
Z-weight Noise Floor	32.72	39.00	Pass

-- End of measurement results--

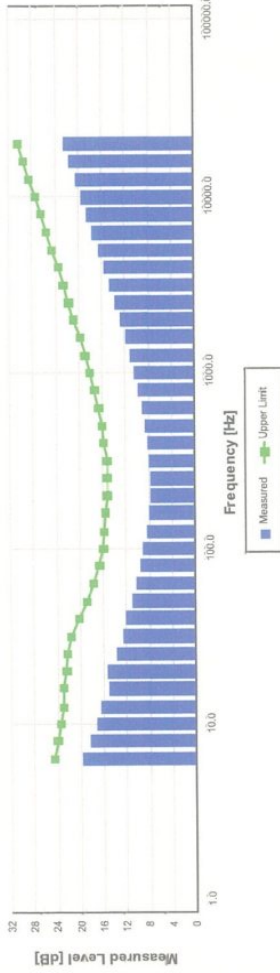
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.30	135.05	136.65	0.15	Pass
THD	-66.99	-58.00	-58.00	0.00 ±	Pass
THD+N	-62.96	-58.00	-58.00	0.00 ±	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.71	24.60	Pass
8.00	18.39	24.00	Pass
10.00	17.27	23.50	Pass
12.50	16.38	23.00	Pass
16.00	15.17	22.90	Pass
20.00	15.37	22.40	Pass
25.00	13.75	22.30	Pass
31.50	12.63	21.50	Pass
40.00	12.07	20.20	Pass
50.00	10.80	18.80	Pass
63.00	10.30	17.60	Pass
80.00	9.46	16.60	Pass
100.00	8.97	15.90	Pass
125.00	8.47	15.70	Pass
160.00	7.89	15.50	Pass
200.00	7.72	15.20	Pass
250.00	7.61	15.20	Pass
315.00	7.89	15.20	Pass
400.00	8.05	15.70	Pass
500.00	8.56	16.00	Pass
630.00	9.04	16.60	Pass
800.00	9.65	17.30	Pass
1,000.00	10.40	18.10	Pass
1,250.00	11.21	18.90	Pass
1,600.00	11.94	19.80	Pass
2,000.00	12.87	20.80	Pass
2,500.00	13.75	21.70	Pass
3,150.00	14.69	22.60	Pass
4,000.00	15.68	23.50	Pass
5,000.00	16.56	24.50	Pass
6,300.00	17.54	25.50	Pass
8,000.00	18.55	26.50	Pass
10,000.00	19.51	27.40	Pass
12,500.00	20.51	28.50	Pass
16,000.00	21.47	29.50	Pass
20,000.00	22.48	30.40	Pass

-- End of measurement results--

# Calibration Certificate

Certificate Number 2023003632

Customer:  
United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonmit 41, Sukhumvit Road,  
Bangchak, Pura Khanong,  
Bangkok, 10260, Thailand

Model Number LX11

Serial Number 0007302

Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 1

Class 1 Sound Level Meter

Firmware Revision: 2.404

## Evaluation Method

Tested with:

PCB 377B02, S/N 344896

Larson Davis PRLX11, S/N 077637

Larson Davis CAL291, S/N 0108

Larson Davis CAL200, S/N 9079

## Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

- IEC 60651:2001 Type 1
- IEC 60804:2000 Type 1
- IEC 61252:2002
- IEC 61260:2001 Class 1
- IEC 61672:2013 Class 1

- ANSI S1.4-2014 Class 1
- ANSI S1.4 (R2006) Type 1
- ANSI S1.11 (R2009) Class 1
- ANSI S1.25 (R2007)
- ANSI S1.43 (R2007) Type 1

Data reported in dB re 20 µPa.

Procedure Number	D0001.8384
Technician	Jacob Cannon
Calibration Date	23 Mar 2023
Calibration Due	23.49 °C ± 0.25 °C
Temperature	49.6 %RH ± 2.0 %RH
Humidity	98.01 kPa ± 0.13 kPa
Static Pressure	

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a \* in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Ltd, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

LARSON DAVIS - A PCB DIVISION

1681 West 820 North

Provo, UT 84601, United States

716-684-0001

2023-3-23T17:16:26



Page 1 of 3



D0001.8406 Rev G

เอกสารไม่ควบคุม

Signature: Jacob Cannon

LARSON DAVIS - A PCB DIVISION

1681 West 820 North

Provo, UT 84601, United States

716-684-0001

2023-3-23T13:44:56

Page 8 of 8

D0001.8407 Rev G





1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz, Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1.72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-50.14	-52.44	-48.33	0.14	Pass

— End of measurement results—

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.24	-0.20	-1.20	0.80	0.23	Pass
1000	0.15	0.00	-0.70	0.70	0.23	Pass
8000	-2.72	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

Signature: *Jacob Cannon*

— End of Report—

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.88

— End of measurement results—





# Calibration Certificate

Certificate Number 2023003635

Customer:  
United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonnuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

Model Number	LXT1	Procedure Number	D0001.8378
Serial Number	0007302	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	23 Mar 2023
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LXT Class 1 Class 1 Sound Level Meter	Temperature	23.62 °C ± 0.25 °C
	Firmware Revision: 2.404	Humidity	50.3 %RH ± 2.0 %RH
		Static Pressure	86.12 kPa ± 0.13 kPa

**Evaluation Method**  
Tested electrically using Larson Davis PRMLXT1 SN 077637 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

**Compliance Standards**  
Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LXT Manual for SoundTrack LXT & SoundExpert Ltd, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



2023-5-23T13:54:02

Page 1 of 8

D0001.8407 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003635

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe SRS DS360 Ultra Low Distortion Generator	2021-08-25	2023-05-25	006798
	2022-09-02	2023-09-02	007167

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



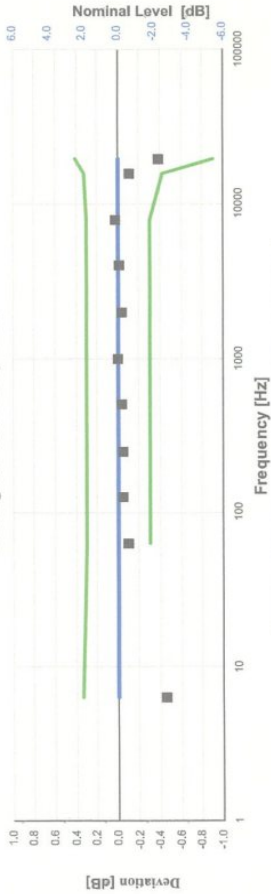
2023-5-23T13:54:02

Page 2 of 8

D0001.8407 Rev G

เอกสารไม่ควบคุม

Z-weight Filter Response

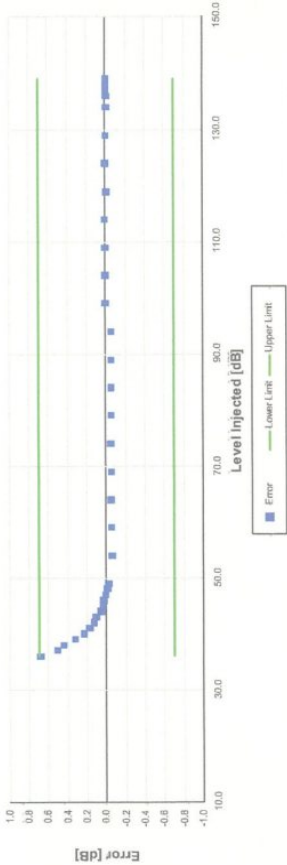


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.45	-0.45	-1.11	0.33	0.15	Pass
63.10	-0.09	-0.09	-0.30	0.30	0.15	Pass
125.89	-0.05	-0.05	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.04	-0.04	-0.30	0.30	0.15	Pass
3,981.07	-0.02	-0.02	-0.30	0.30	0.15	Pass
7,943.28	0.02	0.02	-0.30	0.30	0.15	Pass
15,848.93	-0.11	-0.11	-0.30	0.32	0.15	Pass
19,952.62	-0.39	-0.39	-0.91	0.41	0.15	Pass

— End of measurement results—

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6; IEC 60804:2000 6.2; IEC 61252:2002 8; ANSI S1.4 (R2006) 6.9; ANSI S1.4-2014 Part 1: 5.6; ANSI S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.69	-0.70	0.70	0.16	Pass
37.00	0.51	-0.70	0.70	0.16	Pass
38.00	0.45	-0.70	0.70	0.16	Pass
39.00	0.33	-0.70	0.70	0.16	Pass
40.00	0.23	-0.70	0.70	0.16	Pass
41.00	0.18	-0.70	0.70	0.16	Pass
42.00	0.13	-0.70	0.70	0.16	Pass
43.00	0.11	-0.70	0.70	0.17	Pass
44.00	0.06	-0.70	0.70	0.17	Pass
45.00	0.04	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.02	-0.70	0.70	0.16	Pass
48.00	-0.01	-0.70	0.70	0.16	Pass
49.00	-0.02	-0.70	0.70	0.16	Pass
50.00	-0.06	-0.70	0.70	0.16	Pass
51.00	-0.05	-0.70	0.70	0.16	Pass
52.00	-0.05	-0.70	0.70	0.16	Pass
53.00	-0.05	-0.70	0.70	0.16	Pass
54.00	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.05	-0.70	0.70	0.16	Pass
57.00	-0.05	-0.70	0.70	0.16	Pass
58.00	-0.05	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
60.00	-0.05	-0.70	0.70	0.16	Pass
61.00	-0.05	-0.70	0.70	0.16	Pass
62.00	-0.05	-0.70	0.70	0.16	Pass
63.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.05	-0.70	0.70	0.16	Pass
65.00	-0.05	-0.70	0.70	0.16	Pass
66.00	-0.05	-0.70	0.70	0.16	Pass
67.00	-0.05	-0.70	0.70	0.16	Pass
68.00	-0.05	-0.70	0.70	0.16	Pass
69.00	-0.05	-0.70	0.70	0.16	Pass
70.00	-0.05	-0.70	0.70	0.16	Pass
71.00	-0.06	-0.70	0.70	0.16	Pass
72.00	-0.06	-0.70	0.70	0.16	Pass
73.00	-0.06	-0.70	0.70	0.16	Pass
74.00	-0.06	-0.70	0.70	0.16	Pass
75.00	-0.06	-0.70	0.70	0.16	Pass
76.00	-0.06	-0.70	0.70	0.16	Pass
77.00	-0.06	-0.70	0.70	0.16	Pass
78.00	-0.06	-0.70	0.70	0.16	Pass
79.00	-0.06	-0.70	0.70	0.16	Pass
80.00	-0.05	-0.70	0.70	0.16	Pass
81.00	-0.05	-0.70	0.70	0.16	Pass
82.00	-0.05	-0.70	0.70	0.16	Pass
83.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.05	-0.70	0.70	0.16	Pass
85.00	-0.05	-0.70	0.70	0.16	Pass
86.00	-0.05	-0.70	0.70	0.16	Pass
87.00	-0.05	-0.70	0.70	0.16	Pass
88.00	-0.05	-0.70	0.70	0.16	Pass
89.00	-0.05	-0.70	0.70	0.16	Pass
90.00	-0.05	-0.70	0.70	0.16	Pass
91.00	-0.05	-0.70	0.70	0.16	Pass
92.00	-0.05	-0.70	0.70	0.16	Pass
93.00	-0.05	-0.70	0.70	0.16	Pass
94.00	-0.05	-0.70	0.70	0.16	Pass
95.00	-0.05	-0.70	0.70	0.16	Pass
96.00	-0.05	-0.70	0.70	0.16	Pass
97.00	-0.05	-0.70	0.70	0.16	Pass
98.00	-0.05	-0.70	0.70	0.16	Pass
99.00	-0.05	-0.70	0.70	0.16	Pass
100.00	-0.05	-0.70	0.70	0.16	Pass
101.00	-0.05	-0.70	0.70	0.16	Pass
102.00	-0.05	-0.70	0.70	0.16	Pass
103.00	-0.05	-0.70	0.70	0.16	Pass
104.00	-0.05	-0.70	0.70	0.16	Pass
105.00	-0.05	-0.70	0.70	0.16	Pass
106.00	-0.05	-0.70	0.70	0.16	Pass
107.00	-0.05	-0.70	0.70	0.16	Pass
108.00	-0.05	-0.70	0.70	0.16	Pass
109.00	-0.05	-0.70	0.70	0.16	Pass
110.00	-0.05	-0.70	0.70	0.16	Pass
111.00	-0.05	-0.70	0.70	0.16	Pass
112.00	-0.05	-0.70	0.70	0.16	Pass
113.00	-0.05	-0.70	0.70	0.16	Pass
114.00	-0.05	-0.70	0.70	0.16	Pass
115.00	-0.05	-0.70	0.70	0.16	Pass
116.00	-0.05	-0.70	0.70	0.16	Pass
117.00	-0.05	-0.70	0.70	0.16	Pass
118.00	-0.05	-0.70	0.70	0.16	Pass
119.00	-0.05	-0.70	0.70	0.16	Pass
120.00	-0.05	-0.70	0.70	0.16	Pass
121.00	-0.05	-0.70	0.70	0.16	Pass
122.00	-0.05	-0.70	0.70	0.16	Pass
123.00	-0.05	-0.70	0.70	0.16	Pass
124.00	-0.05	-0.70	0.70	0.16	Pass
125.00	-0.05	-0.70	0.70	0.16	Pass
126.00	-0.05	-0.70	0.70	0.16	Pass
127.00	-0.05	-0.70	0.70	0.16	Pass
128.00	-0.05	-0.70	0.70	0.16	Pass
129.00	-0.05	-0.70	0.70	0.16	Pass
130.00	-0.05	-0.70	0.70	0.16	Pass
131.00	-0.05	-0.70	0.70	0.16	Pass
132.00	-0.05	-0.70	0.70	0.16	Pass
133.00	-0.05	-0.70	0.70	0.16	Pass
134.00	-0.05	-0.70	0.70	0.16	Pass
135.00	-0.05	-0.70	0.70	0.16	Pass
136.00	-0.05	-0.70	0.70	0.16	Pass
137.00	-0.05	-0.70	0.70	0.16	Pass
138.00	-0.05	-0.70	0.70	0.16	Pass
139.00	-0.05	-0.70	0.70	0.16	Pass

— End of measurement results—

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
137.85	40	Negative Pulse	135.39	133.91	135.91	Pass
		Positive Pulse	135.36	133.88	135.88	Pass
30	30	Negative Pulse	134.11	133.91	135.91	Pass
		Positive Pulse	134.04	133.88	135.88	Pass
— End of measurement results—						

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
		OVLD	± 1.00	0.15 ±	Pass
126.85	10	OVLD	± 1.50	0.15 ±	Pass
		OVLD	± 0.50	0.15 ±	Pass
116.85	5	OVLD	± 1.00	0.16 ±	Pass
		OVLD	± 1.50	0.15 ±	Pass
106.85	3	OVLD	± 0.50	0.15 ±	Pass
		OVLD	± 1.00	0.15 ±	Pass
106.85	10	OVLD	± 1.50	0.15 ±	Pass
		OVLD	± 0.50	0.15 ±	Pass
106.85	5	OVLD	± 1.00	0.15 ±	Pass
		OVLD	± 0.50	0.15 ±	Pass
106.85	10	OVLD	± 1.50	0.15 ±	Pass
		OVLD	± 0.50	0.15 ±	Pass
-- End of measurement results--					

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVLD	± 0.50	0.15 ±	Pass
		5	± 1.00	0.15 ±	Pass
126.85	10	OVLD	± 1.50	0.15 ±	Pass
		3	± 0.50	0.15 ±	Pass
116.85	5	OVLD	± 1.00	0.15 ±	Pass
		10	± 1.50	0.15 ±	Pass
106.85	3	OVLD	± 0.50	0.15 ±	Pass
		5	± 1.00	0.15 ±	Pass
106.85	10	OVLD	± 1.50	0.15 ±	Pass
		3	± 0.50	0.15 ±	Pass
— End of measurement results—					



เอกสารไม่ควบคุม

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.16	Pass
0 dB Gain, Linearity	41.17	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass
— End of measurement results—					

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.13	36.00	Pass
C-weight Noise Floor	26.92	35.00	Pass
Z-weight Noise Floor	33.10	39.00	Pass

— End of measurement results—

Total Harmonic Distortion

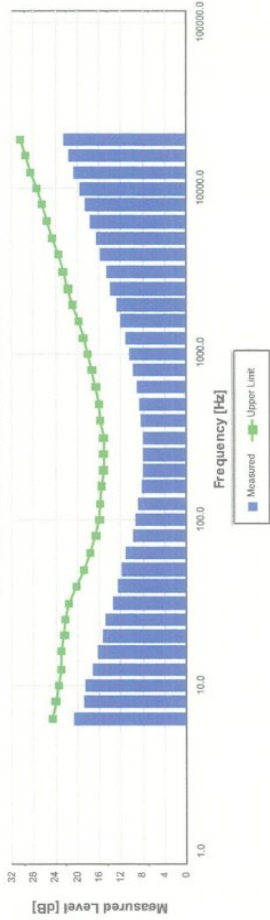
Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.91	135.05	136.65	0.15	Pass
THD	-66.52	-58.00	-58.00	0.01 ‡	Pass
THD+N	-62.48	-56.00	-56.00	0.01 ‡	Pass
— End of measurement results—					



เอกสารไม่ควบคุม

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	20.62	24.60	Pass
8.00	18.88	24.00	Pass
10.00	18.67	23.50	Pass
12.50	17.18	23.00	Pass
16.00	16.16	22.90	Pass
20.00	15.32	22.40	Pass
25.00	14.76	22.30	Pass
31.50	13.47	21.50	Pass
40.00	12.44	20.20	Pass
50.00	11.87	18.80	Pass
63.00	11.05	17.60	Pass
80.00	9.80	16.60	Pass
100.00	9.37	15.90	Pass
125.00	8.84	15.70	Pass
160.00	8.20	15.50	Pass
200.00	7.91	15.20	Pass
250.00	7.88	15.20	Pass
315.00	7.97	15.20	Pass
400.00	8.31	15.70	Pass
500.00	8.70	16.00	Pass
630.00	9.13	16.60	Pass
800.00	9.77	17.30	Pass
1,000.00	10.47	18.10	Pass
1,250.00	11.13	18.90	Pass
1,600.00	11.99	19.80	Pass
2,000.00	12.85	20.80	Pass
2,500.00	13.82	21.70	Pass
3,150.00	14.73	22.60	Pass
4,000.00	15.68	23.50	Pass
5,000.00	16.59	24.50	Pass
6,300.00	17.56	25.50	Pass
8,000.00	18.61	26.50	Pass
10,000.00	19.55	27.40	Pass
12,500.00	20.58	28.50	Pass
16,000.00	21.55	29.50	Pass
20,000.00	22.54	30.40	Pass

-- End of measurement results--



เอกสารไม่ควบคุม

-- End of Report--



เอกสารไม่ควบคุม



# Calibration Certificate

Certificate Number 2023003660

**Customer:**  
United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsook 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

**Model Number** LxT1  
**Serial Number** 0007303  
**Test Results** Pass  
**Initial Condition** As Manufactured  
**Description** SoundTrack LXT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

**Procedure Number** D0001.8384  
**Technician** Jacob Cannon  
**Calibration Date** 23 Mar 2023  
**Calibration Due**  
**Temperature** 23.58 °C ± 0.25 °C  
**Humidity** 49.4 %RH ± 2.0 %RH  
**Static Pressure** 86 kPa ± 0.13 kPa

**Data reported in dB re 20 µPa.**

**Tested with:**  
Larson Davis PRLMT1, S/N 077638  
PCB 377B02, S/N 345232  
Larson Davis CAL291, S/N 0108  
Larson Davis CAL200, S/N 9079

**Compliance Standards**  
Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

ANSI S1.4-2014 Class 1  
ANSI S1.4 (R2006) Type 1  
IEC 60804:2000 Type 1  
IEC 61252:2002  
ANSI S1.11 (R2009) Class 1  
IEC 61260:2001 Class 1  
ANSI S1.25 (R2007)  
ANSI S1.43 (R2007) Type 1  
IEC 61672:2013 Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017.

Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LXT Manual for SoundTrack LXT & SoundExpert LXT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



2023-5-23T17:30:48

Page 1 of 3

D0001.8406 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003660

1/2" adaptor is used with the preamplifier.

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 successfully completed by Physikalisch-Technische Bundesanstalt (PTB) on 2007-10-09 reference number PTB-1,72-4034218.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organization responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013 / ANSI/ASA S1.4-2014/Part 2, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1; the sound level meter submitted for testing conforms to the class 1 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2022-09-09	2023-09-09	001250
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
Larson Davis CAL200 Acoustic Calibrator	2022-07-21	2023-07-21	007027
Larson Davis Model 831	2023-02-22	2024-02-22	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2023-03-06	2024-03-06	007185
SRS DS360 Ultra Low Distortion Generator	2022-03-29	2023-03-29	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2022-09-28	2023-09-28	PCB0004783

## Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

## Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.56	-52.44	-46.33	0.14	Pass

— End of measurement results—

## Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.23	-0.20	-1.20	0.80	0.23	Pass
1000	0.17	0.00	-0.70	0.70	0.23	Pass
8000	-3.19	-3.00	-5.50	-1.50	0.32	Pass

— End of measurement results—

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001



2023-5-23T17:30:48

Page 2 of 3

D0001.8406 Rev G

เอกสารไม่ควบคุม

Certificate Number 2023003660

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1  
Measurement  
A-weighted  
Test Result [dB]  
42.55  
— End of measurement results—



เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2023003636

Customer:  
United Analyst and Engineering Consultant Co Ltd  
No. 81 Soi Udonsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok, 10260, Thailand

Model Number LxT1  
Serial Number 0007303  
Test Results Pass  
Initial Condition As Manufactured  
Description SoundTrack LxT Class 1  
Class 1 Sound Level Meter  
Firmware Revision: 2.404

Procedure Number D0001.8378  
Technician Jacob Cannon  
Calibration Date 23 Mar 2023  
Calibration Due  
Temperature 23.66 °C ± 0.25 °C  
Humidity 50.2 %RH ± 2.0 %RH  
Static Pressure 86.12 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1 SN 077638 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

- ANSI S1.4-2014 Class 1
- ANSI S1.4 (R2006) Type 1
- ANSI S1.25 (R2007)
- ANSI S1.43 (R2007) Type 1
- ANSI S1.11 (R2009) Class 1
- IEC 60651:2001 Type 1
- IEC 60804:2000 Type 1
- IEC 61252:2002
- IEC 61672:2013 Class 1
- IEC 61260:2001 Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa



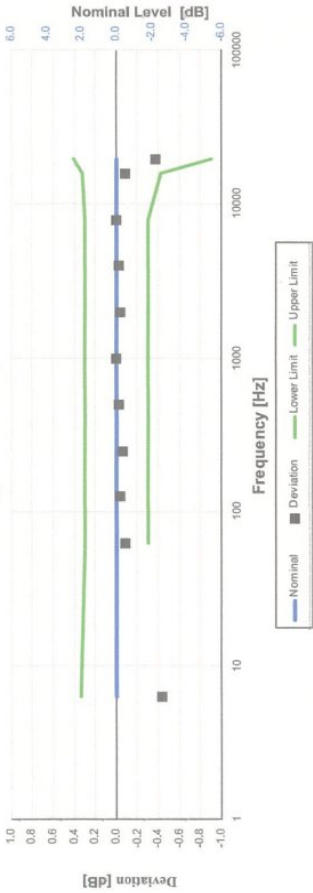
เอกสารไม่ควบคุม

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-08-25	2023-05-25	006798
SRS DS360 Ultra Low Distortion Generator	2022-12-29	2023-12-29	007118



เอกสารไม่ควบคุม

Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.43	-0.43	-1.11	0.33	0.15	Pass
63.10	-0.08	-0.08	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.06	-0.06	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.02	-0.02	-0.30	0.30	0.15	Pass
7,943.28	0.00	0.00	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.37	-0.37	-0.91	0.41	0.15	Pass

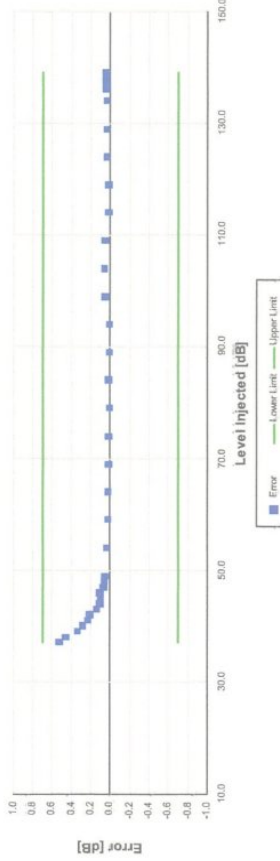
— End of measurement results—



เอกสารไม่ควบคุม



A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 8.3, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.4.3 (R2007) 8.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
37.00	0.53	-0.70	0.70	0.16	Pass
38.00	0.46	-0.70	0.70	0.16	Pass
39.00	0.33	-0.70	0.70	0.16	Pass
40.00	0.29	-0.70	0.70	0.16	Pass
41.00	0.23	-0.70	0.70	0.16	Pass
42.00	0.22	-0.70	0.70	0.16	Pass
43.00	0.15	-0.70	0.70	0.17	Pass
44.00	0.11	-0.70	0.70	0.17	Pass
45.00	0.10	-0.70	0.70	0.16	Pass
46.00	0.11	-0.70	0.70	0.16	Pass
47.00	0.07	-0.70	0.70	0.16	Pass
48.00	0.06	-0.70	0.70	0.16	Pass
49.00	0.06	-0.70	0.70	0.16	Pass
54.00	0.04	-0.70	0.70	0.16	Pass
59.00	0.02	-0.70	0.70	0.16	Pass
64.00	0.02	-0.70	0.70	0.16	Pass
69.00	0.02	-0.70	0.70	0.16	Pass
74.00	0.02	-0.70	0.70	0.16	Pass
79.00	0.01	-0.70	0.70	0.16	Pass
84.00	0.02	-0.70	0.70	0.16	Pass
89.00	0.01	-0.70	0.70	0.16	Pass
94.00	0.01	-0.70	0.70	0.16	Pass
99.00	0.06	-0.70	0.70	0.15	Pass
104.00	0.06	-0.70	0.70	0.15	Pass
109.00	0.06	-0.70	0.70	0.15	Pass
114.00	0.02	-0.70	0.70	0.15	Pass
119.00	0.02	-0.70	0.70	0.15	Pass
124.00	0.04	-0.70	0.70	0.15	Pass
129.00	0.04	-0.70	0.70	0.15	Pass
134.00	0.04	-0.70	0.70	0.15	Pass
139.00	0.04	-0.70	0.70	0.15	Pass
137.00	0.04	-0.70	0.70	0.15	Pass
138.00	0.05	-0.70	0.70	0.15	Pass
139.00	0.04	-0.70	0.70	0.15	Pass
— End of measurement results—					

เอกสารไม่ควบคุม

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [µs]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result	
137.85	40	Negative Pulse	135.21	133.74	135.74	0.15	Pass
		Positive Pulse	135.21	133.73	135.73	0.15	Pass
	30	Negative Pulse	134.28	133.74	135.74	0.15	Pass
		Positive Pulse	134.23	133.73	135.73	0.15	Pass
— End of measurement results—							

Positive Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
126.85	10	OVL	± 1.50	0.15 ±	Pass
	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.16 ±	Pass
116.85	10	OVL	± 1.50	0.15 ±	Pass
	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
106.85	10	-0.05	± 1.50	0.15 ±	Pass
	3	-0.15	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
	10	-0.17	± 1.50	0.15 ±	Pass
— End of measurement results—					

Negative Pulse Crest Factor

200 µs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
136.85	3	OVL	± 0.50	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
126.85	10	OVL	± 1.50	0.15 ±	Pass
	3	-0.13	± 0.50	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
116.85	10	OVL	± 1.50	0.15 ±	Pass
	3	-0.14	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
106.85	10	0.00	± 1.50	0.15 ±	Pass
	3	-0.15	± 0.50	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
	10	-0.17	± 1.50	0.15 ±	Pass
— End of measurement results—					

เอกสารไม่ควบคุม



Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.95	93.90	94.10	0.15	Pass
0 dB Gain, Linearity	41.13	40.30	41.70	0.16	Pass
OBA Low Range	94.00	93.90	94.10	0.15	Pass
OBA Normal Range	94.00	93.20	94.80	0.15	Pass
-- End of measurement results--					

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.01	36.00	Pass
C-weight Noise Floor	26.70	35.00	Pass
Z-weight Noise Floor	32.84	39.00	Pass

-- End of measurement results--

Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.78	135.05	136.65	0.15	Pass
THD	-67.22		-68.00	0.01 ±	Pass
THD+N	-62.91		-68.00	0.01 ±	Pass

-- End of measurement results--



เอกสารไม่ควบคุม

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	18.55	24.60	Pass
8.00	18.33	24.00	Pass
10.00	18.11	23.50	Pass
12.50	16.77	23.00	Pass
16.00	15.74	22.90	Pass
20.00	14.70	22.40	Pass
25.00	13.54	22.30	Pass
31.50	13.13	21.50	Pass
40.00	12.18	20.20	Pass
50.00	10.89	18.80	Pass
63.00	10.30	17.60	Pass
80.00	9.65	16.60	Pass
100.00	9.08	15.90	Pass
125.00	8.51	15.70	Pass
160.00	7.86	15.50	Pass
200.00	7.66	15.20	Pass
250.00	7.66	15.20	Pass
315.00	7.68	15.20	Pass
400.00	7.98	15.70	Pass
500.00	8.38	16.00	Pass
630.00	8.87	16.60	Pass
800.00	9.56	17.30	Pass
1,000.00	10.29	18.10	Pass
1,250.00	11.10	18.90	Pass
1,600.00	11.90	19.80	Pass
2,000.00	12.78	20.80	Pass
2,500.00	13.70	21.70	Pass
3,150.00	14.55	22.60	Pass
4,000.00	15.46	23.50	Pass
5,000.00	16.50	24.50	Pass
6,300.00	17.50	25.50	Pass
8,000.00	18.46	26.50	Pass
10,000.00	19.44	27.40	Pass
12,500.00	20.45	28.50	Pass
16,000.00	21.46	29.50	Pass
20,000.00	22.43	30.40	Pass

-- End of measurement results--



เอกสารไม่ควบคุม

— End of Report—

Sign

LARSON DAVIS – A PCB DIVISION  
1681 West 820 North  
Provo, UT 84601, United States  
716-684-0001  
2023-5-23T13:58:00



Page 8 of 8



D0001.5407 Rev G

เอกสารไม่ควบคุม



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



NSC-TS1817625  
CALIBRATION 0008

Cert.No.: 23CH1487  
Page.: 1 of 3

## Certificate of Calibration

Equipment : pH Meter  
Manufacturer : EcoSense  
Model : pH100A  
Serial No. : JC03354  
ID No. : UAE.EFM.063/2562(ENV.pH 03/62)  
Condition As-Received: Used Item  
Received Date : 21 November 2023  
Calibration Date : 22 November 2023  
Reference : 2311-0720WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
Ambient Temperature : (25 ± 2.5) °C  
Relative Humidity : (50 ± 15) %  
Calibration Procedure : In - house method :  
- CP-CH5 by direct measurement with standard  
voltage calibrator and direct measurement with  
certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lemgagrakul

Approved by :

(✓) Saithip Meangmai  
( ) Warakorn Lemgagrakul  
( ) Ponpan Palpim

Issue Date : 27 November 2023

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.

เอกสารไม่ควบคุม



Cert.No.: 23CH1487  
Page.: 2 of 3

#### Condition of this calibration result

- Reference Standard Instrument : -  

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-  
- Technology Promotion Association (Thailand-Japan)
- Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	913598	14 July 2025
pH 6.985	CPA chem	913599	14 July 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

#### Calibration Results

Function : mV Measurement

Performing standard curve by Fluke at pH (4.7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
			mV	pH		
pH Meter S/N.: JC03354	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	0.00	0	7.00	0.58	2.00
		-177.48	-178	10.01	0.58	2.00

1191352  
a 1191352



Cert.No.: 23CH1487  
Page.: 3 of 3

#### Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N.: 230906SIA605377	4.008	4.01	174	0.0085	2.05
	6.985	7.00	-2	0.0099	2.00
	6.985	7.00	-2	0.0093	2.00
	9.997	10.00	-177	0.0092	2.00

#### Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : 230906SIA605377
- Dimension of probe:
  - Length : 110 mm
  - Diameter : 12 mm
  - Immersion Depth : 100 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.1	0.098	0.13	2.00
30.0	30.001	30.1	0.099	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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 %.

-000-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

53/44 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 23TW174  
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter  
Manufacturer : YSI  
Model : Pro 20i  
Serial No. : 18H110495  
ID No. : UAE.EFM.200/2561(ENV.DO.04/61)  
Received Date : 25 July 2023  
Test Date : 26 July 2023  
Reference : 2307-0788WSC-1  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260

Laboratory Condition : Temperature ( 25 ± 5 ) °C  
Humidity ( 50 ± 20 ) %  
Test Procedure : In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithean

Approved by :

( ) Malee Butkruea  
(✓) Saithip Meangmai  
( ) Warakorn Lemgagrakul

Issue Date : 27 July 2023

เอกสารไม่ควบคุม

B 0320266



Cert.No.: 23TW174  
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments Serial No. ID No. Certificate No. Due Date  
1) Burette - 130BU10 23CG1172 22 Mar 2025  
2) Balance 1126143764 140RC004 22MM50 20 Sep 2023

2. Standard Material :-

Material Manufacturer Lot.No. Assay  
Sodium Thiosulfate pentahydrate Merck AM1763316 100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 18H100129

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.18	8.18	0.0045

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full without written approval of the laboratory

-000-





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



NAC-TS-171925  
CALIBRATION 0008

Cert. No.: 23LM123  
Page.: 1 of 2

## Certificate of Calibration

**Equipment :** DO Meter with Sensor  
**Manufacturer :** YSI  
**Model :** Pro 20i  
**Serial No. :** 18H110495  
**ID No. :** UAE.EFM.200/2561(ENV.DO.04/61)

**Submitted by :** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok,  
Phrakhanong, Bangkok 10260

**Location :** TPA On Site Calibration Laboratory

**Received Order :** 25 July 2023  
**Calibrated Date :** 27 July 2023  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %  
**AC Line Voltage :** ( 220 ± 22 ) V

**Calibrated by :** Preecha Hlatib

**Approved by :**

( ) Pornthippa Tameyakul  
( ) Malee Butkruea  
(✓) Suwit Imjai

**Issue Date :** 4 August 2023

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.

เอกสารไม่ควบคุม

A 0056826



**Equipment :** DO Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2307-0788WSC-2

**Procedure Used :-**

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer ( IPRT ) into Temperature Bath.

The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-

**Instrument** **Serial No.** **Cert. No.** **Traceable** **Due Date**  
1) Digital Thermometer 2188080 2211285 TPA 21 Oct 2023  
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function :** Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 18H100129

Calibration Point ( °C )	Immersion Depth ( mm )	Standard Temperature ( °C )	UUC* Reading ( °C )	Error ( °C )	Uncertainty ( ± °C )	Coverage Factor k
25.0	100	25.009	24.8	-0.209	0.16	2.00
30.0	100	30.010	29.8	-0.210	0.16	2.00
35.0	100	35.009	34.7	-0.309	0.16	2.00

UUC\* : Unit Under Calibration

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-

Cert. No.: 23LM123  
Page.: 2 of 2

0-1110004



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.: 23CH1228  
Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Conductivity Meter  
**Manufacturer :** YSI  
**Model :** Pro30  
**Serial No. :** 17A102921  
**ID No. :** UAE.EFM.12312560(ENV.SCT.03/60)  
**Condition As-Received:** Used Item  
**Received Date :** 26 September 2023  
**Calibration Date :** 28 September 2023  
**Reference :** 2309-0882WSC-1  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraekhanong, Bangkok 10260

**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 15) %  
**Calibration Procedure :** In-house method :  
- CP-CH6 by direct measurement  
with certified reference material (CRM)  
- CP-CH8 by comparison with standard thermometer

**Calibrated by :**   
**Approved by :**  
☒ Saitip Meangmai  
☐ Warakorn Lengagtrakul  
☐ Ponpan Paipim

**Issue Date :** 2 October 2023

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.

เอกสารไม่ควบคุม  
A 0053078



Cert.No.: 23CH1228  
Page.: 2 of 3

### Condition of this result of calibration

1. Reference Standard Instrument :-  

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	1963878	130RC095	231051	05 Sep 2024
2) Ref. Std. Thermometer	4982054	110RC044	231908	26 Jul 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
- | Conductivity Solution | Manufacturer | Lot No. | Exp. date    |
|-----------------------|--------------|---------|--------------|
| 1413.0 µS/cm          | CPA Chem     | 913596  | 14 July 2024 |
| 12.880 mS/cm          | CPA Chem     | 913597  | 14 July 2024 |
- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C
3. This certificate is valid only to the item calibrated on date and place of calibration.

**Function : Conductivity Measurement**  
**( \* ) After Adjustment at 1413.0 µS/cm**  
**Conductivity Electrode Serial No.: 17A100315**

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( ± )	Coverage factor k
1413.0 µS/cm	1271.5 µS/cm	1412 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	10.11 mS/cm	11.52 mS/cm	0.086 mS/cm	2.00

**Remark** - UUC\* = Unit Under Calibration

Cert.No.: 23CH1228  
 Page.: 3 of 3

### Calibration Results

Function : Temperature Measurement

(\*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PRO 30 COND-T

- Serial No. : 17A100315

Dimension of probe;

- Length : 95 mm

- Diameter : 2.5 mm

- Immersion Depth : 90 mm

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (± °C)	Coverage factor k
25.0	25.003	24.7	-0.303	0.13	2.00
30.0	30.004	29.7	-0.304	0.13	2.00
35.0	35.004	34.7	-0.304	0.13	2.00

Remark : - UUC\* = Unit Under Calibration

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-

### Certificate of Calibration

#### Customer

Name : UNITED ANALYST AND ENGINEERING

CONSULTANT CO.,LTD.

