

ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ผลสอบ

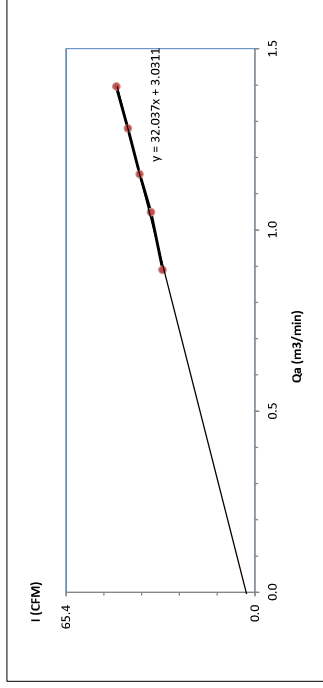
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM10)	High Volume	CHM_F50114	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	Digital Balance	BKC_E00403	30-May-25	30-May-26	12
Ambient	Total Suspended Particulate	High Volume	CHM_F50037	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKC_E00403	30-May-25	30-May-26	12
Ambient	Carbon Monoxide	DRYCAL FLOWMETER	RYG_F50208	27-Jan-25	26-Jan-26	12
Ambient	Carbon Monoxide	DRYCAL FLOWMETER	BKC_F50614	9-Sep-24	9-Sep-25	12
Ambient	Carbon Monoxide	Air Sampling Pump	CHM_F50016	24-May-25	24-Aug-25	3
Ambient	Carbon Monoxide	CO Analyzer	BKC_E00375	5-Aug-24	5-Aug-25	12
Water Lab	Total Coliform	Autoclave	BKC_JL0041	4-Mar-25	4-Sep-26	18
Water Lab	Total Coliform	Incubator	BKC_JL0031	21-Aug-25	21-Aug-26	12
Water Lab	Total Coliform	Hot Air Oven	BKC_JL0013	9-Oct-25	9-Apr-27	18
Water Lab	Fecal Coliform	Autoclave	BKC_JL0041	4-Mar-25	4-Sep-26	18
Water Lab	Fecal Coliform	Incubator	BKC_JL0031	21-Aug-25	21-Aug-26	12
Water Lab	Fecal Coliform	Hot Air Oven	BKC_JL0013	9-Oct-25	9-Apr-27	18
Water Lab	Fecal Coliform	Water Bath	BKC_JL0056	4-Mar-25	4-Mar-26	12
Water Lab	BOD	DO Meter	BKC_E00017	20-May-25	20-Nov-26	18
Water Lab	BOD	Incubator	BKC_E00304	4-Mar-25	4-Mar-26	12
Water Lab	BOD	Burette	BKC_E00422	5-Sep-25	5-Sep-26	12
Water Lab	BOD at 25 °C	DO meter	BKC_E00382	9-Oct-25	9-Oct-26	12
Water Lab	Settleable Solids	Chamber (Cooling Room)	BKC_E00167	4-Jun-25	4-Dec-26	18
Water Lab	Soluble Solids	Burette	BKC_E00422	5-Sep-25	5-Sep-26	12
Water Lab	Soluble Solids	Chamber (Cooling Room)	BKC_E00167	4-Jun-25	4-Dec-26	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKC_E00069	17-Jul-25	17-Dec-26	12
Water Lab	Total Kjeldahl Nitrogen	Water Bath	BKC_E00425	4-Oct-25	4-Oct-26	12
Water Lab	Total Kjeldahl Nitrogen	Digestion Unit	BKC_E00384	15-Jul-25	15-Jul-26	12
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKC_E00093	17-Jul-25	17-Jul-26	12
Water Lab	Total Dissolved Solids 180°C	Digestion Unit	BKC_E00384	15-Jul-25	15-Jul-26	12
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKC_E00025	6-Oct-25	6-Oct-26	12
Water Lab	Total Suspended Solids	Oven	BKC_E00425	6-Oct-25	6-Oct-26	12



High Volume Air Sampler Calibration Worksheet

Project Site : The Base Highe-Chiangmai Juristic Person Condominium	Barometric Pressure (mm Hg) : 726.8
Calibrate Location : บริษัทพีทีเอสอาร์	Temperature (°C) : 30.9
Calibrate Date : 7-Jul-25	High Volume ID : CHM_F50114
Calibrations Sheet No. : C-070725-CHM_F50114	High Volume Model : TE-5009X
Calibrator ID : CHM_F50039	High Volume S/N : 1090
Calibrator Model : TE-5028A	Calibrator Slope : 1.05066
Calibrator S/N : 3680	Calibrator Intercept : -0.01943

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.890	32	Slope : 32.0369
2	2.8	1.049	36	Intercept : 3.0311
3	3.4	1.154	40	Correlation Coefficient : 0.9978
4	4.2	1.281	44	
5	5.0	1.396	48	



Calibrated by :  Approved by : 

(Mr. Tanakorn Insuta)
CHM Field Services Scientist (3)

(Mr. Warakorn Pookrak)
Field Services Supervisor

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 25BC10197

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards. Uncertainties of measurements are taken into account when only statements of compliance are made. This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08. This certificate relate and apply this equipment only.
Manufacturer	Ohaus	
Type	EX225D/AD	
Serial QM Ident. no.	C309774648 BKK_EN0403	
Customer	ALS Laboratory Group (Thailand)Co., Ltd.	
Order no.	261969	104 Phatthanakarn 40,Phattanakarn Rd.,Khwaeng Phatthanakarn ,Khet Suan Luang,Bangkok 10250
Number of pages	6	261969
Date of calibration	30 May 2025	30/05/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date

30 May 2025

Approval of the Calibration Certificate



Mr. Chonchai Inthana

Date

30 May 2025

Person in charge



Chonchai Inthana

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 Bangkok

Verical®
Version 6.5

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Calibration certificate No.: 25BC10197

Calibration Certificate

Calibration object

Multi range instrument

Model

EX225D/AD

Serial Number

C309774648

QM Ident. no | Inventory no.

BKK_EN0403 | ---

Range

120.00000 g 220.0000 g

Maximum capacity (Max. load)

120.00000 g 220.0000 g

Measured range

0.00001 g 0.0001 g

Scale interval

Place of calibration

Address

Department | Cost center

Building | Floor

Room

Maximum temperature variation at place of calibration

According to page 1

Environment Department. | ---

--- | 1st Floor.

Laboratory Room.

5 K

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type

Test equipment ID

Valid until

Thermometer

Testo 174(Traceable to Si unit through ENTECH)

11 Nov 2025

Test weight set OIML R111 E2

Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)

23 Aug 2025

Sartorius (Thailand) Co., Ltd.
129 Rama 9 Road, Huaykwang
10310 Bangkok

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Range 1

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration
30 May 2025
Temperature at place of calibration | Temp. diff.
21.7 °C | 0.5 K
 $T_{\text{weights}} - T_{\text{place}}$
Measuring conditions
The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments
Humidity 60.0 %RH.

Measurement results | Measurement uncertainties

Repeatability		Eccentricity	
Test load (nominal): 1 g 100 g		Test load (nominal): 50 g	
1 g	100 g	Center	49.9996 g
0.99983 g	99.9971 g	Front left	49.9993 g
0.99991 g	99.9971 g	Back left	49.9993 g
0.99992 g	99.9974 g	Back right	49.9994 g
0.99993 g	99.9973 g	Front right	49.9990 g
0.99992 g	99.9974 g	Maximum deviation from centric loading indication	
0.99991 g	99.9970 g	Δ _{load} max = 0.00006 g	
0.99983 g	99.9973 g		
0.99984 g	99.9972 g		
0.99995 g	99.9971 g		
0.99995 g	99.9969 g		
s = 0.000014 g s = 0.000017 g			

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U _{rel} (E)
0.00000 g	0.00000 g	0.00000 g	2.00	0.000030 g	---
0.01000 g	0.00995 g	-0.00005 g	2.00	0.000037 g	0.37 %
0.10000 g	0.09991 g	-0.00009 g	2.00	0.000038 g	0.038 %
0.50000 g	0.49985 g	-0.00015 g	2.00	0.000040 g	0.0080 %
1.00000 g	0.99991 g	-0.00009 g	2.00	0.000041 g	0.0041 %
5.00002 g	4.99997 g	-0.00005 g	2.00	0.000050 g	0.0010 %
10.00002 g	10.00003 g	0.00001 g	2.00	0.000069 g	0.00069 %
50.00002 g	49.99972 g	-0.00030 g	2.00	0.000091 g	0.00018 %
70.00004 g	69.99975 g	-0.00029 g	2.00	0.00017 g	0.00024 %
100.00001 g	99.99958 g	-0.00043 g	2.00	0.00017 g	0.00017 %
115.00006 g	114.99966 g	-0.00040 g	2.00	0.00028 g	0.00024 %
Maximum error of indication		E _{max} = 0.00043 g			

$U_{rel}(E)$ is the quotient of $U(E)$ and test load L . The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
The uncertainty of measurement is also the expanded uncertainty U_{exp} if the measurement result is multiplied by the documented expansion factor, determined in accordance with the European Calibration Guideline EURAMET-19-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Range 2

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration
30 May 2025
Temperature at place of calibration | Temp. diff.
21.7 °C | 0.5 K
 $T_{\text{weights}} - T_{\text{place}}$
Measuring conditions
The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments
Humidity 60.0 %RH.

Measurement results | Measurement uncertainties

Repeatability		Eccentricity	
Test load (nominal): 200 g		Test load (nominal): 100 g	
200 g	Center	99.9984 g	100 g
199.9988 g	Front left	99.9990 g	
199.9988 g	Back left	99.9993 g	
199.9988 g	Back right	99.9979 g	
200.0000 g	Front right	99.9979 g	
199.9988 g	Maximum deviation from centric loading indication		
199.9989 g	Δ _{load} max = 0.00006 g		
199.9989 g			
200.0000 g			
199.9988 g			
199.9999 g			
s = 0.00008 g			

Error of indication

Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
L	I	E	k	U(E)	U _{rel} (E)
0.00000 g	0.00000 g	0.00000 g	2.00	0.000030 g	---
20.00002 g	19.99885 g	-0.00016 g	2.00	0.000069 g	0.00034 %
50.00002 g	49.99878 g	-0.00024 g	2.00	0.000091 g	0.00018 %
70.00004 g	69.99981 g	-0.00023 g	2.00	0.00017 g	0.00024 %
90.00007 g	89.99976 g	-0.00031 g	2.00	0.00018 g	0.00020 %
110.00003 g	109.99986 g	-0.00017 g	2.00	0.00028 g	0.00025 %
130.0001 g	129.9999 g	-0.0002 g	2.00	0.00028 g	0.00022 %
150.0000 g	149.9999 g	-0.0001 g	2.00	0.00028 g	0.00019 %
170.0000 g	170.0000 g	0.0000 g	2.00	0.00028 g	0.00016 %
200.0000 g	199.9998 g	-0.0002 g	2.00	0.00028 g	0.00014 %
220.0000 g	219.9999 g	-0.0001 g	2.00	0.00029 g	0.00013 %
Maximum error of indication		E _{max} = 0.0003 g			

$U_{rel}(E)$ is the quotient of $U(E)$ and test load L . The uncertainty of measurement $U(E)$ is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
The uncertainty of measurement is also the expanded uncertainty U_{exp} if the measurement result is multiplied by the documented expansion factor, determined in accordance with the European Calibration Guideline EURAMET-19-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

Range 1

Device adjusted before measurement Yes
Temperature deviation considered 5 K
Temperature coefficient considered $2 \cdot 10^{-5}/\text{K}$

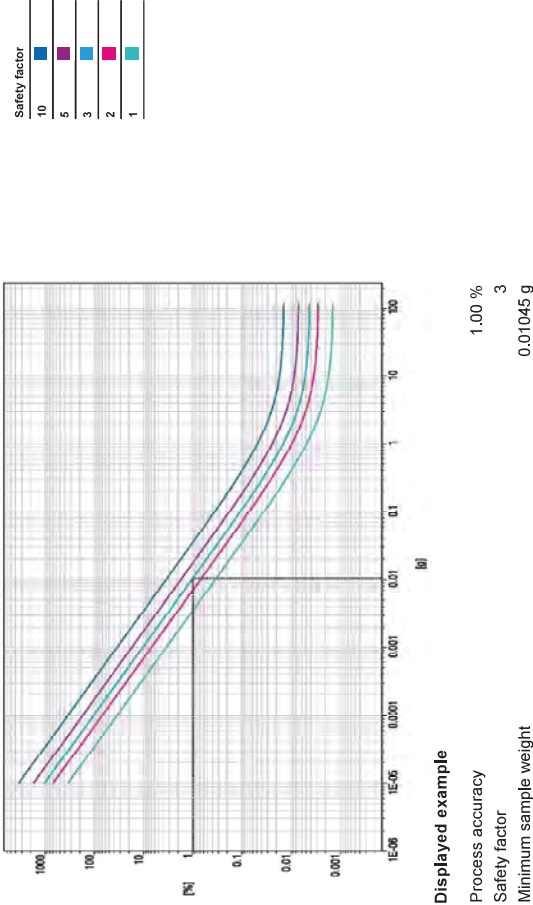
Uncertainty of the weighing result $U_{g_l}(W)$

$$U_{g_l}(W) = 0.000035 \text{ g} + 1.38 \cdot 10^{-5} \cdot R$$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-16, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{g_l}(W)$	Uncertainty relative $U_{g_l}(W)_{\text{rel}}$
1 %	1.20000 g	0.000052 g	0.0043 %
25 %	30.00000 g	0.00045 g	0.0015 %
50 %	60.00000 g	0.00086 g	0.0014 %
75 %	90.00000 g	0.0013 g	0.0014 %
100 %	120.00000 g	0.0017 g	0.0014 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0.01045 g

Uncertainty of measurement in use

Range 2

Device adjusted before measurement Yes
Temperature deviation considered 5 K
Temperature coefficient considered $2 \cdot 10^{-7}/\text{K}$

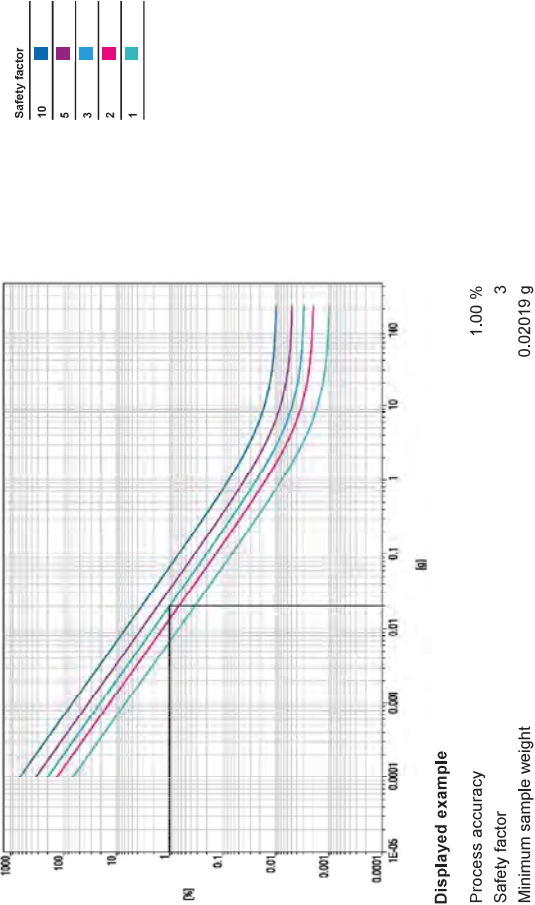
Uncertainty of the weighing result $U_{g_l}(W)$

$$U_{g_l}(W) = 0.000067 \text{ g} + 9.52 \cdot 10^{-6} \cdot R$$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-16, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{g_l}(W)$	Uncertainty relative $U_{g_l}(W)_{\text{rel}}$
1 %	2.20000 g	0.000088 g	0.0040 %
25 %	55.00000 g	0.00059 g	0.0011 %
50 %	110.00000 g	0.0011 g	0.0010 %
75 %	165.00000 g	0.0016 g	0.00099 %
100 %	220.00000 g	0.0022 g	0.00098 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0.02019 g