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,

Prakanong, Bangkok 10260

Certificate No : 23-TPM-370

Request No : Req-2023-1525

Page : 1/2

#### Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : 3M

Model : QT-32

Serial Number : TPQ020022

Resolution : 0.1 °C

ID Number : UAE.EFM.005/2559

Range Calibration : 20 °C to 60 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 4.5

Calibration Position (mm) : 67.5

Instrument Status : Used

#### Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 21 July 2023

Calibrated Date : 7 August 2023

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN:

08000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-

0494

#### Traceability

: This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:

Calibration 0292

#### Note

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

Approved

Signature

Technical Manager

7 August 2023

Issue Date :

เอกสารไม่ควบคุม

a 1182389



### Calibration Note

UUC Adjustment : Not Adjust

Certificate No: 23-TPM-370

Request No : Req-2023-1525

Page : 2/2

### Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	20.030	19.9	+0.1	0.13
	25.034	24.9	+0.1	0.13
	30.035	29.9	+0.1	0.13
	35.038	34.9	+0.1	0.13
	40.040	40.0	0.0	0.13
	45.042	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
	60.048	60.0	0.0	0.13

DRY	20.033	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.036	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.040	40.0	0.0	0.13
	45.041	45.0	0.0	0.13
	50.045	50.0	0.0	0.13
	60.047	60.0	0.0	0.13

GLOBE					
	20.031	19.9	+ 0.1		0.13
	25.035	24.9	+ 0.1		0.13
	30.034	29.9	+ 0.1		0.13
	35.036	34.9	+ 0.1		0.13
	40.038	40.0	0.0		0.13
	45.042	45.0	0.0		0.13
	50.042	50.1	- 0.1		0.13
	60.048	60.1	- 0.1		0.13

End of Certificate

Calibrated By :

1

Approved By :

heart

heart

Issue Date :

12 May 2023

Note

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



Calibration Note		Certificate No : 23-TPM-255
UUC Adjustment	: Not Adjust	Request No : Req/2023-09
		Page : 2/2

**Result of Calibration :**

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
WET	20.031	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.036	30.1	-0.1	0.13
	35.039	35.1	-0.1	0.13
	40.040	40.1	-0.1	0.13
	45.042	45.1	-0.1	0.13
	50.045	50.1	-0.1	0.13
	60.050	60.1	-0.1	0.13
DRY	20.033	20.0	0.0	0.13
	25.034	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.040	40.0	0.0	0.13
	45.044	45.0	0.0	0.13
	50.042	50.0	0.0	0.13
	60.048	60.0	0.0	0.13
GLOBE	20.032	20.1	-0.1	0.13
	25.034	25.1	-0.1	0.13
	30.034	30.1	-0.1	0.13
	35.037	35.1	-0.1	0.13
	40.038	40.0	0.0	0.13
	45.039	45.0	0.0	0.13
	50.044	50.0	0.0	0.13
	60.047	60.0	0.0	0.13

End of Certificate

Calibrated B

kum

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

Issue Date :

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Institute of Standards and Standards Engineering (ISSE).  
FM-708-TPPM1 Rev.01 Issue date 13/02/20

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

**เอกสารไม่ควบคุม** <sup>20</sup>

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-502

Request No : Req-2023-2230

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (k=2)
WET	20.031	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.035	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.040	40.0	0.0	0.13
	45.040	45.0	0.0	0.13
DRY	50.043	50.0	0.0	0.13
	60.047	60.0	0.0	0.13
	20.033	20.1	- 0.1	0.13
	25.036	25.1	- 0.1	0.13
	30.037	30.1	- 0.1	0.13
	35.039	35.1	- 0.1	0.13
GLOBE	40.039	40.1	- 0.1	0.13
	45.041	45.1	- 0.1	0.13
	50.043	50.1	- 0.1	0.13
	60.045	60.1	- 0.1	0.13
	20.032	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.035	35.0	0.0	0.13
	40.038	40.0	0.0	0.13
	45.040	45.0	0.0	0.13
	50.043	50.0	0.0	0.13
	60.046	60.0	0.0	0.13

End of Certificate

Calibrated By :

Approved By :

Issue Date : 7 November 2023

Signature

เอกสาร ไม้ควบคุม

FM-708-AFM-01 Rev.00 Issue date 01/07/19

INNOVATIVE

INSTRUMENT

LAB

INNOVATIVE INSTRUMENT CO., LTD.

7/139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAEO,

AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND

TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

ANAB

ASIA PACIFIC ACCREDITED

ACCREDITED

7/139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KAEO,

AMPHOE BANG PHLI SAMUT PRAKAN PROVINCE 10540 THAILAND

TEL: (66)0-2116-5860-1 FAX: (66)0-2116-7140

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 23-AFM-221 Rev.1

Request No : Req-2023-2172

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : TSI

Model : 4146

Serial Number : 41461922007

ID : UAE EFM.223/2562

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 October 2023

Calibration Date : 25 October 2023

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 Standard flow	19031011003	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qreborn	27 February 2024
Pressure meter	CPG2400	41000KDU/651882	TPA	7 November 2023

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 %.

This Certificate was issued to replace to Calibration Certificate No. 23-AFM-221

Call

Approved By

Signature

Issue Date :

7 November 2023

Certificate No : 23-AFM-221 Rev.1  
Request No : Req-2023-2172

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
25.40	101.16	0.020	0.019	-0.001	0.0013
25.30	101.17	0.049	0.049	0.000	0.0033
25.30	101.19	0.098	0.101	0.003	0.0028
25.20	101.18	0.196	0.200	0.004	0.0056
25.30	101.18	0.498	0.500	0.002	0.0073
25.20	101.16	1.001	1.001	0.000	0.083
25.20	101.18	1.705	1.701	-0.004	0.085
25.40	101.15	2.003	2.007	0.004	0.086
25.30	101.10	2.986	3.000	0.014	0.042
25.30	101.10	3.979	4.001	0.022	0.056
25.30	101.10	5.013	5.002	-0.011	0.070

Note STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 21.1 °C, 101.3 kPa, Air

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

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

where Q = Flow Rate

P = Absolute Pressure

T = Absolute Temperature

Meas = Measurement Condition

ref = Standard Condition

\* Indicates non accredited

End of Certificate



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 23H1200  
Page : 1 of 2

Equipment : Dial Thermo-Hygrometer  
Manufacturer : Barigo  
Model : -  
Serial No. : -  
ID No. : UAE.ANV.130/2550  
Condition As-Received: Used Item  
Received Date: 26 May 2023  
Calibration Date: 30 May 2023  
Reference: to 06 June 2023  
2305-0919WSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phraekhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	23105	15 Mar 2024

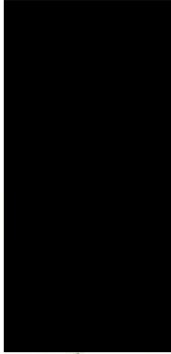
2. The certificate is valid only to the item calibrated on date and place of calibration.

3. This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Standards and Technology (NIST) , The United States of America

-Technology Promotion Association (Thailand-Japan), NSC-ONSC Accredited No. Calibration 0008

Calibrated by : Somchai Dumwor  
Issue Date : 07 June 2023



เอกสารไม่ควบคุม  
B 0316274





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250  
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Cert. No.: 23H1200  
Page.: 2 of 2

Result of Calibration:-		Before Adjustment		Humidity Measurement	
Function:		Humidity Measurement		Humidity Measurement	
Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)	
25.0	40.1	48	7.9	1.6	
25.0	60.0	63	3.0	1.7	
25.0	80.0	76	-4.0	1.9	

Result of Calibration:-		After Adjustment		Humidity Measurement	
Function:		Humidity Measurement		Humidity Measurement	
Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)	
25.0	40.1	44	3.9	1.6	
25.0	60.0	60	0.0	1.7	
25.0	80.0	75	-5.0	1.9	

Result of Calibration:-		Without Adjustment		Temperature Measurement	
Function:		Temperature Measurement		Temperature Measurement	
Reference Temperature (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)	
25.0	19.987	20.0	0.013	0.72	
25.0	30.016	30.0	-0.016	0.72	
25.0	39.944	39.5	-0.444	0.72	

UUC\* : Unit Under Calibration  
The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

-o0o-

เอกสารไมเควบคุม  
a 1165295

## Certificate of Calibration

Certificate No. : 23H1101  
Page : 1 of 2

Equipment : Digital Thermo-Hygrometer  
Manufacturer: Digicon  
Model : TH-02  
Serial No.: 395034175  
ID No.: UAE.EFM.184/2585  
Condition As-Received: Used Item  
Received Date: 18 May 2023  
Calibration Date: 22 May 2023 to 24 May 2023  
Reference: 2305-0641WSC  
Ambient Temperature: ( 25 ± 3 ) °C  
Relative Humidity: ( 50 ± 20 ) %  
Submitted by: United Analyst and Engineering Consultant Co., Ltd.  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Procedure used: Calibration was conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

### Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Chilled Mirror Hygrometer	Dew Master	44730	20563A	14 Jun 2023
2) Handheld Thermometer With Sensor	1521	A5A339	221251	12 Oct 2023
2. The certificate is valid only to the item calibrated on date and place of calibration.				
3. This Certification is traceable to the International System of Unit maintained through:-				
-National Institute of Standards and Technology (NIST), The United States of America				
-National Institute of Metrology Thailand (NIMT)				

Calibrated by : Kraipon Onrat  
Issue Date : 25 May 2023

Approved Signatory :

[✓] Chakrit  
[ ] Pornthipa Tantiyawutti  
[ ] Viporn Tantiyawutti

เอกสารไมเควบคุม  
B 0314979



## Certificate of Calibration

Customer Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO. LTD.  
Certificate No : 23-ACT-117  
Request No : Req-2023-1546

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

### Unit Under Calibration Details

Measurement item	: Acoustic Calibrator	Class :	1
Manufacturer	: SVANTEK	Range :	94, 114 dB / 1000 Hz
Model	: SV 36	Instrument Status :	Used

### Calibration Environment and Details

Temperature	: (23 ± 2 °C)
Humidity	: (50 ± 20 %RH)
Barometric Pressure	: (1013 ± 0.0 hPa)
Received Date	: 21 July 2023
Calibration Date	: 4 August 2023
Location of Calibration	: LAB 1 Acoustic
Calibration Procedure	: In-house method C

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SW 35A	58079	EEL	31 May 2024
THD Multimeter	2015	1047765	NIMT	31 January 2024

**Traceability** : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

**Note**

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

Calibrated By:

Mr. Noppadon Luangart  
Service Calibration Engineer

Supervisor 23

Result of Calibration:-	Without Adjustment	Humidity Measurement
Function:		

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	41	0.9	1.3
25.0	50.1	51	0.9	1.6
25.0	60.0	60	0.0	1.6
25.0	70.2	67	-3.2	1.6

Result of Calibration:-	Without Adjustment
Function:	Temperature Measurement

Standard Temperature	UUC* Reading	Error	Uncertainty of Measurement
(°C)	(°C)	(°C)	(±°C)
20.014	20.4	0.386	0.42
25.022	25.6	0.578	0.42
30.033	30.3	0.267	0.42
40.000	40.1	0.100	0.42

UUC\* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor  $k = 2.00$ , providing confidence level approximately 95%.

-000-

Certificate No : 23-ACT-117

Request No : Req-2023-1546

Calibration Results : Without Adjustment

Sound pressure level

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.03	0.03	-	-	0.13	0.25
114 dB / 1000 Hz	114.11	0.11	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.26		-		0.40	2.5
114 dB / 1000 Hz	0.38		-		0.40	2.5

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

NSC-TSI-TS 17025  
CALIBRATION 0394

Cert. No. : ACL23146

Pages : 1 of 8

## Calibration Certificate

Equipment :

SOUND LEVEL METER

Manufacturer :

RION

Model :

NL-42/ Microphone UC-52 / Preamplifier NH-24

Serial No.:

01010779 / 194534 / 14657

ID No.:

UAE.EFM.082/2565

Condition As Found :

GOOD

Customer :

UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)

81 SOI UDOMSUK 41, SUKHUMVIT ROAD,

BANGCHAK SUB-DISTRICT,

PHRAKHANONG DISTRICT, BANGKOK 10260

THAILAND.

Location :

-

Ambient Temperature :

( 23.0 ± 3 ) °C

Pressure :

( 101.3 ± 3 ) kPa

Relative Humidity :

( 50.0 ± 20 ) %

Received Date :

05 MAY 2023

Calibration Date :

08 -09 MAY 2023

Date of Issue :

10 MAY 2023

Calibrated by :

Nathakorn Pisupaisan

Approved by :



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

เอกสารไม่ควบคุม



## Continuation of Calibration Certificate

Cert. No. : ACL23146  
Job No. : VC66AC0053  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

### Calibration Method :

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

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

### Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

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

## Continuation of Calibration Certificate

Cert. No. : ACL23146  
Job No. : VC66AC0053  
Pages : 3 of 8

### Summary of Measurement Result :

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23146  
Job No. : VC66AC0053  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
14.2

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	16.2
Flat	21.9

3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.3	0.4	0.4
1000	0.0	0.0	0.0
8000	-1.1	-1.1	-1.1

Continuation of Calibration Certificate

Cert. No. : ACL23146  
Job No. : VC66AC0053  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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



## Continuation of Calibration Certificate

Cert. No. : ACL23146  
Job No. : VC66AC0053  
Pages : 6 of 8

## 7. Level linearity on the reference level range

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

## Continuation of Calibration Certificate

Cert. No. : ACL23146  
Job No. : VC66AC0053  
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 Weighing	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

## 10. Peak C sound level

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23146  
Job No. : VC66AC0053  
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
89.7	89.7		

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



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

Cert. No. : ACL23119  
Pages : 1 of 8

Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42 / Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 01010780 / 194535 / 14658  
**ID No.:** UAE.EFM.083/2565

**Condition As Found :** GOOD

**Customer :** UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

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

**Received Date :** 05 APRIL 2023  
**Calibration Date :** 10-11 APRIL 2023  
**Date of Issue :** 18 APRIL 2023

**Calibrated by :** Nathakorn Pisupaisan

**Approved by :**

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



Continuation of Calibration Certificate

Cert. No. : ACL23119  
Job No. : VC66AC0044  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

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

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

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23119  
Job No. : VC66AC0044  
Pages : 3 of 8

**Summary of Measurement Result :**

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

Note : Pass/Fail evaluation for each parameter,

will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23119  
Job No. : VC66AC0044  
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal ( dB )	Measured Value ( dB )	Deviation ( dB )	Acceptance Limit ( dB )
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value ( dB )
14.6

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

Frequency Weighting	Measured value ( dB )
A - weight	10.8
C - weight	16.8
Flat	22.6

3. Acoustical signal tests of frequency weightings

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.3	0.3	0.3
1000	0.0	0.0	0.0
8000	0.5	0.6	0.6

Continuation of Calibration Certificate

Cert. No. : ACL23119  
Job No. : VC66AC0044  
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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



## Continuation of Calibration Certificate

Cert. No. : ACL23119  
Job No. : VC66AC0044  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 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	30.3	0.3	± 1.1
29.0	29.3	0.3	± 1.1
28.0	28.4	0.4	± 1.1
27.0	27.2	0.2	± 1.1
26.0	26.6	0.6	± 1.1
25.0	25.8	0.8	± 1.1

## Continuation of Calibration Certificate

Cert. No. : ACL23119  
Job No. : VC66AC0044  
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 Weighing	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, Lcpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.6	-0.8	±3.0

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

## Continuation of Calibration Certificate

Cert. No. : ACL23119  
Job No. : VC66AC0044  
Pages : 8 of 8

### 11. Overload indication

Measured value ( dB )		Deviated Value ( dB )	Acceptance Limits ( dB )
Positive one-half cycle	Negative one-half cycle		
89.7	89.7	0.0	±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

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



NSC-TS1-TIS 17025  
CALIBRATION 0394

Cert. No. : ACL23131  
Pages : 1 of 8

## Calibration Certificate

**Equipment :** SOUND LEVEL METER  
**Manufacturer :** RION  
**Model :** NL-42/ Microphone UC-52 / Preamplifier NH-24  
**Serial No.:** 00409178 / 185837 / 90624  
**ID No.:** UAE.FFM.017/2564

**Condition As Found :** GOOD

**Customer :** UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)  
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,  
BANGCHAK SUB-DISTRICT,  
PHRAKHANONG DISTRICT, BANGKOK 10260  
THAILAND.

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

**Received Date :** 18 APRIL 2023  
**Calibration Date :** 24 -26 APRIL 2023  
**Date of Issue :** 27 APRIL 2023

**Calibrated by :** Nathakorn Pisutpaisan

**Approved by :**

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



Continuation of Calibration Certificate

Cert. No. : ACL23131  
Job No. : VC66AC0048  
Pages : 2 of 8

Calibration Procedure : CP-AC-01

**Calibration Method :**

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

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

**Condition of this result of calibration :**

1. Reference Standard Instruments :

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

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

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

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

Continuation of Calibration Certificate

Cert. No. : ACL23131  
Job No. : VC66AC0048  
Pages : 3 of 8

**Summary of Measurement Result :**

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

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

## Continuation of Calibration Certificate

Cert. No. : ACL23131  
Job No. : VC66AC0048  
Pages : 4 of 8**Result of calibration :****1. Absolute sensitivity**

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

**2. Self-generated noise**

## 2.1 Normal test

Measured Value ( dB )
14.8

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

Frequency Weighting	Measured value ( dB )
A - weight	12.0
C - weight	18.1
Flat	23.9

**3. Acoustical signal tests of frequency weightings**

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

Frequency ( Hz )	Deviation from various frequency weighting response curve (dB)		
	Flat	C-weight	A-weight
125	0.3	0.3	0.3
1000	0.1	0.1	0.1
8000	1.3	1.3	1.3
			±1.5
			±1.0
			±5.0

## Continuation of Calibration Certificate

Cert. No. : ACL23131  
Job No. : VC66AC0048  
Pages : 5 of 8**4. Electrical signal tests of frequency weightings**

Weighting network response with relative to 1 kHz.