High Volume Air Sampler Calibration Worksheet

Project Site : The Base Hight-Chiangmai Juristic Person Condominium **Barometric Pressure (mm Hg) :** 726.8

Calibrate Location : บึงกุ่มพื้นที่โครงการ **Temperature (°C) :** 30.9

Calibrate Date : 7-Jul-25 **High Volume ID :** CHM_FS0037

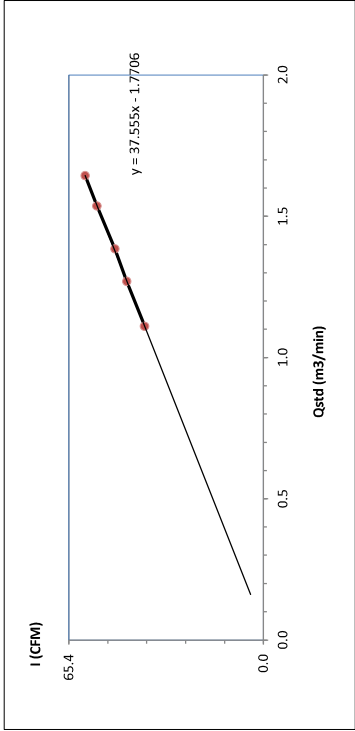
Calibration Sheet No.: C-070725-CHM_FS0037 **High Volume Model :** TE-5170D

Calibrator ID: CHM_FS0039 **High Volume S/N :** 5850

Calibrator Model : TE-5028A **Calibrator Slope :** 1.6774

Calibrator S/N : 3680 **Calibrator Intercept :** -0.0312

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	3.5	1.1112	40	Slope : 37.5552
2	4.6	1.2694	46	Intercept : -1.7706
3	5.5	1.3851	50	Correlation Coefficient : 0.9998
4	6.8	1.5366	56	
5	7.8	1.6435	60	



Calibrated by Insuta Approved by Warakorn Pookrak
(Mr. Tanakorn Insuta) (Mr. Warakorn Pookrak)
CHM Field Services Scientist (3) CHM Field Services Supervisor

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/139 MOO 13, SOI SINTINAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: (66)9-2116-5860-1 FAX: (66)9-2116-7140



Certificate of Calibration

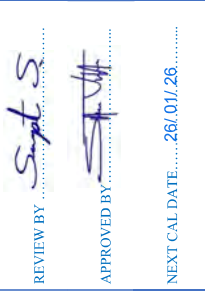
Customer : ALS Laboratory Group Thailand Co., Ltd.
Certificate No : 25-AFM-023
Request No : Req-2025-0169

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang,
Bangkok 10250

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Mesa Labs
Model : 200-510L
Serial Number : 130027
ID : RYG_FS0208
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 : 21 January 2025
Calibration Date : 27 January 2025

Instrument Status : Used



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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010066	Sensidyne	6 August 2025
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	2 August 2025
Temperature meter	GT 11	08000057	Qeebom	1 March 2025
Pressure meter	CPG2400	41000KDU/651882	TPA	21 October 2025

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

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

Calibration By : Mr. Noppadon Luangart
Approved By : Mr. Pact Mathavorn
Service Calibration Engineer Calibration Engineer Supervisor
Issue Date : 27 January 2025

Certificate No : 25-AFM-023
Request No : Req-2025-0169

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	MPE (cc/min)	Result
22.50	100.90	20	19.854	-0.1	1.3	0.2	Pass1
22.50	100.90	50	49.732	-0.3	3.3	0.5	Pass1
22.60	100.90	101	100.77	-0.2	2.8	1.0	Pass1
22.70	100.90	151	150.23	-0.8	4.2	1.5	Pass1
22.70	100.90	201	200.39	-0.6	5.6	2.0	Pass1
22.70	100.90	301	300.69	-0.3	8.4	3.0	Pass1
22.80	100.90	400	402.96	3.0	11	4.0	Pass1
23.10	100.90	500	504.62	4.6	7.2	5.0	Pass1

Note STD : Standard UUC : Unit Under Calibration

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

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

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

where Q = Flow Rate

P = Absolute Pressure

T = Absolute Temperature

Meas = Measurement Condition

ref = Standard Condition

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

Certificate No : 25-AFM-023
Request No : Req-2025-0169

Decision Rule for Statements of Conformity

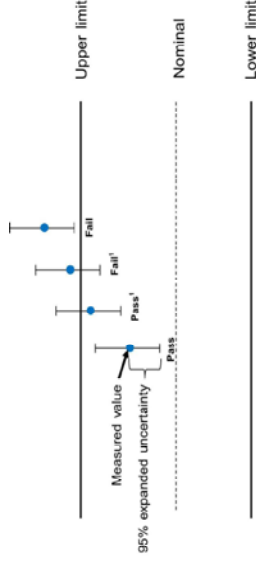
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

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.

FW-708-AFM-01 Rev.04 Issue date 17/6/24



Certificate of Calibration

Customer
Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanasak 40, Phatthanasak Road, Suan Lum,
Bangkok 10250

Unit Under Calibration Details

Measurement Unit : Air Flow Meter
Manufacturer : Metcalfe
Model : Defender S10-M
Serial Number : 151114
ID : BKK-FS0614
Accuracy : 1% of Reading
Sensor Model : -
Sensor Serial Number : -
Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23.5°C ± 1°C
Humidity : 55%RH ± 20%RH
Barometric Pressure : 1013 mb ± 10 mb
Received Date : 30 August 2024
Calibration Date : 9 September 2024

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Calibrator 3 Low flow	18501010066	Sensodyne	6 August 2025
Air Flow Meter	Calibrator 3 Standard flow	19031011003	Sensodyne	2 August 2025
Temperature meter	GT 11	08000057	Qesborn	1 March 2025
Pressure meter	CP03400	410006KDU1651802	TIPA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Sensodyne A2LA Accreditation No. 1463.01

Note :

The reported uncertainties is based on standard uncertainty multiplied by 1.96 (Coverage Factor k = 2) providing a level of confidence approximately 95 %.

Calibration By :

Mr. Nopadon Litangrat
Service Calibration Engineer

Approved By :

Mr. Paci Mahasorn
Calibration Engineer Supervisor
Issue Date : 9 September 2024



Certificate No : 24-AFM-129

Request No : Req-2024-1987

Result of Calibration : Without adjustment

Temperature (°C)	Pressure (kPa)	STD (cc/min)	UUC (cc/min)	Error (cc/min)	Uncertainty (cc/min)	NPE (cc/min)	Result
24.70	100.95	100	100.41	0.4	2.8	1.0	N/A
24.90	100.90	502	500.47	-1.5	7.1	5.0	N/A
24.90	100.97	1003	1001.3	-2	14	10.0	N/A
25.00	100.92	2014	2009.9	-4	29	20.1	N/A
25.20	101.02	3042	3058.3	15	44	30.4	N/A
25.30	101.10	4043	4005.1	-38	57	40.4	N/A
25.50	101.13	5052	5003.9	-48	74	50.5	N/A

Note : STD - Standard UUC - Unit Under Calibration

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

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

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

where : Q = Flow Rate

P = Absolute Pressure

T = Absolute Temperature

UUCS - Measurement Condition

ref - Standard Condition

* Indicates our standard

MPH = Maximum Permissible Error (Specified in Manufacturer's Specification)

N/A = Not Applicable. Customer does not require a statement of conformity.

Certificate No : 24-AFM-179

Request No : Req-2024-1987

Decision Rule for Statements of Conformity

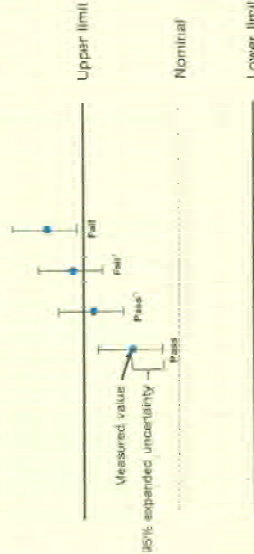
The standard decision rule employed for the statements of conformity to each calibration result will be applied using the following Fig. and statements on the Reporting of Compliance with Specification as following Fig. and statements

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement is 95% exceeds the limit

Fail - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement is 95% is within the limit

Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit



End of Certificate

ALS Laboratory Group (Thailand) Co., Ltd.
 104 Phatthanarat 40 Phatthanarat Rd.
 Phatthanarat Suburb Bangkok 10250
 T+66 2 760 3000 F+66 2 760 3187



Certificate of Calibration

Certificate No. C-240525-CHM_FS0016

Air Sampling Pump Detail

Equipment name : Personal Air Sampling Pump
 Brand : Gillan
 Model/Type : Gillan Plus
 Equipment ID : CHM_FS0016
 Serial No. : 20180910111
 Calibration Date : 24-May-25
 Next calibration date : 24-Aug-25

Reference Standard Low Flow Meter

Equipment name : Air Flow Meter
 Brand : MesaLabs
 Model/Type : Defender 510-L
 Equipment ID : RYG_FS0208
 Serial No. : 130027
 Calibration Date : 27-Jan-25
 Due Date : 26-Jan-26

Reference Standard High Flow Meter

Equipment name : Air Flow Meter
 Brand : MesaLabs
 Model/Type : Defender 510-M
 Equipment ID : BKK_FS0614
 Serial No. : 151114
 Calibration Date : 9-Sep-24
 Due Date : 9-Sep-25

Calibration Data

Air Sampling Pump setting (cc/min)	Reference Std. Flow Reading (cc/min)			Avg. (cc/min)	%Error acceptance	Acceptable range (cc/min)	Evaluation (Pass/Fail)
	1	2	3				
Low Flow							
20	20.8	20.3	20.6	20.6	5%	19 - 21	Passed
50	49.2	48.7	48.9	49.3	5%	48 - 53	Passed
100	99.7	99.9	99.4	99.7	5%	95 - 105	Passed
200	199.5	200.1	199.8	199.8	5%	190 - 210	Passed
High Flow							
500	503.4	506.7	504.8	505.0	3%	485 - 515	Passed
1000	1004.5	1005.1	1003.9	1004.5	3%	970 - 1030	Passed
2000	2004.4	2001.3	2003.1	2002.9	3%	1940 - 2060	Passed
2500	2508.4	2503.9	2505.6	2506.0	3%	2425 - 2575	Passed

END OF REPORT

Calibrated By:

(Mr. Natchapon Thamklang)
 RYG Field Services Scientist (I)

Issue date : 25-May-25

Approved By:

(Mr. Supot Salameh)
 Field Services Section Head

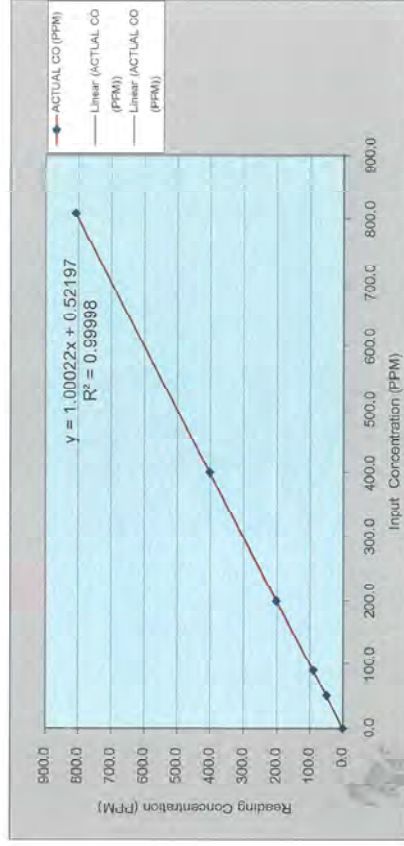
MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co.Ltd.	
EQUIPMENT NAME : CO Analyzer	
MANUFACTURER : Teledyne - API	SERIAL NO : 5947
MODEL : T300	CERTIFIED DATE : 07/39572
STANDARD GAS CONCENTRATION (PPM) : 808.9	CERTIFIED DATE : Nov. 05. 2020
CYLINDER PRESSURE (psig) : 900	EXPIRED DATE : Nov. 05. 2028
CERTIFIED BY : AIRGAS SPECIALTY GASES	

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.00	0.01	0.01	-
1	80.00	49.35	-0.64	-1.28
2	80.00	89.54	-0.46	-0.51
3	199.20	202.08	2.88	1.45
4	400.30	402.41	2.11	0.53
5	808.90	808.47	-0.43	-0.05
AVERAGE (%)				0.75

REVIEW BY : V. S. N.
 APPROVED BY : T. N.
 NEXT CAL. DATE : 5 Aug. 15



CALIBRATED BY : คุณณพคุณ นพคุณ	DATE : 5 สิงหาคม 2567
ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณณพคุณ นพคุณ โทรศัพท์ : 02-515-8987	
เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทน์เกษม เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์ : 0-2515-8959 โทรสาร : 0-2515-8988 E-Mail : info@inetics.co.th	



Metrology

SCI ECO Services Company Limited
 33/2 Moo 3, T.Banpa, A.Kaengkhon, Saraburi 18110, Thailand.
 Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
 Bangkok Tel : +668 9205 6851 , +669 8247 2360
 Website : www.scieco.co.th E-Mail : calibrate@scg.com

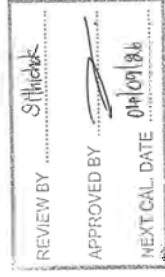


Certificate No. T250353

Page 1 of 4

Certificate of Calibration

Equipment : Autoclave
 Manufacturer : TOMY
 Model : SX-700
 Serial No. : 48134190
 Customer Code : BKK_ML0041
 ID No. : T7725A3
 Customer : ALS Laboratory Group (Thailand) Co., Ltd.



104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
 Khut Suan Luang, Bangkok 10250

Customer Location : Washing Room
 Date of Receipt : 26 February 2025
 Calibrated By : Boonchai Suriyawong (Site Calibration Manager)
 Approved By : / Sujjar Naknakred (Site Calibration Manager)
 Date of Issue : 10 Mar 2025

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.