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

**5. Frequency and time weightings at 1 kHz**

## 5.1 Frequency weightings at 1 kHz

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

## 5.2 Time weighting at 1 kHz

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

**6. Long - term stability**

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



## Continuation of Calibration Certificate

Cert. No. : ACL23131  
Job No. : VC66AC0048  
Pages : 6 of 8

## 7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

## Continuation of Calibration Certificate

Cert. No. : ACL23131  
Job No. : VC66AC0048  
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, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.1	-0.3	±3.0

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

Continuation of Calibration Certificate

Cert. No. : ACL23131  
Job No. : VC66AC0048  
Pages : 8 of 8

11. Overload indication

Measured value ( dB )		Deviated Value	Acceptance Limits
Positive one-half cycle	Negative one-half cycle	( dB )	( dB )
89.6	89.6	0.0	±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

INNOVATIVE INSTRUMENT CALIBRATION LAB  
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE  
7/139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAEO,  
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND  
TEL: (6690)216-5869-1 FAX: (6690)216-7140



Certificate of Calibration

**Customer**  
Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok, 10260  
Certificate No : 23-NDM-185  
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement item : Noise Dosimeter  
Manufacturer : SVANTEK  
Model : SV 104  
Serial Number : 143231  
ID : -  
Resolution : 0.1 dB  
Calibration Environment and Details  
Temperature : 23 °C ± 2 °C  
Humidity : 50 %RH ± 20 %RH  
Barometric Pressure : 1013 hPa ± 10 hPa  
Received Date : 12 July 2023  
Calibrated Date : 7 August 2023  
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017  
Location of Calibration : Lab Acoustic  
Reference Standard  
Instrument : Quest  
Model : Quest-cal  
SN : 188272  
Due calibration : 25 July 2024  
Traceability : TSI  
Standard Microphone : GRAS  
40AN  
Sine Generator : Svan401  
Timer : EXTECH  
Svan401  
WK Electric  
TPA  
Microphone Class : 2  
Microphone Model : SV 27  
Microphone S/N : 136863  
Preamplifier Model : -  
Preamplifier S/N : -  
Instrument Status : New

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	Svanitek	Svan401	131	12 October 2023	WK Electric
Timer	EXTECH	-	05-ACT	20 March 2024	TPA

Note

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

Calibr-

Calibration Officer  
Calibration Engineer Supervisor  
Issue Date : 7 August 2023

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement		Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h) <sup>2</sup>	UUC (Pa h) <sup>2</sup>	
FAST / A / 55-140	120	120	3.18	3.13	-21, +26
Calibrator Setting					
1000 Hz 114 dB					

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting			UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	Frequency Weighting				
	A (dB)	C (dB)			
FAST / 55-140					
STD Setting					
*63 Hz	0.0	0.1		0.40	2.0
125 Hz	0.3	0.6		0.40	1.5
250 Hz	0.0	0.5		0.40	1.5
500 Hz	0.1	0.5		0.40	1.5
1000 Hz	0.0	0.0		0.40	-
2000 Hz	-0.4	0.0		0.40	2.0
4000 Hz	1.7	1.8		0.40	3.0
8000 Hz	-2.9	-2.9		0.40	5.0

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High									
	Ref (dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
1000 Hz	Level A (dB)	54.6	80.1	90.1	100.0	110.0	114.0	120.0	130.0	140.0
	Error (dB)	-0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Ref (dB)									
8000 Hz	Level A (dB)									
	Error (dB)									
	Ref (dB)									
63 Hz	Level A (dB)									
	Error (dB)									
	Ref (dB)									
Tolerances Limit (±dB)		1.0								
UNCERTAINTY (±dB)		0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa h) <sup>2</sup>	UUC (Pa h) <sup>2</sup>	Error (%)	
FAST / A / 55-140						
Calibrator Setting						
1000 Hz 110 dB	27	27	0.30	0.30	0.00	
1000 Hz 110 dB	45	45	0.50	0.50	0.00	
1000 Hz 110 dB	90	90	1.00	0.99	-1.00	
1000 Hz 110 dB	180	180	2.00	1.98	-1.00	
1000 Hz 120 dB	36	36	4.00	3.94	-1.50	
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	
1000 Hz 120 dB	90	90	10.00	9.90	-1.00	
1000 Hz 120 dB	180	180	20.00	19.76	-1.20	
1000 Hz 120 dB	360	360	40.00	39.42	-1.45	
1000 Hz 120 dB	720	720	80.00	78.66	-1.68	



Certificate No : 23-NDM-185

Request No : Req-2023-1488

#### 4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (Pa <sup>2</sup> h)	Tolerances Limit (Pa <sup>2</sup> h)
	Ref (s)	UUC (s)	Ref (Pa <sup>2</sup> h)	UUC (Pa <sup>2</sup> h)	Error (Pa <sup>2</sup> h)		
FAST / A / 55-140							
Calibrator Setting							
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 - +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref (s)	UUC (s)	Ref (Pa <sup>2</sup> h)	UUC (Pa <sup>2</sup> h)	Error (%)		
FAST / A / 55-140							
Calibrator Setting							
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00		-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 - +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 - +41

### 5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances Limit (%)
		UUC	Different (%)		
FAST / A / 55-140	UUC				
Calibrator Setting	(s)				
Continuous Rectangle +					
Continuous Rectangle -	29				
		10.13	0.00	3.7	-21 - +26
		10.13			

\* Indicates non accredited

## End of Certificate

## Certificate of Calibration

## Customer

Name UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 23-NDM-179

Address  
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260  
Request No : Req-2023-1488

### Unit Under Calibration Details

Measurement item : Noise Dosimeter

Manufacturer : SVANTEK

Model : SV 104

Serial Number : 143225

ID: A60897

Resolution : 0.1 d

### Calibration Environment and Details

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

Humidity : 50 % RH :

Barometric Pressure : 1013 hPa  $\pm$  10 hPa

Received Date : 12 July 2023

Calibrated Date : 7 August 2023

Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017

Location of Calibration : Lab Acoustic

### Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	182772	25 July 2024	TSI
Standard Microphone	GRAS	40AN	182773	6 October 2023	GRAS
Sine Generator	Svanitec	Svan401	131	12 October 2023	WK Electric
Timer	EXTECH	-	05-ACT	20 March 2024	TPA

Note

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

Calibration Officer

Calibration Engineer Supervisor

Issue Date : 7 August 2023



Certificate No : 23-NDM-179  
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			Tolerances Limit
	Ref	UUC	Ref	UUC	Error	
FAST / A / 55-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)
Calibrator Setting						
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052
						-0.29 - +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			Tolerances Limit
	Ref	UUC	Ref	UUC	Error	
FAST / A / 55-140	(s)	(s)	(Pa <sup>2</sup> h)	(Pa <sup>2</sup> h)	(%)	(%)
Calibrator Setting						
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	-21 - +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00	-29 - +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00	-29 - +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			Tolerances Limit
	UUC	(s)	UUC	Different	(%)	
FAST / A / 55-140			(Pa <sup>2</sup> h)			
Calibrator Setting						
Continuous Rectangle +	29		10.37			-21 - +26
Continuous Rectangle -			10.37	0.00	3.7	

\* indicates non accredited

End of Certificate



List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Air Quality Analysis									
1	Analytical Balance (Readability 0.1 mg)	ฝุ่นละอองรวม (TSP) ฝุ่นละอองเล็กกว่า 10 ไมครอน (PM10)	Mettler-Toledo	MS204TS/00 C252436235	National Food Institute, Ministry of Industry, Thailand	2402420-003-01	19 Apr 24	18 Apr 25	-
2	Analytical Balance (Readability 0.001 mg)	ฝุ่นทุกขนาด ฝุ่นละอองขนาดเล็กที่สามารถเข้าถึงและสะสมในถุงลมปอดได้	Mettler-Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2402420-002-01	19 Apr 24	18 Apr 25	-
Equipment for Water Quality Analysis									
3	pH Meter	อุณหภูมิ (Temperature) ความเป็นกรด-ด่าง (pH)	Mettler-Toledo	Seven Easy S20 / 1231155210	National Food Institute, Ministry of Industry, Thailand	2401718-001-01	11 Mar 24	10 Mar 25	-
4	Conductivity Meter	ค่าการนำไฟฟ้า (EC)	SI Analytics	Lab955 / 16300356	DKSH (Thailand) Ltd.	C24240057	11 Mar 24	10 Mar 25	-
5	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	XSR204 / C117635043	Technology Promotion Association (Thailand-Japan)	24MM293	11 May 24	10 May 25	-
6	Analytical Balance (Readability 0.01 mg)	ของแข็งละลายน้ำทั้งหมด (TDS) ของแข็งแขวนลอย (TSS)	Mettler-Toledo	XSR205DU / C009071872	National Food Institute, Ministry of Industry, Thailand	2402283-001-01	2 Apr 24	1 Apr 25	-
7	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2400141-001-01	11 Oct 23	10 Oct 24	-
8	BOD Incubator	บีโอดี (BOD)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	24TM303	10 Feb 24	9 Feb 25	-
9	COD Reactor (Heating Block)	ซีโอดี (COD)	Hanna	HI839800-02 / 6480019101	Hanna Instruments (Thailand) Ltd.	HIT-2413-0434	25 Mar 24	24 Mar 25	-

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Water Quality Analysis									
10	Digestor Unit	ไทเคเอ็น (TKN)	FOSS TECATOR	DT2520 / 91794469	FOSS South East Asia	9809	8 Feb 24	7 Feb 25	-
11	Distillation Unit (Kjeldahl Method)		FOSS TECATOR	KT200 / 91790524	FOSS South East Asia	9810	9 Feb 24	7 Feb 25	-
12	UV-VIS Spectrophotometer	แอมโมเนีย-ไนโตรเจน (Ammonia), ซีโอดี (COD) ไนเตรท ไนทไรต์ไนโตรเจน (Nitrate-Nitrogen)	Agilent Technologies	Cary60 G6860A / MY15410009	DOE Services Co.,Ltd.	SP24-018	9 May 24	8 May 25	-
13	UV-VIS Spectrophotometer	ซัลเฟต (Sulfate), ไนเตรต (Nitrate)	Hitachi	U-1900 / 2021-064	DOE Services Co.,Ltd.	SP24-008	16 Jan 24	15 Jan 25	-
14	Atomic Absorption Spectrophotometer (AAS)	สารหนู, ทองแดง แคดเมียม, อะลูมิเนียม ตะกั่ว	Agilent Technologies	System ID:G8432A AA240FS / MY13160001	Thailand Institute of Scientific and Technological Research(TISTR)	MTC_ACLNo 358/67	11 Mar 24	10 Mar 25	-
15	Inductively Coupled Plasma (ICP)	แมงกานีส โซเดียม เหล็ก	Agilent Technologies	System ID:G8015A G8015AA / MY18030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	13 Nov 23	12 Nov 24	-
16	Cold Vapor Atomic (CVAAS)	ปรอท	Nippon Instrument Corporation	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	11 Jul 23	10 Jul 24	-

List of Instruments Certification for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
Equipment for Water Quality Analysis									
17	Incubator	โคลิฟอร์มแบคทีเรีย ฟิคัลโคลิฟอร์มแบคทีเรีย	Memmert	IPP 260 / V616.0066	Technology Promotion Association (Thailand-Japan)	24TM650	2 Apr 24	1 Apr 25	-
18	Incubator		Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	24TM648	1 Apr 24	31 Mar 25	-
19	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	24TM29	10 Feb 24	8 Feb 25	-
20	Water Bath		Memmert	WNE 14 / L416.0612	Technology Promotion Association (Thailand-Japan)	24TM30	10 Feb 24	8 Feb 25	-
21	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2304203-001-01	10 Aug 23	9 Aug 24	-
22	Auto Clave		ALP	CL-40L / 808763	National Food Institute, Ministry of Industry, Thailand	2402281-001-01	2 Apr 24	1 Apr 25	-
23	Analytical Balance		OHAUS	PX623 / C236754745	DKSH (Thailand) Ltd.	C01234158	7 Dec 23	6 Dec 24	-

Due Date of Calibration\* : Based on the annual calibration plan. At least 1 time per year.









## Calibration Report

**Certificate No.:** 2402420-002-01  
**Equipment:** Electronic Balance  
**Model:** XP6  
**Serial No.:** B322373893  
**Capacity:** 6.1 g

**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.000001 g  
**ID No.:** UAE.AIR.019/2556

**Date of Calibration:** 19 April 2024

**Environment Condition:** Ambient Temperature:  $22.6 \pm 1.8$  °C Relative Humidity:  $48 \pm 6.0$  %  
**Place of Calibration:** Room 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1-500mg	15880	TCS	M2311181S	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M2311182S	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH.019/23	Quality Reborn	QR24-0492	4 March 2025

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

**Calibration Results:**

**1. Repeatability of Reading:**

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.0000057
6	0.0000019

**2. Off-Center Error:**

A mass of 2 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.

1	2	3	4	5	6	(Maximum Difference)	
(g)	(g)	(g)	(g)	(g)	(g)	(g)	
1.999981	1.999983	1.999980	1.999984	1.999983	1.999981	0.000003	

F-C5-012 Revision: 01 Date: 20-04-65



เอกสารนี้ควบคุม  
nfi.or.th

## Calibration Report

**Certificate No.:** 2402420-002-01  
**Equipment:** Electronic Balance  
**Model:** XP6  
**Serial No.:** B322373893  
**Capacity:** 6.1 g

**Manufacturer:** METTLER TOLEDO  
**Resolution:** 0.000001 g  
**ID No.:** UAE.AIR.019/2556

**Date of Calibration:** 19 April 2024

**Calibration Results:** (Continued)

**Calibration Range:** 0-6 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:**

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000032	2.00
0.01	0.0099970	0.009999	-0.000002	0.0000047	2.00
0.05	0.0500010	0.050003	-0.000002	0.0000048	2.00
0.10	0.1000010	0.100001	0.000000	0.0000069	2.00
0.15	0.1500020	0.150002	0.000000	0.0000083	2.00
0.17	0.1700050	0.170006	-0.000001	0.000012	2.00
0.20	0.1999990	0.200002	-0.000003	0.0000083	2.00
1.50	1.4999750	1.499971	0.000004	0.000027	2.00
3.00	2.9999680	2.999959	0.000009	0.000028	2.00
4.50	4.4999810	4.499967	0.000014	0.000022	2.00
6.00	5.9999490	5.999931	0.000018	0.000032	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by level of confidence of approximately 95 %.

----- End -----

F-C5-012 Revision: 01 Date: 20-04-65



เอกสารนี้ควบคุม  
nfi.or.th



## Calibration Certificate

**Certificate No.:** 2401718-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 5

**Equipment:** pH Meter  
**Manufacturer:** METTLER TOLEDO  
**Model:** SevenEasy pH  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Order No.:** 2401718  
**Operation No.:** 2401718-001  
**Date of Receipt:** 27 February 2024  
**Date of Calibration:** 11 March 2024

**Calibrated by** Mr.Manas Somsak  
Specialist  
**Date of Issue:** 12 March 2024  
**Approved by** [Redacted]  
Manager  
**Responsible Team**

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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2401718-001-01  
**Equipment:** pH Meter  
**Manufacturer:** METTLER TOLEDO  
**Serial No.:** 1231155210  
**ID No.:** UAE.WAT.010/2553  
**Resolution:** 0.01 pH ; 1 mV  
**Model:** SevenEasy pH  
**Type:** Bench top

Page 2 of 5

**Date of Calibration:** 11 March 2024  
**Location:** Chemical Calibration Laboratory, National Food Institute  
**Environment Condition:** Ambient Temperature: ( 23.4 ± 1.5 ) °C  
**Condition of Equipment:** Good Condition  
**Condition of this Results of Calibration**

**Relative Humidity:** ( 51 ± 3 ) %

1. Calibration Method  
W.CC-002 : In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	23E2003	14 June 2024
2.2 Digital Thermometer	2709007	Fluke	CC 660570-01	30 October 2024
2.3 Thermo-Hygro Meter	NFI.BTH.014/23	Iesto	CC 660353-01	3 April 2024
Certified Reference Material	Lot No.	Manufacturer	Ref. N.	Expiry Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	888842	CPAchem	PH216.L5	13 April 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	888843	CPAchem	PH217.L5	13 April 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	888844	CPAchem	PH220.L5	13 April 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	C03109	HACH LANGE GmbH	S11M004	16 October 2025

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments Ng.2.1	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0008
3.2 Instruments Ng.2.2 and 2.3	through	NSC-TIS-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Certified Reference Material Ng.2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

3.4 Certified Reference Material Ng.2.7  
traceable to  
PTB Certificate Nr. PTB-PHOA-56330504/23 and Certificate Nr. PTB-PHOB-55530620/22 (PTB- Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)

4. This certificate was certified only for the instrument we calibrated.

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

F-CS-012 Revision: 01 Date: 20-04-65





## Calibration Report

**Certificate No.:** 2401718-001-01  
**Equipment:** Digital Thermometer with RTD (pH Meter)  
**Resolution:** 0.1 °C  
**Model:** SevenEasy pH  
**Serial No.:** 123155210  
**ID No.:** UAE.WAT.010/2553  
**Manufacturer:** METTLER TOLEDO  
**Date of Calibration:** 11 March 2024

**Calibration point:** 15.0, 25.0 and 35.0 °C  
**Calibration result:**  
- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.  
- Description of probe, model: N/A S/N: N/A  
Dimension of probe: Diameter 4 mm, Length 120 mm.,  
Sheath material: Stainless Steel

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.1	14.998	0.1	0.099
25.1	24.998	0.1	0.099
35.1	34.997	0.1	0.099

Note

- UUC\*: Unit Under Calibration

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

F-CS-012 Revision: 01 Date: 20-04-65

## Certificate of Calibration

**Equipment:** CONDUCTIVITY METER  
**Model:** Lab 955  
**Serial No. (or ID.):** 16300356  
**Manufacturer:** SI Analytic  
**Electrode Serial No.** 16070067  
**Condition:** In Condition  
**Certificate No.:** C24240057  
**Issued Date:** 11 March 2024  
**Job No.:** WO-00020309  
**Page:** 1 of 2  
**Model:** LF413T  
**Brand:** SI Analytic

**Customer:** United Analyst and Engineering Consultant Company Limited  
3 Soi Udomsuk 41 Sukhumvit Road,  
Bangkok, Prakanong, Bangkok 10260 Thailand

**Environment Condition:** Temperature 23 °C ± 2 °C  
Humidity 50 %RH ± 15 %RH

**Calibration Place:** Environment Laboratory, DKSH Technology Limited,  
2533 Sukhumvit Road, Bangchak,  
Phrakhanong, Bangkok 10260 Thailand

**Calibration By:** Mr. Pongpisut Suebchantha

**Calibration Date:** 11 March 2024

**The Method used:** In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14  
**Traceability:** This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 960753, 890591, 890593

### Person in charge

### Authorized Signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 ถนนสุขุมวิท แขวงบางนา เขตคลองเตย กรุงเทพมหานคร 10260  
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

**เอกสารไม่ควบคุม**

CAL-FM-C24-09: 12 Sep 2022



Calibration Results:

Before Adjustment

Standard Conductivity Solution	Unit Under Calibration Reading	Correction	Coverage Factor ( k )	Uncertainty ( ± )
25.000    μS/cm	26.7    μS/cm	-1.700    μS/cm	2.00	0.21    μS/cm
1413.0    μS/cm	1428    μS/cm	-15.0    μS/cm	2.00	9.0    μS/cm
111.3    mS/cm	108.4    mS/cm	2.9    mS/cm	2.00	0.67    mS/cm

After Adjustment ; at 1413 µS/cm

Standard	Unit Under Calibration	Correction	Coverage Factor	Uncertainty ( ± )
Conductivity Solution	Reading			
25.000 µS/cm	25.9 µS/cm	-0.900 µS/cm	2.00	0.21 µS/cm
1413.0 µS/cm	1413 µS/cm	0.0 µS/cm	2.00	9.0 µS/cm
111.3 mS/cm	107.5 mS/cm	3.8 mS/cm	2.00	0.67 mS/cm

The End of Certificate

เอกสารไม่ควบคุม  
CAL-FM-C24-008: 12 Sep 2022



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



Certificate of Calibration

Cert.No.: 24MM293  
Page.: 1 of 3

Equipment : Electronic Balance  
Manufacturer : Mettler Toledo  
Model : XSR204  
Serial No. : C117635043  
ID No. : UAE.WAS.012/2564  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phra Khanong,  
Bangkok 10260

Location : Balance Room (108)

Received order : 11 May 2024  
Calibration Date : 11 May 2024  
Ambient Temperature : 15 °C to 40 °C  
Relative Humidity : 30 % to 90 %

Calibrated by : Kait Buttanapongchok  
Approved by :  
( ) Por  
( ) Suw  
(✓) Kur

Issue Date : 15 May 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.

เอกสารไม่ควบคุม





**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 2 of 3

**Procedure used :-**

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

**Condition of this result of calibration**

1. Reference standard instruments:-

- | Instruments                 | Model | Serial No. | ID No.  | Test report No. | Due date    |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053      | 70RC007 | MM-0013-24      | 25 Jan 2026 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

**Result of calibration** ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

**Range capacity :** 0 g to 220 g **Resolution** 0.0001 g

**Before Adjustment :**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement		Coverage Factor ( k )
			Uncertainty ( ± mg )		
100	100.0000	0.0000	0.27		2.03
200	200.0001	-0.0001	0.31		2

**After Adjustment :**

1. Determination of the standard deviation of weighing machine ( n = 10 )

Applied Weight ( g )	Standard Deviation of Reading ( g )
100	0.00007
200	0.00007



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 3 of 3

**Result of calibration**

**2. Effect of off center loading**

A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference between off-center and central loading (g)
(g)	(g)	(g)	(g)	(g)	
+0.0002	-0.0001	0.0000	+0.0002	0.0000	
					0.0003

**3. Departure from nominal value**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
Unload	0.0000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
5	5.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
20	20.0000	0.0000	0.19	2.03
50	50.0001	-0.0001	0.19	2.06
60	60.0001	-0.0001	0.19	2.04
80	80.0001	-0.0001	0.27	2
100	100.0002	-0.0002	0.27	2.03
120	120.0001	-0.0001	0.29	2
200	200.0001	-0.0001	0.31	2

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 %.