Metrology

SCI ECO Services Company Limited

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



Certificate No. T250353

Calibration Report

Page 2 of 4

Equipment : Autoclave

Date of Calibration : 4 March 2025

Environment : Temperature : 22.2-25.4 °C

Line Voltage : 221.1-224.7 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 3 standard temperature recorder into its chamber and test according to WI-T23 inhouse method.(based on BS 2646-1 : 2021)

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

2. Reference Standard Instrument :

Instrument	Model	Standard No.	Certificate No.	Due Date
1. Temperature recorder	RTD	T210	T242028	11 December 2025
2. Temperature recorder	RTD	T211	T242029	11 December 2025
3. Temperature recorder	RTD	T212	T242030	11 December 2025

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Pressure Indicator 0.11-0.12 MPa At 121 °C Holding time 20 minute

5. Adjustment :

(X) without adjustment

() after adjustment

Approved By. _____

FM-L15 118/18-08-66



Metrology

SCI ECO Services Company Limited

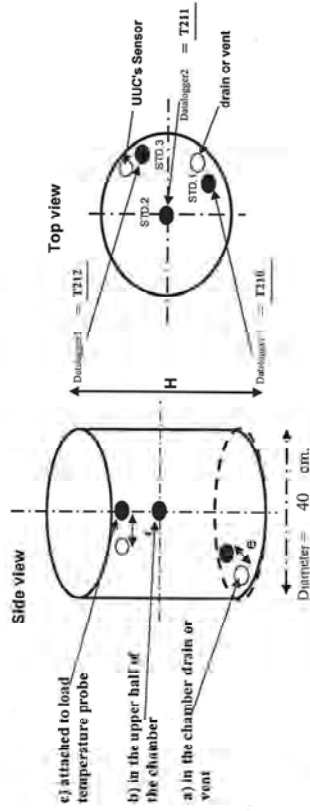
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T250353

Calibration Report

Page 3 of 4



Remark :

Size of Installed Standard sensor STD.1 : Distance the chamber drain or vent. $\pm \leq 10$ cm. (less than or be equal to 10 cm.)

Size of Installed Standard sensor STD.2 : Geometric Center (upper half of the chamber)

Size of Installed Standard sensor STD.3 : Distance UUC's Sensor $f = 2$ cm.

Measurement Results :

Calibration Point	Average Standard Reading at each position (°C)		
	T210	T211	T212
121	121.2	121.1	121.1

Setting (°C)	Autoclave		Temperature Distribution			
	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)
	Min	Max				
121	-	123	121.2	0.1	0.1	0.65
						Coverage Factor k
						2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate

Approved By. _____

FM-L15 118/18-08-66



Metrological Center

SCI ECO Services Company Limited

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

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

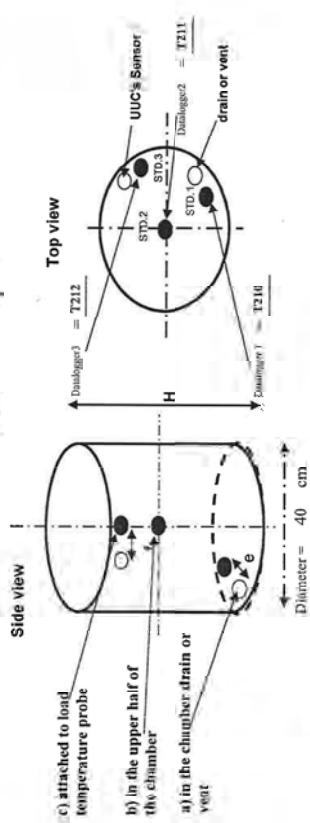
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250353

TEST REPORT (BKK_ML0041)

Page 4 of 4

Calibration Report



Remark :

- Size of Installed Standard sensor STD.1 : Distance the chamber drain or vent $e \leq 10$ cm. (less than or be equal to 10 cm.)
- Size of Installed Standard sensor STD.2 : Geometric Center (upper half of the chamber)
- Size of Installed Standard sensor STD.3 : Distance UUC's Sensor $f = 2$ cm.

Measurement Results :

Calibration Point	Average Standard Reading at each position (°C)		
	T210	T211	T212
121	121.18	121.12	121.13

Setting (°C)	Autoclave Reading (°C)		Temperature Distribution			
	Min	Max	Average	Stability	Uniformity	Coverage
121	-	121	121.16	0.10	0.10	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate

Approved By:



FM-L13 108/30-05-57



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 16, SUKUMVIT, SUKUMVIT BANGKOK 10250
TEL.0-2717-3000-28 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 25TM1235
Page : 1 of 3

Equipment : Incubator
Manufacturer : Memmert
Model : IPP750eco
Serial No. : V821.0172
ID No. : BKK_ML0231

Submitted by : ALS Laboratory Group (Thailand) Co.Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : Incubation & Microbiological Reading

Received Order : 21 August 2025
Calibration Date : 21 August 2025
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
AC Line Voltage : $(220 \pm 22) \text{ V}$

Calibrated by : Khit Ruttanaprapachai

Approved by :

() Chakrit Waewwanjua
() Suwit Injai
(✓) Kunchit Promprat

Issue Date : 25 August 2025

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.

REVIEW BY

Sithichok T.

APPROVED BY

[Signature]

NEXT CAL DATE: 21/08/26



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2508-0459OC-2

Cert. No.: 25TM1235
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	MY44073381	25LM82	TPA	17 May 2026
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This measurement result is traceable to the International System of Unit maintained through :

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

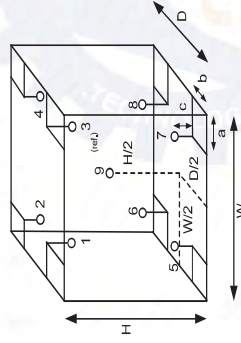
Result of Calibration :-

Function of UUC* : (*) Without Adjustment

Fresh air setting : Temperature Source

Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	21	20
REL.Humid. (%)	62	65
AC Supply (Volt)	222	221



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.75 m³



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2508-0459OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 25TM1235
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	0.12	0.37	0.43	2
37.0	37.0	37.0	0.15	0.47	0.49	2
41.5	41.5	41.5	0.13	0.79	0.84	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	34.834	34.929	34.924	34.849	34.856	34.954	35.002	35.002	35.127	0.30
37.0	36.940	37.065	37.010	36.921	36.883	36.973	37.043	37.043	37.235	0.31
41.5	41.641	41.838	41.742	41.484	41.249	41.427	41.466	41.495	41.926	0.34

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 % .

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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.: 24TM667
Page : 1 of 3

Equipment : Hot Air Oven
Manufacturer : Binder
Model : ED 240E2
Serial No. : 00-15533
ID No. : BKK_ML0013

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : Media Preparation Room

Received Order : 23 April 2024
Calibration Date : 23 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Tawatchai Pama

Approved by :
Approved Signatory

() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 26 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.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-04390C-8
Procedure Used :-

Cert. No.: 24TM667
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.
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 24LM44 TPA 17 Mar 2025

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.

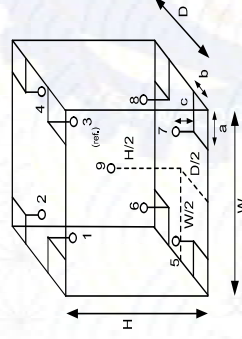
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	23
REL.Humid. (%)	65	65
AC Supply (Volt)	223	222



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.50 m
W = 0.80 m
H = 0.60 m
Capacity = 0.24 m³

Position :	Ref. Std. ID No.:
1	24-19TC-01
2	24-19TC-02
3	24-19TC-03
4	24-19TC-04
5	24-19TC-05
6	24-19TC-06
7	24-19TC-07
8	24-19TC-08
9 (ref.)	24-19TC-09



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-04390C-8
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM667
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
180	180	180	0.64	2.7	3.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (±°C)
	1	2	3	4	5	6	7	8	9 (ref.)	
180	181.009	181.511	180.922	181.359	181.217	183.659	181.664	181.986	181.474	1.5

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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 25TM525
Page : 1 of 3

Equipment : Hot Air Oven

Manufacturer :

Binder

Model :

ED 240/E2

Serial No. :

00-15533

ID No. :

BKK_ML0013

Submitted by :

ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location :

Media Preparation Room

Received Order :

08 October 2025

Calibration Date :

09 October 2025

Ambient Temperature :

(26 ± 10) °C

Relative Humidity :

(50 ± 30) %

AC Line Voltage :

(220 ± 22) V

Calibrated by :

Uthen Kankawi

Approved by :

Approved Signatory

() Chakrit Waewwanjua

() Suwit Injai

(✓) Kunchit Promprat

Issue Date :

16 October 2025

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.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2510-0042OC-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 Thermocouple Type T.

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	24LM192	TPA	24 Dec 2025

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

3. This measurement result is traceable to the International System of Unit maintained through :

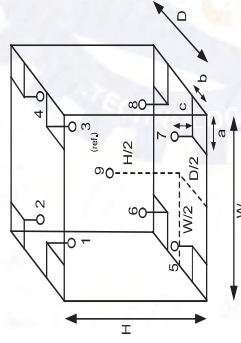
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :-

Function of UUC* : (*) Without Adjustment

Fresh air setting : Temperature Source

Close



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.80 m
H = 0.60 m
Capacity = 0.24 m³



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2510-0042OC-3

Result of Calibration :-

Function of UUC* : (*) Without Adjustment

Fresh air setting : Temperature Source

Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
170	170	170	0.45	1.3	2.3	2

Calibration Point (°C)	Measured Temperature (°C)								Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)
170	169.588	170.427	168.486	168.900	169.725	169.499	168.946	169.327	169.529
									1.3

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-

Cert. No.: 25TM525
Page : 2 of 3



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

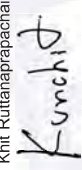
Cert. No.: 25TM460
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 45
Serial No. : L712.0429
ID No. : BKK_ML0056

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : Incubation & Microbiological Reading

Received Order : 04 March 2025
Calibration Date : 04 March 2025
Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$
AC Line Voltage : $(220 \pm 22) \text{ V}$

Calibrated by : Khit Ruitanaprapachai

Approved by : 
Approved Signatory

() Chakrit Waewwanjua
() Suwit Injai
(✓) Kunchit Promprat

Issue Date : 06 March 2025

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.



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2503-0006OC-2

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 : MY44073381
Serial No. : 23LM73
Cert. No. : TPA
Traceable : 18 May 2025

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.

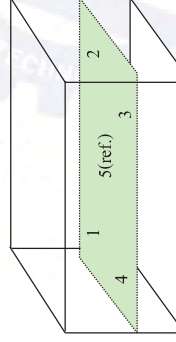
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	
Beginning of Calibration	24	49	220
Finished of Calibration	25	51	221



Front

Position :	Ref. Std. S/N.:
1	4803988-006
2	4803988-007
3	4804539-014
4	4804539-015
5(ref.)	4804539-016

Cert. No.: 25TM460
Page : 2 of 3



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2503-0006OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 25TM460
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	44.5	44.5	44.489	44.469	44.497	44.476	44.479	0.15
45.0	45.0	45.0	44.990	44.966	44.997	44.983	44.980	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.045	0.035	2
45.0	0.047	0.031	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 %.

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TEL 0-2717-3000 FAX. 0-2719-9484

Certificate of Testing

Cert.No.: 25TW101
Page.: 1 of 2

Equipment :
Manufacturer :

Model :

Serial No. :

ID No. :

Received Date :

Test Date :

Reference :

Submitted by :

DO Meter

YSI

500C-230V

09J101147

BKK_EN0017

19 May 2025

20 May 2025

2505-0593DSC-1

ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Temperature (25 ± 5) °C

Humidity (50 ± 20) %

In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by :

Walalak Sirinthean

Approved by :

Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Sathip Meangmai

Issue Date :

20 May 2025

REVIEW BY	<i>Jinda K</i>
APPROVED BY	<i>Sathip P</i>
NEXT CAL DATE	20/11/26



Cert.No.: 25TW101
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This measurement result 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	25CG1126	18 Mar 2027
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 16K100498

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.21	0.0090

This report was certified only for the instrument we tested. It is allowable to use for study
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

-o0o-



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TEL.0-2717-3000-26 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 25LM83
Page.: 1 of 2

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5000-230V
Serial No. : 09J101147
ID No. : BKK_EN0017
Submitted by : ALS Laboratory Group (Thailand) Co.Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 19 May 2025
Calibrated Date : 20 May 2025
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Warakorn Lerngagtrakul
Approved by : 
() Chakrit Waewwanjua
() Suwit Imjai
(✓) Kunchit Promprat
Issue Date : 26 May 2025

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.



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2505-0593DSC-2

Cert. No.: 25LM83
Page: 2 of 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	241022	TPA	17 Sep 2025
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.: 16K100498

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	60	20.003	19.92	-0.083	0.15	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 %.

-000-



Metrology

SCG
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoei, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T250356

Page 1 of 4

Certificate of Calibration

Equipment# : Chamber (Incubator)
Manufacturer : Memmert
Model : ICP 750
Serial No. : F819.0021
Customer Code : BKK_EN0304
ID No. : T9572A4

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,

Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

Customer Location : Wet Chemistry Lab 2

Date of Receipt : 26 February 2025

Calibrated By : Atiplong Rongrat (Technician)

Approved By : *Prinler* / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 17 MAR 2025



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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.



Metrology

SCI ECO Services Company Limited

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



Certificate No. T250356

Page 2 of 4

Calibration Report

Equipment : Chamber (Incubator)
Date of Calibration : 4 March 2025
Environment : Temperature : 24.5-24.7 °C
Line Voltage : 221.4-224.7 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 12 resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2019) and AS2853-1986) .

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	31-(CH1)-(10)	T240399	16 March 2025
RTD	100 ohm	32-(CH1)-(10)	T240399	16 March 2025
DATA LOGGER	34970A	T193	T240399	16 March 2025

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☒ Not Available

5. Adjustment :
(X) without adjustment () after adjustment

Approved By.

FM-L15 118/18-08-66



Metrology

SCI ECO Services Company Limited

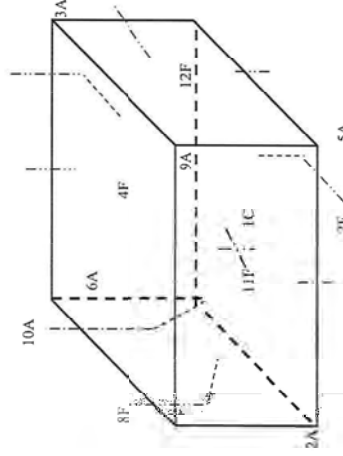
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T250356

Page 3 of 4

Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C = 31-CH1
2A = 31-CH2
3A = 31-CH3
4F = 31-CH4
5A = 31-CH5
6A = 31-CH6
7F = 31-CH7
8F = 31-CH8
9A = 31-CH9
10A = 31-CH10
11F = 32-CH1
12F = 32-CH2

Approved By.