-000-



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 2 of 3

**Procedure used :-**

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

**Condition of this result of calibration**

1. Reference standard instruments:-

- | Instruments                 | Model | Serial No. | ID No.  | Test report No. | Due date    |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053      | 70RC007 | MM-0013-24      | 25 Jan 2026 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

**Result of calibration** ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

**Range capacity :** 0 g to 220 g **Resolution** 0.0001 g

**Before Adjustment :**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement		Coverage Factor ( k )
			Uncertainty ( ± mg )		
100	100.0000	0.0000	0.27		2.03
200	200.0001	-0.0001	0.31		2

**After Adjustment :**

1. Determination of the standard deviation of weighing machine ( n = 10 )

Applied Weight ( g )	Standard Deviation of Reading ( g )
100	0.00007
200	0.00007



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 3 of 3

**Result of calibration**

**2. Effect of off center loading**

A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference between off-center and central loading (g)
(g)	(g)	(g)	(g)	(g)	
+0.0002	-0.0001	0.0000	+0.0002	0.0000	
					0.0003

**3. Departure from nominal value**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
Unload	0.0000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
5	5.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
20	20.0000	0.0000	0.19	2.03
50	50.0001	-0.0001	0.19	2.06
60	60.0001	-0.0001	0.19	2.04
80	80.0001	-0.0001	0.27	2
100	100.0002	-0.0002	0.27	2.03
120	120.0001	-0.0001	0.29	2
200	200.0001	-0.0001	0.31	2

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 %.

-000-



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 2 of 3

**Procedure used :-**

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

**Condition of this result of calibration**

1. Reference standard instruments:-

- | Instruments                 | Model | Serial No. | ID No.  | Test report No. | Due date    |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053      | 70RC007 | MM-0013-24      | 25 Jan 2026 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

**Result of calibration** ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

**Range capacity :** 0 g to 220 g **Resolution** 0.0001 g

**Before Adjustment :**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement		Coverage Factor ( k )
			Uncertainty ( ± mg )		
100	100.0000	0.0000	0.27		2.03
200	200.0001	-0.0001	0.31		2

**After Adjustment :**

1. Determination of the standard deviation of weighing machine ( n = 10 )

Applied Weight ( g )	Standard Deviation of Reading ( g )
100	0.00007
200	0.00007



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 3 of 3

**Result of calibration**

**2. Effect of off center loading**

A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference between off-center and central loading (g)
(g)	(g)	(g)	(g)	(g)	
+0.0002	-0.0001	0.0000	+0.0002	0.0000	
					0.0003

**3. Departure from nominal value**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
Unload	0.0000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
5	5.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
20	20.0000	0.0000	0.19	2.03
50	50.0001	-0.0001	0.19	2.06
60	60.0001	-0.0001	0.19	2.04
80	80.0001	-0.0001	0.27	2
100	100.0002	-0.0002	0.27	2.03
120	120.0001	-0.0001	0.29	2
200	200.0001	-0.0001	0.31	2

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 %.

-000-



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 2 of 3

**Procedure used :-**

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

**Condition of this result of calibration**

1. Reference standard instruments:-

- | Instruments                 | Model | Serial No. | ID No.  | Test report No. | Due date    |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053      | 70RC007 | MM-0013-24      | 25 Jan 2026 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

**Result of calibration** ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

**Range capacity :** 0 g to 220 g **Resolution** 0.0001 g

**Before Adjustment :**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement		Coverage Factor ( k )
			Uncertainty ( ± mg )		
100	100.0000	0.0000	0.27		2.03
200	200.0001	-0.0001	0.31		2

**After Adjustment :**

1. Determination of the standard deviation of weighing machine ( n = 10 )

Applied Weight ( g )	Standard Deviation of Reading ( g )
100	0.00007
200	0.00007



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 3 of 3

**Result of calibration**

**2. Effect of off center loading**

A mass of 100 g was placed to various position on the pan.  
The weighing machine reading error obtained is given in the table

Position 1	Position 2	Position 3	Position 4	Position 5	Maximum difference between off-center and central loading (g)
(g)	(g)	(g)	(g)	(g)	
+0.0002	-0.0001	0.0000	+0.0002	0.0000	
					0.0003

**3. Departure from nominal value**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement Uncertainty ( ± mg )	Coverage Factor ( k )
Unload	0.0000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
5	5.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
20	20.0000	0.0000	0.19	2.03
50	50.0001	-0.0001	0.19	2.06
60	60.0001	-0.0001	0.19	2.04
80	80.0001	-0.0001	0.27	2
100	100.0002	-0.0002	0.27	2.03
120	120.0001	-0.0001	0.29	2
200	200.0001	-0.0001	0.31	2

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 %.

-000-



**Equipment :** Electronic Balance  
**Condition As-Received :** Used Item  
**Reference :** 2405-0166OC-2

**Cert.No.:** 24MM293  
**Page:** 2 of 3

**Procedure used :-**

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

**Condition of this result of calibration**

1. Reference standard instruments:-

- | Instruments                 | Model | Serial No. | ID No.  | Test report No. | Due date    |
|-----------------------------|-------|------------|---------|-----------------|-------------|
| 1) Standard Weight Set (E2) | 15884 | 24053      | 70RC007 | MM-0013-24      | 25 Jan 2026 |
2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This result of calibration was made on requested at the point specified by customer.  
4. This certificate is not certified for any commercial transaction.  
5. This certification is traceable to the International System of Unit.

**Result of calibration** ( ) Without Adjustment ( \* ) After Adjustment by Internal Calibration

**Range capacity :** 0 g to 220 g **Resolution** 0.0001 g

**Before Adjustment :**

Applied Weight ( g )	Balance Reading ( g )	Correction ( g )	Measurement		Coverage Factor ( k )
			Uncertainty ( ± mg )		
100	100.0000	0.0000	0.27		2.03
200	200.0001	-0.0001	0.31		2

**After Adjustment :**

1. Determination of the standard deviation of weighing machine ( n = 10 )


Applied Weight ( g )	Standard Deviation of Reading ( g )
100	0.00007
200	0.00007

## Calibration Certificate

**Certificate No.:** 2402283-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Serial No.:** C009071872  
**ID No.:** UAE.WAO.012/2563  
**Order No.:** 2402283  
**Operation No.:** 2402283-001  
**Date of Receipt:** 2 April 2024  
**Date of Calibration:** 2 April 2024

**Calibrated by** Mr.Jerawut Prapawuttipong  
**Approved by**   
**Scientist** (Mr.Pheraphat Tuanjit )  
**Manager, Division of Calibration Laboratory**  
**Responsible for the Technical Management Team**

**Date of Issue:** 9 April 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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

## Calibration Report

**Certificate No.:** 2402283-001-01  
**Equipment:** Electronic Balance  
**Manufacturer:** METTLER TOLEDO  
**Model:** XSR205DU  
**Resolution:** 0.00001 g / 0.0001 g  
**Serial No.:** C009071872  
**ID No.:** UAE.WAO.012/2563  
**Capacity:** 220 g

Page 2 of 4

**Date of Calibration:** 2 April 2024  
**Environment Condition:** Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %  
**Place of Calibration:** Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Condition of Equipment:** Good Condition

**Condition of This Results of Calibration:**

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M23040535	8 April 2024
Thermo-Hygro Meter	608-H1	NFLBTH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

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

**Calibration Results:**

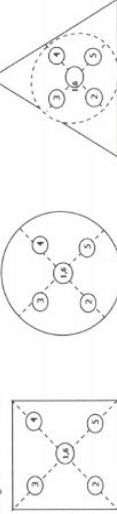
**1. Repeatability of Reading:**

Nominal Value ( g )	Standard Deviation of Reading ( g )
40	0.000052
80	0.000063
100	0.000048
200	0.000053

**2. Off-Center Error:**

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 ( g )	2 ( g )	3 ( g )	4 ( g )	5 ( g )	6 ( g )	(Maximum Difference) ( g )
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

F-CS-012 Revision: 01 Date: 20-04-65



# Calibration Report

**Certificate No.:** 2402283-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.012/2563

Capacity: 220 g

Date of Calibration: 2 April 2024

Page 3 of 4

**Calibration Results:** (Continued)

**Calibration Range:** 0 - 80 g

**Calibration Adjustment:** Internal Calibration

**3. Departure from Nominal Value:** (Range: 0 - 80 g ; Resolution: 0.00001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.0000088	2.00
0.01	0.001003	0.00101	-0.00001	0.0000091	2.00
0.005	0.005003	0.00499	0.00001	0.0000094	2.00
0.01	0.010003	0.01000	0.00000	0.0000091	2.00
0.05	0.049996	0.05000	0.00000	0.0000098	2.00
0.1	0.100011	0.10000	0.00001	0.000011	2.00
0.5	0.500016	0.50001	0.00001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.00001	0.000017	2.00
5	5.000017	5.00002	0.00000	0.000020	2.00
10	10.000009	10.00000	0.00001	0.000026	2.00
20	20.000031	20.00002	0.00001	0.000037	2.00
30	30.000040	30.00003	0.00001	0.000052	2.00
50	50.000028	50.00004	-0.00001	0.000068	2.00
80	80.000065	80.00005	0.00002	0.00011	2.00

F-CS-012 Revision: 01 Date: 20-04-65

**১০৯**

2008 Soi 36, Arun Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand

Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545

**CONFIDENTIAL**

# Calibration Report

**Certificate No.:** 2402283-001-01

**Equipment:**

Electronic Balance

**Manufacturer:** METTLER TOLEDO

Resolution: 0.00001 g / 0.0001 g

ID No.: UAE.WAO.012/2563

Capacity: 220 g

Date of Calibration: 2 April 2024

Page 4 of 4

**Calibration Results:**

**Calibration Range:** 81 - 200 g

**Calibration Adjustment:** Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g )

Nominal Value ( g )	Standard Value ( g )	Average Reading ( g )	Correction ( g )	Uncertainty ( ± g )	Coverage Factor k
90	90.00010	90.00000	0.0001	0.00015	2.00
100	100.00006	100.00000	0.0001	0.00015	2.00
110	110.00007	110.00001	0.0000	0.00017	2.00
120	120.00009	120.00000	0.0001	0.00018	2.00
130	130.00010	130.00000	0.0001	0.00019	2.00
140	140.00014	140.00000	0.0001	0.00020	2.00
150	150.00009	150.00001	0.0000	0.00020	2.00
160	160.00010	160.00001	0.0000	0.00022	2.00
170	170.00012	170.00001	0.0000	0.00023	2.00
200	200.00016	200.00000	0.0002	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a level of confidence of approximately 95 %.

-----End-----

F-CS-012 Revision: 01 Date: 20-04-65

1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813

22008 Soi 36, Arun Amarin Road,, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok

Tel: +66(0) 2422 8588 Fax: +66(0) 2422 8545

Orth



# Calibration Certificate

**Certificate No.:** 2400141-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
 Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

**Equipment:**

**Manufacturer:**

Model: UF 55

Serial No.: B216.1666

UAE.WAO.027/2559

Order No.: 2400141

Operation No.: 2400141-001

Date of Receipt: 11 October 2023

Date of Calibration: 11 October 2023

Calibrated by  
Mr. Worapob Sooktong  
Scientist  
Approved by

Date of Issue: 16 October 2023

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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

E-009 Revision: 01 Date: 20-04-65

**เอกสารโฆษณา**

2008 ๒๕๔๙ กรุณาติดต่อ : 36 ถนนสุขุมวิท แขวงคลองตัน เขตคลองเตย กรุงเทพมหานคร 10710  
2008 Soi 36, Aun Amarin Road, Bang Yi Khan Subdistrict, Bang Phai District, Bangkok 10700, Thailand.  
Tel: +66(0) 2422 8988 Fax: +66(0) 2423 8945

# Calibration Report

<b>Certificate No.:</b>	2400141-001-01
<b>Equipment:</b>	CHAMBER (Hot Air Oven)
Model:	UF 55
Serial No.:	B216.1666
Resolution:	0.1 °C
ID No.:	UAE.WAO.027/2559
Manufacturer:	MEMMERT
<b>Date of Calibration:</b>	11 October 2023

Page 2 of 3

**Location:** Laboratory, Floor 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

**Environment Condition:** Ambient Temperature (  $28 \pm 1$  ) °C

Relative Humidity ( 63 ± 2 ) %

Line Voltage ( 228 ± 1 ) Volt

**Condition of this results of Calibration:**

1. This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
  - The temperature scale used was based on ITS - 90.
  - All data show below were final values and the initial data may be obtained upon request.

## 2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY49016894	TE 660380-01	22 April 2024	NATIONAL FOOD INSTITUTE
	RTD	CHR201-209/ RTD#201-209			

3. This certificate is traceable to International System of Units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated Item : Good

UUC Description :

Time of Record	1 Hour	9 Minute	At 104.0, 140.0 and 180.0 °C
Fresh air Damper	-	Position	-
	X	Close	

	-	Not Available
--	---	---------------

	Without adjustment	After adjustment
7. Result of Calibration :	X	

ECS-012 Revision: 01 Date: 20.04.65

2008 baesqvausuns 36 muasqvausuns knunadon weunwats ngummunus 107  
2008 Sol 36, Avn Amarin Road, Bang Yi Khan Subdistrict, Bang Phlat District, Bangkok 10700, Thailand  
Tel +66(0) 2422 8568 Fax +66(0) 2422 8545

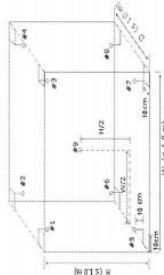
## Calibration Report

**Certificate No.:** 2400141-001-01  
**Equipment:** CHAMBER (Hot Air Oven)  
**Model:** UF 55      **Serial No.:** B216.1666  
**Resolution:** 0.1 °C      **ID No.:** UAE.WAO.027/2559  
**Manufacturer:** MEMMERT  
**Date of Calibration:** 11 October 2023

**Calibration point:** 104.0, 140.0 and 180.0 °C

**Calibration result:**

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	28.2	61.4	227.4
MAX	28.3	65.1	229.3



**Table 1 : Reporting of Temperature**

Calibration point (°C)	Measured Temperature (°C) @ Sensor No.										Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10	
104.0	104.05	103.98	104.02	104.08	104.00	104.05	103.99	104.17	104.00	104.00	0.53
140.0	140.09	139.99	139.91	140.05	139.99	139.91	139.97	140.26	139.97	139.97	0.73
180.0	180.46	180.33	180.25	180.28	180.33	179.96	180.31	180.64	180.16	180.16	0.90

**Table 2 : Reporting of Characterization Result**

UUC* Setting (°C)	UUC* reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.090	0.18	0.38
140.0	140.0	140.1	140.0	0.075	0.28	0.47
180.0	180.0	180.1	180.0	0.13	0.48	0.88

**Note** The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC\* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

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.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65





Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2402-0234OC-1  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Not Available

Cert. No.: 24TM303  
Page : 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
20.0	20.1	19.9	0.37	0.72	1.4	2

Calibration Point ( °C )	Measured Temperature ( °C )								Uncertainty ( ± °C )
	1	2	3	4	5	6	7	8	
20.0	19.873	19.803	20.322	19.690	19.615	19.585	19.612	19.558	0.58

Average\* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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-



Equipment : BOD Incubator  
Condition As-Received : Used Item  
Reference : 2402-0234OC-1

Cert. No.: 24TM303  
Page : 2 of 3

#### Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector ( RTD ).

The temperature scale used was based on ITS-90.

#### Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY59003411	23LM208	TPA	27 Dec 2024

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

3. This certification is traceable to the International System of Unit.

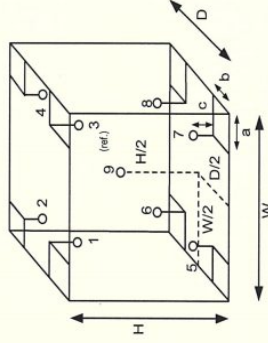
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Not Available

Environment during calibration	
Beginning	Finished
Temp. ( °C )	28 31
REL.Humid. ( % )	70 65
AC Supply ( Volt )	233 234



Position :	Ref. Std. ID No.:
1	20RTD-2/1
2	20RTD-2/2
3	20RTD-2/3
4	20RTD-2/4
5	20RTD-2/5
6	20RTD-2/6
7	20RTD-2/7
8	20RTD-2/8
9 (ref.)	20RTD-2/9

#### Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.62 m
b = 10 cm	W = 1.2 m
c = 10 cm	H = 1.2 m
Capacity = 0.89 m <sup>3</sup>	



## CERTIFICATE OF CALIBRATION

**Equipment :** COD Test Tube Heater  
**Meter Model :** HI839800-02  
**Tube Heater :** 25 Vial Capacity  
**Temperature Range :** (-10 to 160)°C  
**Manufacturer :** Hanna Instruments  
**Condition As-Received :** Used Product  
**Ambient Temperature :** (25 ± 2)°C  
**Customer name :** United Analyst and Engineering Consultant Co., Ltd.  
**Serial No. :** 06480019101  
**Resolution :** 0.1°C  
**Temperature of Reaction :** 150°C  
**Made in :** Romania  
**Reference :** RE240528  
**Relative Humidity :** (50 ± 15)%RH

3 Soi Udonsuk 41, Sukhumvit Rd., Bangchak,  
Phrakhanong, Bangkok 10260

**Received date :** 25 March 2024

**Calibrate date :** 25 March 2024

**Issue date :** 27 March 2024

**Calibrated Location :** Hanna Instruments (Thailand) Ltd.

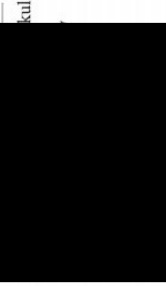
**Calibration Procedure :** This calibrator was conducted by using in-house: calibration procedure  
CP-04 by using certified reference standard instruments.

**Calibrated by :**

☒ Mr. Pichit Pethong

☐ Mr. Chaunarong Soinak

**Approved by :**

  
Mr. Chaunarong Soinak

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).

**เอกสารนี้ควบคุม**

## Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

## Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (± °C)
25 Vial	150.0	150.0	0.50

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
149.477	149.183	150.029	150.627	149.731
(1B)	(2B)	(3B)	(4B)	(5B)
149.845	150.325	150.275	149.688	150.599
(1C)	(2C)	(3C)	(4C)	(5C)
149.869	150.077	150.571	150.217	150.409
(1D)	(2D)	(3D)	(4D)	(5D)
149.295	150.434	150.347	150.243	150.390
(1E)	(2E)	(3E)	(4E)	(5E)
149.911	149.301	150.232	150.162	149.418

Figure: Shows the location of the temperature source.