FM-L15 118/18-08-66



Metrology

SCI ECO Services Company Limited

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



Certificate No. T250356

Page 4 of 4

Calibration Report

Measurement Results :

Calibration Point	Average Standard Reading at each position (°C)											
	31-CH1	31-CH2	31-CH3	31-CH4	31-CH5	31-CH6	31-CH7	31-CH8	31-CH9	31-CH10	32-CH1	32-CH2
20	20.02	20.42	19.56	20.13	19.83	19.44	19.71	20.01	20.06	20.04	20.13	19.98

Chamber (Incubator)		Temperature Distribution				
		Reading (°C)	Average (°C)	Stability (± °C)	Uniformity (°C)	Coverage Factor k
Setting (°C)		Min , Max				
20.0		-	20.0	0.10	0.43	1.02

The calibration result apply only the above calibrated item.

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

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

End of Certificate

Approved By.

[Signature]



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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MIRA
CALIBRATION UNIT

Certificate of Calibration

Cert.No.: 24CG3401
Page: 1 of 2

Equipment : Burette
Capacity : 50 mL
Serial No. :
ID. No. : BKK_EN0422
Manufacturer : Witeg
Made in : Germany

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.
Khwaeng Phatthanakan, Khet Suan Luang
Bangkok 10250 Thailand

Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 756 mmHg
Calibration Procedure : ASTM E 542 - 01
Calibrated by : Sa-ngeunkam Wongsa

Approved by :
(✓) Srisuda Khamtha
() Ponpan Paipim
() Unnopphol Harachai

Issue Date : 3 September 2024

REVIEW BY *[Signature]*
APPROVED BY *[Signature]*
NEXT CAL DATE 03/09/25

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.



Equipment : Burette
Received Date : 29 August 2024
Condition As-Received : Used Item
Calibration Date : 3 September 2024
Reference : 2408-0944DSC-2

Cert.No.: 24CG3401
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	XP205	B134206712	140RC007	24MM316	TPA	15 July 2025
2) Data Logger	HL-20D	20683159	140EC012	23H2174	TPA	10 Oct 2024
3) Thermometer	-	1594592	140EC010	24I175	TPA	22 Feb 2025

This certification is traceable to SI Unit

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

3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	49.9951	0.010	2.00

Remark mL = cm³

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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL.0-2717-3000-29 FAX.0-2719-3484



Certificate of Calibration

Cert.No.: 25CG3385
Page.: 1 of 2

Equipment : Burette
Capacity : 50 mL
Serial No. : -
ID. No. : BKK_EN0422
Manufacturer : Wileg
Made in : Germany

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Ambient Temperature : (20 ± 2.5) °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 753 mmHg
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Srisuda Khamtha

Approved by : 
() Ponpan Paipim
(✓) Chakrit Waewwanjua

Issue Date : 3 September 2025

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.



Equipment : Burette
Received Date : 1 September 2025
Condition As-Received : Used Item
Calibration Date : 3 September 2025
Reference : 2509-0049DSC-1

Cert.No.: 25CG3385
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

Instruments	Model	Serial No.	ID. No.	Certificate No.	Traceability	Due date
1) Balance	MS204TS	C226356983	140RC010	24MM603	TPA	10 Oct 2025
2) Data Logger	HL-20D	20683159	140EC012	24H2129	TPA	15 Oct 2025
3) Digital Thermometer	HH376	230806555	140EC013	25H1740	TPA	17 Jan 2026

This measurement result is traceable to SI Unit

- The certificate is valid only to the item calibrated on date and place of calibration.
- True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
10	9.9941	0.0082	2.00
25	24.9804	0.0087	2.00
50	49.9819	0.010	2.00

Remark mL = cm³

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 %.

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TEL.0-2717-3000-26 FAX.0-2719-9484



Certificate of Calibration

Cert.No.: 24CH1295
Page.: 1 of 3

Equipment :

pH Meter

Manufacturer :

Hach

Model :

HQ411d

Serial No. :

200100031163

ID No. :

BKK_EN0342

Condition As-Received:

Used Item

Received Date :

16 October 2024

Calibration Date :

17 October 2024

Reference :

2410-0548DSC-5

Submitted by :

ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phathanakan 40, Phathanakan Rd.,
Khaewang Phathanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Ambient Temperature :

(25 ± 2.5) °C

Relative Humidity :

(50 ± 15) %

Calibration Procedure :

In - house method :
- CP-CH5 by direct measurement with
certified reference material (CRM)

- CP-CH8 by comparison with temperature standard

Calibrated by :

Warakorn Lengagatrakul

Approved by :

Sathip

Approved Signatory

() Unnophol Harachai

() Ponpan Paipim

(✓) Sathip Meangmai

Issue Date :

21 October 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 24CH1295
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument

1) Ref. Standard Thermometer

Serial No. 2188080 **ID No.** 130RC044 **Cert. No.** 2411022 **Due Date** 16 Sep 2025

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)
2. Certified Reference Materials : The measurement results are traceable to SI through Hach Lenge GmbH Ltd.
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution

Manufacturer
CPA chem
Hach Lenge GmbH
CPA chem

Lot No.

1034203
C03145
1034205

Exp. date

27 Sep 2026
28 Feb 2026
27 Sep 2025

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

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode	4.008	4.028	174.6	0.0044	2.00
S/N.: 230473042902	6.999	7.014	1.4	0.0084	2.05
	10.010	10.018	-172.8	0.0066	2.00

Remark - Can not connect the BNC because the plug does not match with the socket.



Cert.No.: 24CH1295
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PHC281
- Serial No. : 230473042902

Dimension of probe

- Length : 103 mm.
- Diameter : 12 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	25.002	25.0	-0.002	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-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL.0-2711-3000-29 FAX.0-2719-3484



Certificate of Calibration

Cert.No.: 25CH1162
Page.: 1 of 3

Equipment :

Manufacturer :

Model :

Serial No. :

ID No. :

Condition As-Received:

Received Date :

Calibration Date :

Reference :

Submitted by :

pH Meter

Hach

HQ411d

200700031163

BKK_EN0342

Used Item

08 October 2025

09 October 2025

2510-0271DSC-1

ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd.,

Khwaeng Phatthanakan, Khet Suan Luang,

Bangkok 10250 Thailand

(25 ± 2.5) °C

(50 ± 15) %

In - house method :

- CP-CH5 by direct measurement with
certified reference material (CRM)

- CP-CH8 by comparison with temperature standard

Calibrated by :

Walalak Sirthean

Approved by :

Approved Signatory

() Chakrit Waewwanjua

() Ponpan Paipim

(✓) Saithip Meangmai

Issue Date :

10 October 2025

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.



Cert.No.: 25CH1162
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument

1) Ref. Standard Thermometer 4982054 110RC044 251708 03 July 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. 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

pH 4.007

pH 6.965

pH 10.010

Manufacturer

CPA chem

CPA chem

CPA chem

Lot No.

1114384

1066667

1135355

Exp. date

12 June 2027

18 Jan 2026

16 Aug 2026

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

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual pH Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode	4.007	3.996	176.6	0.0046	2.00
S/N.: 252063043080	6.965	6.974	1.1	0.0084	2.00
	10.010	9.996	-176.9	0.0070	2.00

Remark - Can not connect the BNC because the plug does not match with the socket.