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 \*\*

## Verification Certificate

**Certificate No.:** 2302413-001-01  
**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.  
**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 4

**Equipment:** HEATING BLOCK DIGESTION

**Manufacturer:** FOSS

**Model:** 2520

**Serial No.:** 91794469

**ID No.:** UAE.WAS.011/2560

**Order No.:** 2302413

**Operation No.:** 2302413-001

**Date of Receipt:** 28 March 2023

**Date of Calibration:** 30-31 March 2023

**Calibrated by** Mr.Nuttapol Niyomchat  
Specialist

**Date of Issue:** 10 April 2023

Mr. Niyomchat Niyomchat  
Responsible Team

**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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

FCS-009 Revision: 01 Date: 20-04-65

## Verification Report

**Certificate No.:** 2302413-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
**Model:** 2520  
**Serial No.:** 91794469  
**Resolution:** 1 °C  
**ID No.:** UAE.WAS.011/2560  
**Manufacturer:** FOSS  
**Date of Calibration:** 30-31 March 2023

Page 2 of 4

**Location:** Laboratory Room, NATIONAL FOOD INSTITUTE  
**Environment Condition:**  
Ambient Temperature ( 25 ± 3 ) °C  
Relative Humidity ( 55 ± 15 ) %  
Line Voltage ( 220 ± 10 ) Volt

### Condition of this results of Calibration:

1. This instrument was calibrated by insert standard thermocouples type R into its heating block digestion and compared to temperature obtained from reference standards thermometer at calibrated point.
  - The temperature scale used was based on ITS - 90 .
  - All data show below were final values and the initial data may be obtained upon request.
2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with Thermocouple	34970A Type R	HY4405576 / MY41194453 TC#101-103 / CH#101-103	TC22/0044	5-May-2023	N.M. Technical Center Laboratory

3. This certificate is traceable to international system of units (SI Units).
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.
6. Condition of Calibrated item : Good

UUC\* Description

Time of Record - Hour 30 Minute At 380 °C

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

FCS-009 Revision: 01 Date: 20-04-65



## Verification Report

**Certificate No.:** 2302413-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
 Model: 2520 Serial No.: 91794469  
 Resolution: 1 °C ID No.: UAE.WAS.011/2560  
 Manufacturer: FOSS

**Date of Calibration:** 30-31 March 2023  
**Calibration point:** 380 °C  
**Calibration result:**

Page 4 of 4

### Reporting of Temperature

Block No.	UUC* Setting (°C)	UUC* Reading (°C)	Stability (±°C)	Standard Thermometer (°C)	Uncertainty (±°C)
1	380	380	0.96	377.74	2.1
2	380	380	0.40	377.28	2.1
3	380	380	1.18	377.82	2.1
4	380	380	0.44	377.19	1.6
5	380	380	0.11	377.30	1.6
6	380	380	0.14	377.90	1.6
7	380	380	1.17	373.85	2.1
8	380	380	0.33	376.96	2.1
9	380	380	0.14	374.18	2.1
10	380	380	0.96	378.56	2.0
11	380	380	1.04	378.34	2.0
12	380	380	0.35	378.06	2.0
13	380	380	0.48	377.05	1.6
14	380	380	0.38	379.19	1.6
15	380	380	0.50	377.48	1.6
16	380	380	0.48	378.33	1.7
17	380	380	0.71	377.60	1.7
18	380	380	0.35	376.77	1.7
19	380	380	0.84	377.06	1.8
20	380	380	0.41	378.58	1.8

Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperature for at least half an hour after reaching steady state.

FCS-009 Revision: 01 Date: 20-04-65

## Verification Report

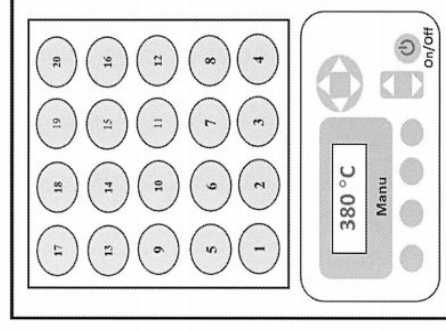
**Certificate No.:** 2302413-001-01  
**Equipment:** HEATING BLOCK DIGESTION  
 Model: 2520 Serial No.: 91794469  
 Resolution: 1 °C ID No.: UAE.WAS.011/2560  
 Manufacturer: FOSS

**Date of Calibration:** 30-31 March 2023  
**Calibration point:** 380 °C  
**Calibration result:**

Page 4 of 4

Figure 1. Location of Reference Standard and Block Diagram of Digestion Unit

### TOP VIEW



### Sensor Installation Location

Note:

- UUC\* = Unit Under Calibration
- Immersion depth of standard thermometer in tube level high of sand is equal heater plate of UUC.
- Stability = One-half of the greatest maximum difference of measured temperatures at one sensors for at least half an hour after reaching steady state.

The report uncertainty of measurement was based on standard uncertainty providing a level of confidence of approximately 95 %.

----- End -----

FCS-009 Revision: 01 Date: 20-04-65



# FOSS

## Customer Service Report

FOSS South East Asia  
3388 Srinrat Building, 25th - 26th Floor, Unit No. 3388/90,  
Rama IV Road, Klongtoey, Klongtoey, Bangkok, Thailand 10110

Report No: **5874**

Date: 30/11/21

Customer: UAE

Instrument: KT 200

Hours  
Start 8.00  
Finish 14.00

Labour  
9.00  
14.00

Travel From Customer  
14.00  
15.00

Address: 91 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร 10210

Serial: 91790524

Application		Special		Job Type		Standard	
Normal	<input checked="" type="checkbox"/>	Courtesy Visit	<input checked="" type="checkbox"/>	Installation	<input checked="" type="checkbox"/>	Training	<input checked="" type="checkbox"/>
Distributor	<input checked="" type="checkbox"/>	PMA Onboarding	<input checked="" type="checkbox"/>	Quote	<input checked="" type="checkbox"/>	In House	<input checked="" type="checkbox"/>
Internal	<input checked="" type="checkbox"/>	Warranty	<input checked="" type="checkbox"/>	Repair	<input checked="" type="checkbox"/>	PM	<input checked="" type="checkbox"/>
Digital Service	<input checked="" type="checkbox"/>	Sales Support	<input checked="" type="checkbox"/>	Remote	<input checked="" type="checkbox"/>	Other	<input checked="" type="checkbox"/>

PO/Quote Number: FOSS case no. 170

PMA Type: FOSS case no. 170

Details of Work / Test		Condition / Status	
- Check instrument		OK	
- Check PM kit for KT 200		Pass	
- Check safety valve		Pass	
- Check rubber gasket		Pass	
- Check seal		Pass	
- Check heating element		Pass	
- Check new panel PCB		Pass	
- Check safety desl		Pass	
- Clean & lubricant		Pass	
- Check level topped		Pass	
- Check volum		Pass	

Instrument Ready for Use		OK	Not OK	If not OK - Comment	
Part No:	Batch			Description	Qty
10009065	11235-983			Foss PM kit KT 200	1
15750024	24.08.21			Safety Valve	1
15460024	09.11.20			Rubber Gasket for Heating oil	2
11008512	02.08.21			Heating Element	1

เอกสารไม่ควบคุม

# FOSS Preventive Maintenance Protocol

FossCare™

## Instrument

Recommended PM interval (which varies between interval and no. of samples analysed)  
Preventive maintenance kit (P/N)

## Introduction

A maintenance protocol provides systematic type. The recommended PM interval depends on the operational conditions and is based on our extensive experience and knowledge of manufacturing and maintaining analytical instruments.  
Apart from sample throughput, the environmental conditions also need to be considered. A demanding environment, such as high ambient temperature, humidity, dirtiness etc can measurably shorten component lifetime and also the maintenance and component replacement intervals.

## NOTE!

The content of this protocol is subject to change over time. In order to safeguard that you obtain the correct parts, please make sure to indicate serial no and date of installation when contacting your FOSS representative.

## Dedicated Analytical Solutions

**FOSS Analytical A/S**  
69 Stangerupgate  
DK-3400 Hillerød  
Denmark  
Tel +45 7010 3370  
Fax +45 7010 3371  
E-mail support@foss.dk  
Web www.foss.dk

**FOSS Analytical AB**  
Box 70  
SE-263 21 Högåns  
Sweden  
Tel +46 42 361500  
Fax +46 42 340349  
E-mail support@foss.dk  
Web www.foss.dk

Customer Support, 1001 4572 / Rev. 3

1(2)

เอกสารไม่ควบคุม



## Maintenance Procedure

### Exchange of Parts and Cleaning

Step	Action	Part	P/N	OK
1	Replace	Adapter for dig. tube 250 ml	1000 0056	<input type="checkbox"/>
2	Replace	Non return valve	1000 3538	<input type="checkbox"/>
3	Replace valves in alkali pump	Valve kit reagent/water pump	1575 0093	<input type="checkbox"/>
4	Replace steam tubing	Silicone tubing 8/12 mm	1582 0006	<input type="checkbox"/>
5	Replace alkali tubing	Tubing reinforced for alkali	1582 0011	<input type="checkbox"/>
6	Replace water tubing	Tubing PVC 8/11 mm	1582 0004	<input type="checkbox"/>
7	Cleaning	Steam generator		<input type="checkbox"/>
8	Cleaning	Splash head		<input type="checkbox"/>

### Check and Adjustments

Step	Action	Module	Measured	Limits	OK
1	Check alkali volume, 10 ml/stroke	Alkali pump	98	At 50 ml -0/+3 ml	<input checked="" type="checkbox"/>
2	Check distillation volume		120ml	100 – 150 ml/4 min	<input checked="" type="checkbox"/>
3	Check front panel switches				<input checked="" type="checkbox"/>
4	Check cables and electrical connections				<input checked="" type="checkbox"/>
5	Check level pins in steam generator				<input checked="" type="checkbox"/>
6	Check safety door switch				<input checked="" type="checkbox"/>

## CERTIFICATE OF CALIBRATION

Certificate No. : SP22-016

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,

Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Agilent Technologies

Model : Cary 60

Serial No. : MY15410009

ID No. : N/A

Received Date : 23 May 2022

Calibration Date : 23 May 2022

Issue Date : 26 May 2022

Condition Instrument : Good

Cal

The c

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 DQE Services Co., Ltd.

## REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °CRelative humidity  $55 \pm 20$  %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

## Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	95935	22 October 2023
Absorbance Standard set	25757	95929	22 October 2023
Wavelength Standard set	25806	95916	22 October 2023
Wavelength Standard set	25758	95915	22 October 2023

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Sarna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 90 nm/min

Scan Interval of UUC : 0.15 nm.

Resolution of UUC : Photometric 0.0001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 3 of 5

Calibration Results : Without adjustment

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.0000	0.0000	0.0028	2.00
	0.5787	0.5755	0.0032	0.0031	2.00
	1.0490	1.0436	0.0054	0.0029	2.00
	2.1900	2.1847	0.0053	0.0075	2.00
440	0.0000	0.0000	0.0000	0.0028	2.00
	0.5607	0.5588	0.0019	0.0034	2.00
	1.0247	1.0232	0.0015	0.0035	2.00
	2.1229	2.1211	0.0018	0.0082	2.00
465	0.0000	0.0000	0.0000	0.0028	2.00
	0.5236	0.5197	0.0039	0.0029	2.00
	0.9634	0.9625	0.0009	0.0028	2.00
	1.9763	1.9752	0.0011	0.0070	2.00
546.1	0.0000	-0.0001	0.0001	0.0028	2.00
	0.5191	0.5171	0.0020	0.0031	2.00
	1.0003	0.9984	0.0019	0.0033	2.00
	1.9987	1.9946	0.0041	0.0084	2.00
590	0.0000	0.0000	0.0000	0.0028	2.00
	0.5523	0.5509	0.0014	0.0030	2.00
	1.0809	1.0799	0.0010	0.0029	2.00
	2.0391	2.0329	0.0062	0.0080	2.00
635	0.0000	0.0000	0.0000	0.0028	2.00
	0.5601	0.5584	0.0017	0.0031	2.00
	1.0512	1.0498	0.0014	0.0029	2.00
	1.9294	1.9265	0.0029	0.0082	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021



## REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 4 of 5

## Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor <i>k</i>
235	0.0000 0.7478	0.0001 0.7421	-0.0001 0.0057	0.0050 0.0056	2.00 2.00
257	0.0000 0.8686	0.0000 0.8619	0.0000 0.0067	0.0050 0.0059	2.00 2.00
313	0.0000 0.2912	0.0000 0.2896	0.0000 0.0016	0.0050 0.0051	2.00 2.00
350	0.0000 0.6448	0.0000 0.6403	0.0000 0.0045	0.0050 0.0055	2.00 2.00

## REPORT OF CALIBRATION

Certificate No. : SP22-016

Page 5 of 5

## Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor <i>k</i>
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.5	0.31	0.18	2.00
334.06	333.5	0.56	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.4	0.54	0.18	2.00
453.66	453.2	0.46	0.18	2.00
460.02	459.7	0.32	0.18	2.00
536.59	536.2	0.39	0.18	2.00
637.98	638.3	-0.32	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.5	-0.03	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.7	-0.30	0.18	2.00
740.72	740.8	-0.08	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.0	0.28	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- 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%

- \* Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

## CERTIFICATE OF CALIBRATION

Certificate No. : SP24-008 Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-1900

Serial No. : 2021-064

ID No. : UAE.WAS.006/2552

Received Date : 16 January 2024

Calibration Date : 16 January 2024

Issue Date : 19 January 2024

Condition Instrument : Good

Calibrated by :



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

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

## REPORT OF CALIBRATION

Certificate No. : SP24-008 Page 2 of 5

Environment Condition : Ambient Temperature  $25 \pm 5$  °C

Relative humidity  $55 \pm 20$  %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

### Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 4.0 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.046	0.0024	0.0029	2.00
	2.1876	2.186	0.0016	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.024	-0.0001	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.999	0.0012	0.0033	2.00
	1.9973	1.994	0.0033	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.080	0.0003	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.051	0.0008	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

เอกสารไม่ควบคุม

REPORT OF CALIBRATION

Certificate No. : SP24-008

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.748	-0.0011	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.865	0.0024	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.293	-0.0011	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00



E-mail : [sumalee@tistr.or.th](mailto:sumalee@tistr.or.th)

## CALIBRATION DATA

## 1. Noise Level

Element	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Zn
	0.0006	0.0004	-0.0003	0.0001	-0.0011	-0.0005	0.0008	0.0004
	0.001	0.0017	-0.0009	0.0008	0.0001	0.0002	-0.0003	0.0007
	0.0006	0.0017	-0.0020	0.0005	0.0005	0.0004	0.0013	0.0014
	0.0001	0.0018	-0.0007	0.0005	0.0004	-0.0003	-0.0001	0.0010
	-0.0001	0.0019	-0.0014	0.0003	0.0010	0.0000	0.0002	-0.0001
	0.0011	0.0014	-0.0017	0.0009	-0.0008	0.0004	0.0006	0.0010
	-0.0002	0.0015	-0.0015	0.0003	0.0002	-0.0008	0.0009	0.0013
	0.0006	0.0012	-0.0001	0.0006	0.0008	0.0001	-0.0002	0.0013
	0.0008	0.0009	-0.0003	0.0003	0.0005	0.0002	0.0001	0.0007
Absorbance	0.0012	0.0011	-0.0012	0.0008	0.0003	0.0004	0.0004	0.0013
	0.0003	0.0015	-0.0019	0.0001	-0.0002	0.0000	-0.0003	0.0003
	0.0005	0.0017	-0.0019	-0.0007	0.0000	-0.0007	0.0005	0.0005
	-0.0006	0.0016	0.0000	0.0006	-0.0001	0.0013	0.0006	0.0010
	0.0003	0.0011	-0.0002	0.0001	-0.0007	0.0009	0.0009	0.0002
	0.0003	0.0012	-0.0011	0.0007	-0.0003	-0.0003	0.0010	0.0009
	0.0004	0.0018	-0.0016	-0.0004	-0.0006	0.0008	0.0007	0.0007
	-0.0001	0.0018	-0.0018	0.0013	-0.0006	-0.0001	0.0014	0.0006
	0.0003	0.0017	-0.0001	0.0001	-0.0012	-0.0004	0.0001	0.0002
	0.0010	0.0018	-0.0007	0.0003	-0.0005	-0.0002	0.001	0.0003
Average Absorbance	0.0004	0.0019	-0.0008	-0.0001	-0.0004	0.0003	0.0002	0.0008
	0.000	0.001	-0.001	0.000	0.000	0.000	0.000	0.000

Continue 2 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Request No. 25-67 / 0275

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

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

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4

## 2. Precision

Element	Conc. (mg/l)	Absorbance															Ave. Abs.	SD	%RSD	
Cd	0.02	0.0078	0.0076	0.0069	0.0075	0.0071	0.0070	0.0076	0.0074	0.0077	0.0067	0.0077	0.0074	0.0076	0.0077	0.0067	0.007	0.0004	5.15	
	0.30	0.1008	0.1007	0.0999	0.0997	0.1000	0.0996	0.1008	0.1002	0.1005	0.0999	0.1005	0.1002	0.1005	0.0999	0.100	0.0005	0.46		
	0.70	0.2301	0.2306	0.2277	0.2305	0.2310	0.2295	0.2290	0.2293	0.2305	0.2296	0.2305	0.2293	0.2290	0.2305	0.230	0.0010	0.42		
Cr	0.10	0.0094	0.0093	0.0093	0.0098	0.0094	0.0095	0.0090	0.0091	0.0094	0.0090	0.0094	0.0091	0.0090	0.0094	0.0090	0.0003	2.75		
	0.30	0.0241	0.0236	0.0221	0.0238	0.0231	0.0226	0.0231	0.0223	0.0230	0.0231	0.0230	0.0223	0.0231	0.0230	0.0231	0.023	0.0006	2.75	
	0.70	0.0500	0.0500	0.0500	0.0524	0.0499	0.0511	0.0509	0.0512	0.0515	0.0504	0.0515	0.0512	0.0515	0.0504	0.051	0.0008	1.63		
Cu	0.05	0.0061	0.0062	0.0064	0.0061	0.0069	0.0069	0.0061	0.0062	0.0064	0.0061	0.0064	0.0062	0.0064	0.0061	0.006	0.0003	5.00		
	0.30	0.0419	0.0411	0.0402	0.0407	0.0405	0.0404	0.0399	0.0400	0.0399	0.0400	0.0399	0.0400	0.0399	0.0400	0.040	0.0006	1.58		
	0.70	0.0960	0.0960	0.0960	0.0959	0.0947	0.0955	0.0952	0.0952	0.0951	0.0955	0.0951	0.0952	0.0952	0.0951	0.095	0.0005	0.48		
Fe	0.10	0.0096	0.0101	0.0103	0.0100	0.0099	0.0096	0.0106	0.0099	0.0105	0.0102	0.0105	0.0102	0.0105	0.0102	0.010	0.0003	3.38		
	0.50	0.0424	0.0415	0.0428	0.0427	0.0421	0.0426	0.0413	0.0430	0.0421	0.0419	0.0421	0.0430	0.0421	0.0419	0.042	0.0006	1.33		
	1.00	0.0830	0.0839	0.0847	0.0834	0.0832	0.0820	0.0839	0.0838	0.0837	0.0845	0.0845	0.0838	0.0837	0.0845	0.084	0.0008	0.92		
Pb	0.20	0.0078	0.0074	0.0078	0.0078	0.0076	0.0078	0.0077	0.0078	0.0078	0.0077	0.0078	0.0078	0.0077	0.0078	0.0077	0.0008	0.0001	1.71	
	0.70	0.0278	0.0273	0.0271	0.0267	0.0270	0.0264	0.0274	0.0273	0.0269	0.0269	0.0273	0.0273	0.0269	0.0273	0.0269	0.027	0.0004	1.45	
	1.50	0.0551	0.0548	0.0552	0.0555	0.0547	0.0546	0.0544	0.0544	0.0549	0.0547	0.0549	0.0544	0.0549	0.0547	0.055	0.0004	0.64		
Mn	0.05	0.0116	0.0107	0.0110	0.0103	0.0108	0.0108	0.0112	0.0107	0.0109	0.0108	0.0111	0.0107	0.0109	0.0108	0.011	0.0003	3.15		
	0.30	0.0650	0.0649	0.0649	0.0651	0.0646	0.0646	0.0649	0.0646	0.0640	0.0648	0.0640	0.0646	0.0649	0.0640	0.064	0.0003	0.48		
	0.70	0.1463	0.1465	0.1459	0.1471	0.1475	0.1474	0.1487	0.1473	0.1462	0.1468	0.1473	0.1462	0.1487	0.1468	0.147	0.0008	0.56		
Ni	0.10	0.0095	0.0100	0.0096	0.0103	0.0102	0.0096	0.0100	0.0095	0.0097	0.0096	0.0100	0.0095	0.0097	0.0096	0.010	0.0003	3.04		
	0.50	0.0493	0.0433	0.0438	0.0444	0.0430	0.0437	0.0444	0.0437	0.0438	0.0434	0.0438	0.0437	0.0444	0.0434	0.044	0.0005	1.09		
	1.00	0.0812	0.0820	0.0834	0.0829	0.0818	0.0829	0.0831	0.0835	0.0816	0.0819	0.0835	0.0831	0.0835	0.0816	0.082	0.0008	0.99		
Zn	0.05	0.0374	0.0377	0.0373	0.0377	0.0374	0.0377	0.0373	0.0377	0.0373	0.0374	0.0377	0.0373	0.0377	0.0374	0.037	0.0002	0.61		
	0.30	0.1985	0.1993	0.1975	0.1992	0.1979	0.1988	0.1995	0.1985	0.1974	0.1984	0.1995	0.1985	0.1995	0.1974	0.198	0.0004	0.62		
	0.70	0.4027	0.4031	0.4019	0.4021	0.4023	0.3981	0.4042	0.4025	0.3993	0.3993	0.3993	0.4025	0.3993	0.3993	0.399	0.0004	0.62		

Continue 3 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

Request No. 25-67 / 0275

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

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

Office  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2577 9000  
Fax. (66) 0 2577 9009  
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4





Request No. 25-67 / 0275

3 / 5

MTC. ACL. No. 358 / 67

### 3. Trueness

#### 3.1 Reading on wavelength- Cadmium(Cd) at 228.8 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cd	0.020	0.020	0.000	1.10	± 0.005
	0.301	0.301	0.000	0.11	± 0.005
	0.707	0.693	-0.013	1.85	± 0.008

#### 3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cr	0.1007	0.104	0.004	3.49	± 0.009
	0.3035	0.297	-0.006	2.11	± 0.012
	0.7071	0.685	-0.023	3.19	± 0.023

#### 3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Cu	0.051	0.047	-0.004	7.58	± 0.003
	0.303	0.296	-0.007	2.11	± 0.005
	0.704	0.698	-0.005	0.71	± 0.005

Continue 4 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

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

FM.BLMTC.002 Rev.4



Request No. 25-67 / 0275

4 / 5

MTC. ACL. No. 358 / 67

### 3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Fe	0.100	0.104	0.005	4.60	± 0.014
	0.500	0.482	-0.018	3.55	± 0.016
	1.006	0.968	-0.038	3.75	± 0.029

### 3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Pb	0.201	0.202	0.001	0.34	± 0.014
	0.706	0.719	0.012	1.73	± 0.030
	1.513	1.459	-0.054	3.57	± 0.061

### 3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Mn	0.0505	0.050	0.000	0.83	± 0.005
	0.3031	0.306	0.003		
	0.7023	0.698	-0.004		

Continue 5 / 5

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

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

FM.BLMTC.002 Rev.4





Request No. 25-67 / 0275

5 / 5

MTC. ACL. No. 358 / 67

3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Ni	0.101	0.098	-0.003	2.90	± 0.013
	0.508	0.502	-0.006	1.16	± 0.018
	1.012	0.962	-0.051	5.02	± 0.032

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

Element	Standard Value of RM (mg/l)	Reading (mg/l)	Error of Measurement (mg/l)	Error of Measurement (%)	Uncertainty (mg/l)
Zn	0.050	0.045	-0.005	9.39	± 0.013
	0.303	0.324	0.021	7.04	± 0.013
	0.707	0.675	-0.032	4.52	± 0.019

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2)

Caliber

Issued Date : 11 March 2024

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE

End of Certificate

The results relate only to the items tested/calibrated or value assigned.  
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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

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

**Office**  
196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 8592  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th

FM.BLMTC.002 Rev.4



Agilent Technologies

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results. Delivered by highly-trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak.

For more information about Agilent Technologies services please visit our web site using the following URL <http://www.agilent.com/en-us/services/analytical-instrument-services>

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- For customers using HP applications, the instrument should be returned to its standard sample introduction system.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of additional or special procedures and/or parts for the instrument service, then these must be ordered separately and charged as a repair, which may incur additional

Service Engineer's Responsibilities

- Only complete/printout pages that relate to the system being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using a "X" or tick mark "✓" in the checkbox.
- Complete Not Applicable check boxes to indicate services not delivered, as needed.
- Complete the PM service in the order of the tasks listed.
- Complete the Service Review section together with the customer.

Issued: 3 February 2017, Revision: 1.1 Copyright © 2017  
Page 1 of 8

Agilent Technologies

เอกสารไม่ควบคุม

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

## System Information

Instrument system name and ID	
ICP 5110 VDV	
Instrument system site and location	
UAE / 3rd Floor Laboratory	
List system component product numbers	
List the serial numbers of each component	
1. G 8015 A	1. MY 18030001
2. G 8481 A	2. 1801-01988
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

ICP-OES Configuration table	
Circle the type or write in the type if other	
Nebulizer Type	SeaSpray (OneNeb) other
Spray Chamber	Cyclonic Single Pass   Cyclonic Double Pass   other
Torch	Radial (Dual View)   other
Injector Diameter	2.4mm   1.8mm   1.4mm   0.8mm   other
Injector Material	Quartz   Ceramic   other

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

## General Preparation

- ☒ Discuss any specific questions or issues with the customer prior to starting.
- ☒ Review the instrument logbook.
- ☒ Perform general external inspection of system for cleanliness.
- ☒ Check for proper installation of safety-related parts, assemblies, sensors etc.
- ☒ Check for required firmware/software updates and verify with customers if they would like it installed.
- ☒ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. N/A
- ☒ Run Instrument Performance test and record results in Instrument Performance Test Results Table - Pre PM.

## Inspect and clean the system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☒ Replace high capacity air inlet dust filter element if installed. N/A
- ☒ Remove and clean instrument water inlet filter.

## G8481A Cooling water system

- ☐ Section NOT Applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter.
- ☒ Re fill with Polyclear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser by compressed air or vacuum cleaner.



**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist****SPS 3 Auto Sampler**

- ☒ **Section NOT Applicable**
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

**SPS 4 Auto Sampler**

- ☒ **Section NOT Applicable**
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles

**AVS 4, 6, 7**

- ☒ **Section NOT Applicable**
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

**Instrument Adjustment**

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.
- ☒ Run Instrument Performance Test and record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above run the following Instrument tests and record the result in the Instrument Test Results Table
  - ☒ Subsystem Communications Test
  - ☒ Air Flow

**Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist**

- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

**Instrument Performance Test Results Table**

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial *
Zn 213.857 nm SRBR	4105.6	8364.0	4375.0	8400.8
Mn 257.610 nm SRBR	11064.7	31842.1	12801.7	30846.2
Al 396.152 nm SBR	7.5	14.9	9.9	16.8
K 766.491 nm SBR	5.1	36.8	6.4	39.7

\* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

**Instrument Test Results Table**

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass



Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

## ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode	Plasma On
Mains Voltage	224.540	217.973 VAC
Mains Current	0.204	0.104 A
Instrument Temperature	22.8	22.7 °C
RF Air Flow (sensor speed)	15.0	19.0 Hz
Plasma Exhaust Temperature	No measurement	26.7 °C
Water Flow Oscillator	No measurement	1.64 L/min
Water Flow Detector	1.06	1.06 L/min
Water Inlet Temperature	18.0	18.0 °C
Polychromator Temperature	35.0	35.0 °C
CCD Temperature	-39.8	-39.8 °C
Thermal Stabilizer	35.0	35.0 °C
Argon Supply Pressure	671.94	627.33 kPa
Purge Gas Supply Pressure*1	674.90	645.40 kPa
Option Gas Supply Pressure*1	N/A	N/A kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	164.63 kPa
Plasma Gas Flow	No measurement	11.98 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1200 W
RF Supply Current	No measurement	8.663 A
RF Supply Voltage	No measurement	184.660 V

\*1 If option installed

Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

## ICP-OES Parts List Table

Part description	Part Number	Product / Model # where used	Quantity Consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Polyclear Cooling Fluid	G3292-80010	G8481A	
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	
PVC waste tubing, 8mm od x 5mm id, 2m	G8410-80122	SPS 4	
Additional Parts may be required from engineers stock:			
X axis drive belt	5410047500	SPS 3	
Z axis drive belt	5410047400	SPS 3	
Peristaltic pump tubing, PVC Solvaflex, 3 bridged,	3710049000	SPS 4	

**Restore system**

For HF applications, ask the customer to reinstall their sample introduction system.

Leave system in an idle state: on and purging.

Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

**Service Review**

- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section below if there are additional comments.



Agilent 5110 and 5100 ICP-OES  
Preventive Maintenance Checklist

- ☒ Review the service and any test results with the customer.
- ☒ If the Instrument firmware was updated, record the details of the change in the Service Engineer's Comments box below or if necessary, in the customer's IQ records.

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Other Important Customer Web Links

How to get information on your product:

- ☒ Literature Library - <http://www.agilent.com/en-us/products/icp-oes/icp-oes-systems/5110-icp-oes#literature>
- ☒ Need to know more? - <http://www.agilent.com/crosslab/university/>
- ☒ Need technical support, FAQs? - <http://www.agilent.com/en-us/support/landing/icp-oes>
- ☒ Need supplies? - [www.agilent.com/chem/supplies](http://www.agilent.com/chem/supplies)

Service Comments

Service request number

Agilent signature

Document part number

Report Summary

Instrument Model  
Agilent 5100/5110 VDV ICP-OES

Instrument ID  
G8011A/G8015A

Instrument Serial Number  
MY18030001

Software Version  
7.3.1.9507

Firmware Version  
3442

Tested By  
Test Before PM

Test Completed On  
11/30/2022 9:35:32 AM

Result Summary

Subsystem Communications Test  
Skipped

Air Flow Test  
Skipped

Water Flow Test  
Skipped

Gas Flows Test  
Skipped

RF Generator Test  
Skipped

Camera Test  
Skipped

Optics Test  
Skipped

Advanced Valve System Test  
Skipped

Resolution Test  
Pass

Sensitivity Test  
Pass

Precision Test  
Pass

Resolution Test			Pass	
Element Wavelength	Specification	Width		
N (174.213 nm)	≤ 9.40	6.62		
As (188.980 nm)	≤ 8.20	6.20		
C (193.027 nm)	≤ 11.50	8.35		
Mo (202.032 nm)	≤ 8.20	6.41		
Cr (206.158 nm)	≤ 13.40	9.04		
Zn (213.857 nm)	≤ 8.70	6.62		
Pb (220.353 nm)	≤ 9.50	7.13		
Co (228.615 nm)	≤ 17.20	11.71		
Ba (230.424 nm)	≤ 9.40	7.21		
Mn (257.610 nm)	≤ 13.30	6.50		
Mn (260.568 nm)	≤ 20.30	14.33		
Cr (267.716 nm)	≤ 11.00	8.14		
Cu (324.754 nm)	≤ 25.00	18.98		
Cu (327.395 nm)	≤ 14.20	11.24		
Sr (338.071 nm)	≤ 33.50	24.47		
Ba (455.403 nm)	≤ 44.00	33.88		
Sr (460.733 nm)	≤ 36.00	17.22		
Ba (493.408 nm)	≤ 36.00	25.48		
Ba (614.171 nm)	≤ 42.00	25.47		
Ar (675.283 nm)	≤ 74.00	59.82		
K (766.491 nm)	≤ 80.00	64.94		

Sensitivity Test			Pass			
Radial	Element Wavelength	Specification	Method	Ratio	Standard	Blank
	As (188.980 nm)	≥ 46.0	SRBR	147.7	1156.5	55.5
	Se (196.026 nm)	≥ 41.0	SRBR	111.1	1195.3	97.7
	Zn (213.857 nm)	≥ 1421.0	SRBR	4100.6	51959.5	159.6
	Pb (220.353 nm)	≥ 46.0	SRBR	192.5	2808.6	185.7
	Mn (257.610 nm)	≥ 3518.0	SRBR	11064.7	264165.0	567.6
	Al (396.152 nm)	≥ 3.4	SBR	7.5	49047.9	5770.5
	Ba (493.408 nm)	≥ 34.0	SBR	107.4	1887710.3	17407.5
	K (766.491 nm)	≥ 1.8	SBR	5.1	100805.9	16626.4
Axial	Element Wavelength	Specification	Method	Ratio	Standard	Blank
	As (188.980 nm)	≥ 208.0	SRBR	234.9	3056.4	152.9
	Se (196.026 nm)	≥ 159.0	SRBR	218.1	3865.1	271.6
	Zn (206.200 nm)	≥ 234.0	SRBR	1306.5	15950.4	144.5
	Zn (213.857 nm)	≥ 1743.0	SRBR	8364.0	183037.8	476.4
	Cd (214.439 nm)	≥ 4227.0	SRBR	7718.5	143240.2	342.8
	Pb (220.353 nm)	≥ 320.0	SRBR	576.3	14465.2	580.4
	Mn (257.610 nm)	≥ 10525.0	SRBR	31842.1	1411257.3	1958.9
	Cr (267.716 nm)	≥ 1048.0	SRBR	4492.1	183110.6	1632.2
	Cu (324.754 nm)	≥ 19.0	SBR	46.2	371487.5	7862.9
	Al (396.152 nm)	≥ 6.0	SBR	14.9	278447.4	17552.6
	Ba (493.408 nm)	≥ 60.0	SBR	190.6	10081527.3	52519.8
	K (766.491 nm)	≥ 24.0	SBR	36.8	1922163.4	50858.1



Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.82	
Se (196.026 nm)	≤ 2.60	0.71	
Zn (213.857 nm)	≤ 1.50	0.43	
Pb (220.353 nm)	≤ 2.60	0.76	
Mn (257.610 nm)	≤ 1.50	0.60	
Al (396.152 nm)	≤ 1.50	0.48	
Ba (483.408 nm)	≤ 1.50	0.89	
K (766.491 nm)	≤ 1.50	0.42	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.57	
Se (196.026 nm)	≤ 1.50	0.76	
Zn (206.206 nm)	≤ 1.50	0.61	
Zn (213.857 nm)	≤ 1.50	0.51	
Cd (214.439 nm)	≤ 1.50	0.55	
Pb (220.353 nm)	≤ 1.50	0.52	
Mn (257.610 nm)	≤ 1.50	0.54	
Cr (267.716 nm)	≤ 1.50	0.54	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.91	
Ba (483.408 nm)	≤ 1.50	0.85	
K (766.491 nm)	≤ 1.50	1.22	

เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	PM Functional test	
Test Completed On	11/30/2022 11:43:36 AM	
Result Summary		
Subsystem Communications Test		
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test		
Pass		
Air Flow Test		
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
14.00	19.00	
Water Flow Test		
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.44	1.05	18.51

เอกสารไม่ควบคุม

Gas Flows Test				Pass
Nebulizer	Actual Flow	Back Pressure	Actual Flow	Back Pressure
	Target Flow	Pressure	Pressure	
0.70	0.70	163.37	1.89	108.49
Makeup	Actual Flow	Back Pressure	Actual Flow	Back Pressure
	Target Flow	Pressure	Pressure	
2.00	2.00	112.85	17.91	23.46
RF Generator Test				
Pass				
RF Power Supply Test				
Passed				
RF Power Supply (V)				
147.437				
RF Oscillator Test				
Passed				
RF Oscillator Frequency (MHz)				
0.000				
Work Coil Current (A)				
45.069				
RF Power Supply Current (A)				
1.997				
Camera Test				
Pass				
Integration Time (ms)				
Status				
1000				
Electronic Offset Test				
Passed				
Dark Current Test				
Passed				
Array Test				
Passed				
Linearity Test				
Passed				

Report Summary				
Instrument Model				
Agilent 5100/5110 VDV ICP-OES				
Instrument ID				
G8011-A/G8015A				
Instrument Serial Number				
MY18030001				
Software Version				
7.3.1.9507				
Firmware Version				
3442				
Tested By				
PM Performance test				
Test Completed On				
11/30/2022 12:10:42 PM				
Result Summary				
Subsystem Communications Test				
Skipped				
Air Flow Test				
Skipped				
Water Flow Test				
Skipped				
Gas Flows Test				
Skipped				
RF Generator Test				
Skipped				
Camera Test				
Pass				
Optics Test				
Skipped				
Advanced Valve System Test				
Pass				
Resolution Test				
Pass				
Sensitivity Test				
Pass				
Precision Test				
Pass				
Optics Test				
Pass				
Radial				
Axial				
Intensity				
5674608				
Wavelength				
737.212				



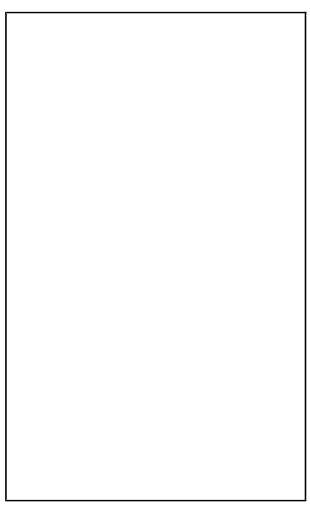


Precision Test	Pass
Radial	
Element Wavelength	Specification
As (188.980 nm)	Measured Value % RSD
Se (196.026 nm)	0.60
Zn (213.857 nm)	0.84
Pb (220.353 nm)	0.29
Mn (257.610 nm)	0.59
Al (396.152 nm)	0.28
Ba (493.408 nm)	0.28
K (766.491 nm)	0.59
	0.23
Axial	
Element Wavelength	Specification
As (188.980 nm)	Measured Value % RSD
Se (196.026 nm)	0.71
Zn (206.200 nm)	0.43
Zn (213.857 nm)	0.46
Cd (214.438 nm)	0.37
Pb (220.353 nm)	0.48
Mn (257.610 nm)	0.48
Cr (267.716 nm)	0.74
Cu (324.754 nm)	0.26
Al (396.152 nm)	0.51
Ba (493.408 nm)	0.46
K (766.491 nm)	0.81
	0.84

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

U ANALYST AND ENGINEER











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



## Certificate of Calibration

Cert. No.: 24TM650  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V616.0066  
ID No. : UAE.MIC.032/2559

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

Location : Microbiology Laboratory (302)

Received Order : 01 April 2024  
Calibration Date : 02 - 03 April 2024  
Ambient Temperature :  $(26 \pm 10) ^\circ\text{C}$   
Relative Humidity :  $(50 \pm 30) \%$

Calibrated by : Man Pattanapongpaiboon

Approved by :   
Approved Signatory

( ) Ponpan Paipim  
(✓) Suwit Imjai  
( ) Kunchit Promprat

Issue Date : 7 April 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.

เอกสารไม่ควบคุม



Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-2

Cert. No.: 24TM650  
Page : 2 of 3

### Procedure Used :

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD ).  
The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-  

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1 ) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certificate is traceable to the International System of Unit.

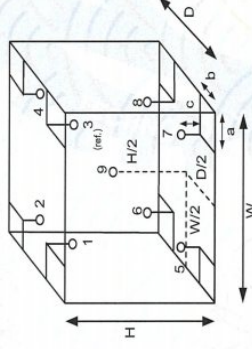
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	25	25
REL.Humid. ( % )	57	54
AC Supply ( Volt )	221	222



### Probe Installation Details :

a = 5.0 cm  
b = 5.0 cm  
c = 5.0 cm

Dimension of Chamber :  
D = 0.50 m  
W = 0.64 m  
H = 0.80 m  
Capacity = 0.26 m<sup>3</sup>

Position :	Ref. Std. ID No.:
1	19-18RTD-01
2	19-18RTD-02
3	19-18RTD-03
4	19-18RTD-04
5	19-18RTD-05
6	19-18RTD-06
7	21-18RTD-07
8	19-18RTD-08
9 (ref.)	19-18RTD-09

เอกสารไม่ควบคุม





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.: 24TM650  
Page : 3 of 3

Equipment : Incubator  
Condition As-Received : Used Item  
Reference : 2404-0003OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source  
Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
25.0	25.0	25.0	0.053	0.78	1.3	2
36.0	36.0	36.0	0.14	0.57	0.93	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
25.0	25.596	25.310	25.439	25.412	24.347	24.332	24.313	24.414	24.875	0.30
36.0	35.843	35.965	35.618	35.701	36.239	36.260	36.343	36.357	36.063	0.31

Average\* : The average of 30 values in each position.  
Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.  
Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.  
UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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-



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



## Certificate of Calibration

Cert. No.: 24TM648  
Page : 1 of 3

Equipment : Incubator  
Manufacturer : Memmert  
Model : IPP 260  
Serial No. : V615.0187  
ID No. : UAE.MIC.003/2559

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

Location : Microbiology Laboratory

Received Order : 01 April 2024  
Calibration Date : 01 April 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Man Pattanapongpalboon

Approved by :   
Approved Signatory

( ) Ponpan Paipim  
(x) Suwit Injai  
( ) Kunchit Promprat

Issue Date : 7 April 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.

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม





**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2404-0003OC-1

**Cert. No.:** 24TM648  
**Page :** 2 of 3

**Procedure Used :-**

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD ).  
The temperature scale used was based on ITS-90.

**Condition of this result of calibration**

1. Reference standard instrument:-  
**Instrument** **Serial No.** **Cert. No.** **Traceable** **Due Date**  
1 ) Data Acquisition MY49023932 23LM122 TPA 26 Jul 2024
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

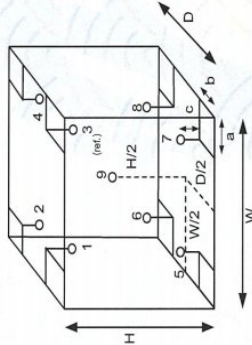
**Result of Calibration :-**

( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Fresh air setting :** Close

Environment during calibration		
	Beginning	Finished
Temp. ( °C )	24	24
REL.Humid. ( % )	54	57
AC Supply ( Volt )	221	223



Probe Installation Details :	
a = 5.0 cm	Dimension of Chamber :
b = 5.0 cm	D = 0.50 m
c = 5.0 cm	W = 0.64 m
	H = 0.80 m
	Capacity = 0.26 m <sup>3</sup>

เอกสารไม่ควบคุม



**Equipment :** Incubator  
**Condition As-Received :** Used Item  
**Reference :** 2404-0003OC-1  
**Result of Calibration :-** ( \* ) Without Adjustment  
**Function of UUC\* :** Temperature Source  
**Fresh air setting :** Close

**Cert. No.:** 24TM648  
**Page :** 3 of 3

Calibration Point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Temperature stability ( ± °C )	Temperature uniformity ( °C )	Overall Variation ( °C )	Coverage Factor k
35.0	35.0	35.0	0.028	0.13	0.24	2

Calibration Point ( °C )	Measured Temperature ( °C )									Uncertainty ( ± °C )
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.908	35.004	34.989	35.099	35.089	35.095	34.921	34.936	35.002	0.30

**Average\* :** The average of 30 values in each position.

**Temperature stability :** One-half of the greatest maximum difference of measured temperature at any one sensor.

**Temperature 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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

**Overall Variation :** The Difference of the maximum and minimum measured temperatures throughout observation.

**UUC\* :** Unit Under Calibration

**Note :** The reported uncertainty of measurement was included stability and excluded uniformity .

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 %.

-000-

เอกสารไม่ควบคุม





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
554/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM29  
Page : 1 of 3

## Certificate of Calibration

**Equipment :** Water Bath  
**Manufacturer :** Memmert  
**Model :** WNE 14  
**Serial No. :** L416.0606  
**ID No. :** UAE.MIC.002/2560

**Submitted by :** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
**Location :** Microbiology Laboratory

**Received Order :** 10 February 2024  
**Calibration Date :** 10 February 2024  
**Ambient Temperature :** ( 26 ± 10 ) °C  
**Relative Humidity :** ( 50 ± 30 ) %

**Calibrated by :**

**Approved by :**

( ) Ponthippa Tameyaku  
(✓) Unnophol Harachai  
( ) Suwit Imjai

**Issue Date :** 19 February 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.

เอกสารไม่ควบคุม



**Equipment :** Water Bath  
**Condition As-Received :** Used Item  
**Reference :** 2402-0232OC-2

Cert. No.: 24TM29  
Page : 2 of 3

### Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPT ) .

The temperature scale used was based on ITS-90.

### Condition of this result of calibration

1. Reference standard instrument:-

**Instrument** **Serial No.** **Cert. No.** **Traceable** **Due Date**  
1 ) Data Acquisition MY49001451 23LM27 TPA 25 Feb 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.  
3. This certification is traceable to the International System of Unit.

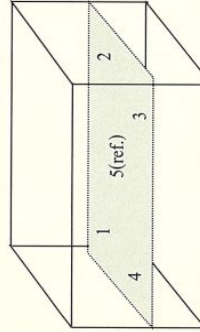
**Remark :** TPA : Technology Promotion Association ( Thailand - Japan )

**Result of Calibration :-** ( \* ) Without Adjustment

**Function of UUC\* :** Temperature Source

**Heat transfer medium used :** Water

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	26	51	220
Finished of Calibration	25	50	221



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425

เอกสารไม่ควบคุม



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2402-0232OC-2  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 24TM29  
Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )					Uncertainty ( ± °C )
			1	2	3	4	5 (ref.)	
44.5	44.4	44.4	44.508	44.469	44.502	44.521	44.527	0.15

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor <i>k</i>
44.5	0.15	0.074	2

Average\* : The average of 30 values in each position.  
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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.  
Stability : One-half of the greatest maximum difference of measured temperature at any one probe.  
UUC\* : Unit Under Calibration  
Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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-

เอกสารนี้ควบคุม

4 0 0 0 0 0 0



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
5544 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



NSC-TS-187625  
CALIBRATION 0008

Cert. No.: 24TM30  
Page : 1 of 3

## Certificate of Calibration

Equipment : Water Bath  
Manufacturer : Memmert  
Model : WNE 14  
Serial No. : L416.0612  
ID No. : UAE.MIC.003/2560  
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260  
Location : Microbiology Laboratory  
Received Order : 10 February 2024  
Calibration Date : 10 February 2024  
Ambient Temperature : ( 26 ± 10 ) °C  
Relative Humidity : ( 50 ± 30 ) %

Calibrated by : Krisda Malee  
Approved by :  
( ) Ponthippa Tan  
( ) Unnophol Ha  
( ) Suwit Imjai

Issue Date : 19 February 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.

เอกสารนี้ควบคุม





Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2402-0232OC-3  
Procedure Used :-

Cert. No.: 24TM30  
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer ( IPRT ).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Serial No. Cert. No. Traceable Due Date  
1 ) Data Acquisition MY49001451 23LM27 TPA 25 Feb 2024

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

3. This certification is traceable to the International System of Unit.

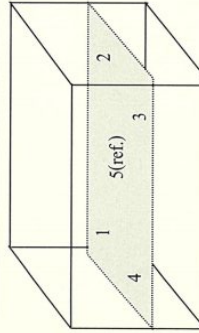
Remark : TPA : Technology Promotion Association ( Thailand - Japan )

Result of Calibration :- ( \* ) Without Adjustment

Function of UUC\* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	( °C )	( %R.H. )	( Volt )
Beginning of Calibration	24	54	221
Finished of Calibration	26	55	220



Front

Position :	Ref. Std. ID No.:
1	N37P301419
2	N37P300732
3	N37P301420
4	N37P301421
5(ref.)	N37P301425



Equipment : Water Bath  
Condition As-Received : Used Item  
Reference : 2402-0232OC-3  
Result of Calibration :- ( \* ) Without Adjustment  
Function of UUC\* : Temperature Source

Cert. No.: 24TM30  
Page : 3 of 3

Calibration point ( °C )	UUC* Setting ( °C )	UUC* Reading ( °C )	Average* Standard Reading ( °C )					Uncertainty ( ± °C )
			1	2	3	4	5 (ref.)	
44.5	44.6	44.6	44.491	44.463	44.496	44.518	44.528	0.15

Calibration point ( °C )	Uniformity ( °C )	Stability ( ± °C )	Coverage Factor k
44.5	0.12	0.059	2

Average\* : The average of 30 values in each position.

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 or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC\* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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-



# Calibration Certificate

**Certificate No.:** 2304203-001-01

**Client name:** UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Address:** 3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchack, Prakanong, Bangkok 10260

Page 1 of 3

Equipment:	Autoclave
Manufacturer:	ALP
Model:	CL-40L
Serial No.:	807298
ID No.:	UAE.MTC.019/2560
Order No.:	2304203
Operation No.:	2304203-001
Date of Receipt:	10 August 2023
Date of Calibration:	10 August 2023

Calibrated by	Mr. Worapob Sooktong	Approved by	
	Scientist		
Date of Issue:	15 August 2023		

Date of Issue: 15 August 2023

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 standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

# Calibration Report

<b>Certificate No.:</b>	2304203-001-01
<b>Equipment:</b>	Autoclave
	Model: CL-40L
	Serial No.: 807298
	Resolution: 1 °C
	ID No.: UAE.MIC.019/2560
<b>Date of Calibration:</b>	Manufacturer: ALP
	10 August 2023

Page 2 of 3

**Location:** 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

**Environment Condition:**

Ambient Temperature	( 28 ± 1 ) °C
Relative Humidity	( 65 ± 2 ) %
Line Voltage	( 225 ± 1 ) Volt

**Condition of this results of Calibration:**

1. This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.
  - The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HTTemp140-2	525601	NC-22-11-22-176	9-Nov-23	MADGETECH INC.
	HTTemp140-2	525602	NC-22-11-22-175	9-Nov-23	MADGETECH INC.
	HTTemp140-2	R54918	TE 660383-01	8-Apr-24	NATIONAL FOOD

3. This certificate is traceable to International System of Units (SI Units).

4. This certificate was certified only for the instrument we calibrated.

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

6. This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.

7. Condition of Calibrated item : Good

UUC Description :	Setting program function sterilization :	STERILIZE/NORMAL

Time of sterilization 15 Minute At 121 °C

8. Result of Calibration :

[illegible]

F-CS-012 Revision: 01 Date: 20-04-65











## Certificate of Calibration

**Equipment:** Balance  
**Model:** PX623  
**Serial No. (or ID.):** C236754745 (UAE.MIC.055/2565)  
**Manufacturer:** Ohaus  
**Condition:** In condition

**Certificate No.:** C01234158  
**Issued Date:** 08 December 2023  
**Job No.:** WO-00011251  
**Page:** 1 of 3

**Customer:** United Analyst and Engineering Consultant Co., Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
Phrakhanong District, Bangkok, THAILAND 10260

**Environment Condition:** Temperature 25 °C ± 0.5 °C  
Humidity 54 %RH ± 1.7 %RH

**Calibration Place:** United Analyst and Engineering Consultant Co., Ltd. (301 Microbiology Room)  
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak Sub-District,  
Phrakhanong District, Bangkok, THAILAND 10260

**Calibration By:** Mr. Adisal Maknoi  
**Calibration Date:** 07 December 2023  
**The Method used:** In-house method, CAL-WI-47, based on UKAS Lab 14  
**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02222534



This certificate is issued for the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.  
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ( $k=2$ ) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).  
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท ถนน, แขวงคลองเตย กรุงเทพมหานคร 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C01-14; 12 Sep 2022



Certificate No.: C01234158

Page: 2 of 3

### Calibration Results:

#### Before Adjustment

**Eccentric Error:** Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value	Reference Points (g)				
	A	B	C	D	E
-	0.000	0.000	-0.003	0.000	0.001

**Repeatability:** Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0006
500	0.0008

**Error of indication from nominal or conventional mass value., Readability** 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0013	2.10
5	5.0001	5.000	0.000	0.0013	2.10
10	10.0001	10.001	0.001	0.0013	2.10
20	20.0000	20.000	0.000	0.0013	2.09
50	50.0001	50.000	0.000	0.0013	2.09
100	100.0001	100.001	0.001	0.0013	2.09
200	200.0004	200.002	0.002	0.0014	2.07
300	300.0005	300.002	0.002	0.0015	2.05
400	400.0006	400.004	0.003	0.0016	2.03
500	500.0006	500.008	0.007	0.0019	2.02
600	600.0007	600.009	0.008	0.0021	2.01

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท ถนน, แขวงคลองเตย กรุงเทพมหานคร 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C01-14; 12 Sep 2022

เอกสารไม่ควบคุม



Certificate No.: C01234158

Page: 3 of 3

#### After Adjustment

Eccentric Error: Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

Nominal Test Value		Reference Points (g)				
		A	B	C	D	E
		-	0.001	-0.002	-0.002	0.001

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
50	0.0006
500	0.0008

Error of Indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (g)	k
1	1.0000	1.000	0.000	0.0013	2.10
5	5.0001	5.000	0.000	0.0013	2.10
10	10.0001	10.000	0.000	0.0013	2.10
20	20.0000	20.000	0.000	0.0013	2.10
50	50.0001	50.000	0.000	0.0013	2.10
100	100.0001	100.000	0.000	0.0014	2.09
200	200.0004	200.000	0.000	0.0014	2.07
300	300.0005	300.001	0.001	0.0015	2.05
400	400.0006	400.002	0.001	0.0017	2.04
500	500.0006	500.001	0.000	0.0019	2.02
600	600.0007	600.002	0.001	0.0021	2.01

#### The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2333 Sukhumvit Road, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/identify-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C01-14: 12 Sep 2022



Refer to Certificate No.: C01234158

Page: 1 of 3

#### Statements of conformity:

This conformity certificate documents the validity of the following statements of conformity based on the measurement results of corresponding calibration certificate:

The error of indication determined during calibration are under given measurement and environmental conditions and considering the expanded measurement uncertainty (coverage probability 95%) within the specification. The given measurement uncertainty already includes other all effects by according to the standard method, UKAS Lab14. Therefore, those parameters have not been assessed separately.

#### Tolerance and Decision rules:

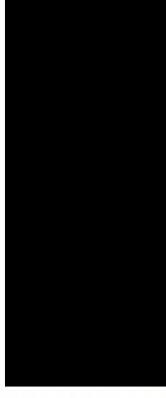
Assessment of the conformity of the measurement device are done based on direct comparison of the relevant measurement results with the tolerances and decision rule are prescribed by the customer.

Decision rule : ☐ Choice A Binary Statement for Simple Acceptance Rule ( $w = 0$ ), Specific Risk  $< 50\%$  PFA.

☒ Choice B Non-binary statement with guard band ( $w = 1$  U), Pass or Fail Specific Risk  $< 2.5\%$  PFA and Condition Pass or Condition Fail Specific Risk  $< 50\%$  PFA.

☐ Choice C Customer defined, Customers may define arbitrary multiple of  $t$  to have applied as guard band ( $w = r$  U).

; PFA – Probability of False Accept



Authorized signature

บริษัท ดีเคเอส อีเซีย จำกัด  
DKSH Technology Limited  
2333 Sukhumvit Road, Bangkok 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/identify-thailand

Delivering Growth - In Asia and Beyond.

CAL-FM-C01-14: 12 Sep 2022

เอกสารไม่ควบคุม



Refer to Certificate No.: C01234158

Page: 2 of 3

### Statements of conformity:

Before Adjustment

Readability: 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.000	0.0013	0.002	Pass
5	0.000	0.0013	0.010	Pass
10	0.001	0.0013	0.020	Pass
20	0.000	0.0013	0.040	Pass
50	0.000	0.0013	0.100	Pass
100	0.001	0.0013	0.200	Pass
200	0.002	0.0014	0.400	Pass
300	0.002	0.0015	0.600	Pass
400	0.003	0.0016	0.800	Pass
500	0.007	0.0019	1.000	Pass
600	0.008	0.0021	1.200	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of conformity

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท ถนนสุขุมวิท กรุงเทพมหานคร 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

เอกสารไม่ควบคุม

Delivering Growth - in Asia and Beyond.

CAL-FM-C01-14; 12 Sep 2022



Refer to Certificate No.: C01234158

Page: 3 of 3

### Statements of conformity:

After Adjustment

Readability: 0.001 g

Nominal Value g	Error of indication g	Guard band (w) g	Tolerance (±) g	Conformity
1	0.000	0.0013	0.002	Pass
5	0.000	0.0013	0.010	Pass
10	0.000	0.0013	0.020	Pass
20	0.000	0.0013	0.040	Pass
50	0.000	0.0013	0.100	Pass
100	0.000	0.0014	0.200	Pass
200	0.000	0.0014	0.400	Pass
300	0.001	0.0015	0.600	Pass
400	0.001	0.0017	0.800	Pass
500	0.000	0.0019	1.000	Pass
600	0.001	0.0021	1.200	Pass

The validity of the statements of conformity cannot be guaranteed for different places of use, environmental conditions or improper use.

The End of Statements of conformity

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด  
DKSH Technology Limited  
2533 สุขุมวิท ถนนสุขุมวิท กรุงเทพมหานคร 10260  
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

เอกสารไม่ควบคุม

Delivering Growth - in Asia and Beyond.

CAL-FM-C01-14; 12 Sep 2022



## ใบตรวจสอบสภาพเครื่องชั่ง

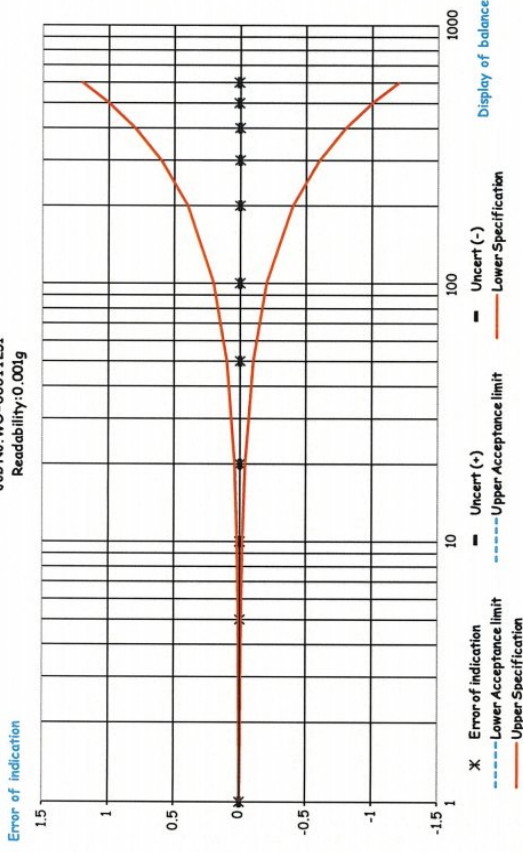
ชดเชยเครื่องมือ: Balance รุ่น: PX623 เลขที่ใบงาน: WO-00011251 หมายเลขเครื่อง: C236754745

ตรวจสอบ (รับ)	รายการตรวจสอบ		ตรวจสอบ (ส่ง)	หมายเหตุ
	07 Dec 2023	07 Dec 2023		
ปกติ	ปกติ	ปกติ	ปกติ	ปกติ
<b>General</b>				
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. สายไฟ/Adapter, power supply 220/110V	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสมบูรณ์ชุดกระจก้นเลน (Cover)	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. ความสมบูรณ์ชุดของระดับน้ำ	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. การปรับระดับของขาตั้งเครื่อง	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. การตอบสนองของปุ่มกด	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	6. ความสมบูรณ์ของ Display	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	7. การแสดงผลของ Display หลังวางน้ำหนัก	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ชุดรองจานชั่ง (Stopper) / pan support	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. การทำงานของ Function Internal / External	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. ความสะอาดของตัวเครื่องภายนอกและแกน load cell	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	<input checked="" type="checkbox"/>	

หมายเหตุเพิ่มเติม/ข้อแนะนำ :

Mr. Adisai Maknoi  
Service Engineer

Before Adjustment  
Job No. WO-00011251  
Readability: 0.001g



After Adjust  
Job No. WO-00011251  
Readability: 0.001g