Cert.No.: 25CH1162
Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PHC281
- Serial No. : 252063043080

Dimension of probe

- Length : 103 mm.
- Diameter : 12 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor <i>k</i>
25.0	25.001	25.0	-0.001	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-

Model	:	KM 320	REVIEW BY	<i>[Signature]</i>
Serial No.	:	TBN-1012061/05	APPROVED BY	<i>[Signature]</i>
Customer Code	:	BKS_EN0167	NEXT CAL DATE	04/12/26
ID No.	:	T2463A3		
Customer	:	ALS Laboratory Group (Thailand) Co., Ltd.		
		104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,		
		Khet Suan Luang, Bangkok 10250		
Customer Location	:	Laboratory Room		
Date of Receipt	:	28 May 2025		
Calibrated By	:	Atiphong Rongrat (Technician)		
Approved By	:	<i>[Signature]</i> / Boonchai Suriyawong (Site Calibration Manager)		
Date of Issue	:	19 JUN 2025		

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



Certificate No. T250873

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 4 June 2025
Environment : Temperature : 23.4-24.9 °C
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :
1. This equipment was calibrated by insert 15 standard thermocouples type T into its chamber, the other one standard thermocouples type T use for ambient temperature measurement. The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN91-TN100	T242036	3 December 2025
TC	TYPE T	TN101-TN110	T242036	3 December 2025
DATA LOGGER	34970A	T121	T242036	3 December 2025

3. This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244).

4. Condition of calibrated item : good

Equipment Description :
Time Constant : 2 Hour
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :
(X) without adjustment () after adjustment

Approved By:

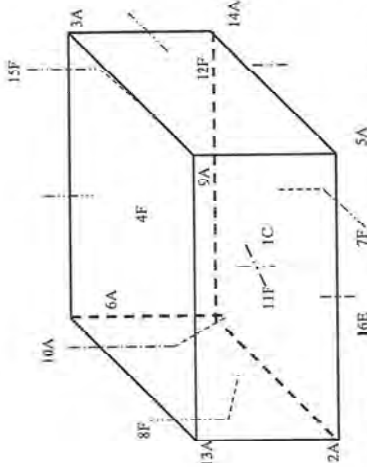
FM-TL07 (02/27-01-68)



Certificate No. T250873

Page 3 of 4

Calibration Report



C = Centre, F = Centre of Face, A = Corner, E = Centre of Edge

1C =	TN91	12F =	TN102
2A =	TN92	13A =	TN103
3A =	TN93	14A =	TN104
4F =	TN94	15F =	TN105
5A =	TN95	16E =	TN106
6A =	TN96		
7F =	TN97		
8F =	TN98		
9A =	TN99		
10A =	TN100		
11F =	TN101		

Approved By:

FM-TL07 (02/27-03-68)



Certificate No. T250873

Page 4 of 4

Calibration Report

Measurement Results

Average Standard Reading at each position (°C)													
Calibration Point	TN91	TN92	TN93	TN94	TN95	TN96	TN97	TN98	TN99	TN100	TN101	TN102	
3.0	2.95	2.92	3.09	2.92	3.16	3.50	3.40	3.03	3.14	2.98	3.44	3.13	
	TN103	TN104	TN105	TN106									
	3.19	3.06	3.46	2.92									

Chamber (Cooling Room)		Temperature Distribution				
		Reading (°C)		Average (°C)		Coverage Factor k
Setting (°C)	Min	Max	Average	Uniformity (°C)	Stability (± °C)	
3.0	2.8	3.9	3.4	1.20	1.20	2.04

The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By:

Manufacturer Sartorius
Type MSE224S-100-DU
Serial | QM Ident. no. 27405555 | BKK_EN0003
Customer ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakarn 40, Phatthanakarn Rd., Khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250
Order no. 265054
Number of pages 4
Date of calibration 17 Jul 2025

REVIEW BY

APPROVED BY

NEXT CAL DATE 17/07/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.
The user is obliged to have the object recalibrated at appropriate intervals.

Date of issue 17 Jul 2025
Approval of the Calibration Certificate
Person in charge
Mr. Chonchai Inthana
Chonchai Inthana

Calibration certificate No.: 25BCI0265

Calibration Certificate

Calibration object

Single range instrument

Model

MSE224S-100-DU

Serial Number

27405555

QM Ident. no | Inventory no.

BKK_EN0003 | ---

Maximum capacity (Max. load)

220.0000 g

Measured up to

220.0000 g

Scale interval

0.0001 g

Place of calibration

Address

According to page 1

Department | Cost center

ENVI Department | ---

Building | Floor

--- | 1st Floor.

Room

Laboratory Room.

Maximum temperature variation at place of calibration

5 K

Calibration procedure

EURAMET Calibration Guide No. 18, Version 4.0 (11/2015) - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

Test equipment type

Test equipment ID

Valid until

Thermometer

Testo 174(Traceable to SI unit through ENTECH)

11 Nov 2025

Test weight set OIML R111 E2

Certificate No.M2308197S.E2(Traceable to SI unit through TCS)

23 Aug 2025

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang

10310 Bangkok

Verical®

Version 6.6

Page

2 | 4

Calibration certificate No.: 25BCI0265

Calibration Certificate

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

Date of calibration

17 Jul 2025

Temperature at place of calibration | Temp. diff.

22.5 °C | 0.7 K

Twights - T_{place}

The installation site is suitable. The device is level. Balance was loaded up to Max before test.

Measuring conditions

Humidity 58.0 %RH.

Comments

Measurement results | Measurement uncertainties

Repeatability

Eccentricity

Test load (nominal): 10 g | 200 g

Test load (nominal):

100 g

1

10.0000 g

200.0000 g

Center

100.0000 g

2

10.0000 g

199.9999 g

Front left

100.0001 g

3

10.0000 g

200.0000 g

Back left

100.0000 g

4

10.0000 g

200.0000 g

Back right

100.0001 g

5

10.0001 g

199.9999 g

Front right

100.0001 g

6

10.0000 g

200.0000 g

Maximum deviation from centric loading indication

Δ_{load} max = 0.0001 g

7

10.0000 g

200.0000 g

8

10.0001 g

200.0000 g

9

10.0000 g

200.0000 g

10

10.0000 g

199.9999 g

s = 0.00004 g

s = 0.00005 g

Error of indication

Testload

L

Indication

I

Error

E

Expansion factor

k

Uncertainty

U(E)

Uncertainty relative

U_{rel}(E)

0.0100 g

0.0100 g

0.0100 g

0.0000 g

0.0000 g

2.00

0.00012 g

1.2 %

0.1000 g

0.1000 g

0.1000 g

0.0000 g

0.0000 g

2.00

0.00013 g

0.13 %

1.0000 g

1.0000 g

1.0000 g

0.0000 g

0.0000 g

2.00

0.00013 g

0.013 %

2.0000 g

2.0000 g

2.0000 g

0.0000 g

0.0000 g

2.00

0.00013 g

0.0065 %

5.0000 g

5.0000 g

5.0000 g

0.0000 g

0.0000 g

2.00

0.00013 g

0.0026 %

10.0000 g

10.0000 g

10.0000 g

0.0000 g

0.0000 g

2.00

0.00013 g

0.0013 %

20.0000 g

20.0000 g

20.0000 g

0.0000 g

0.0000 g

2.00

0.00014 g

0.00066 %

50.0000 g

50.0000 g

50.0000 g

0.0000 g

0.0000 g

2.00

0.00015 g

0.00029 %

100.0000 g

100.0000 g

100.0000 g

0.0000 g

0.0000 g

2.00

0.00018 g

0.00018 %

200.0000 g

200.0000 g

200.0000 g

0.0000 g

0.0000 g

2.00

0.00028 g

0.00014 %

220.0000 g

220.00001 g

220.00001 g

0.0001 g

0.0001 g

2.00

0.00032 g

0.00015 %

Maximum error of indication

E_{max} = 0.0001 g

U_{rel}(E) is the quotient of U(E) and test load L. The uncertainty of measurement U(E) is valid only if error E is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.

Expansion factor, determined in accordance with the European Calibration Guideline EURAMET-cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang

10310 Bangkok

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Page

3 | 4

Uncertainty of measurement in use

Device adjusted before measurement
Temperature deviation considered
Temperature coefficient considered

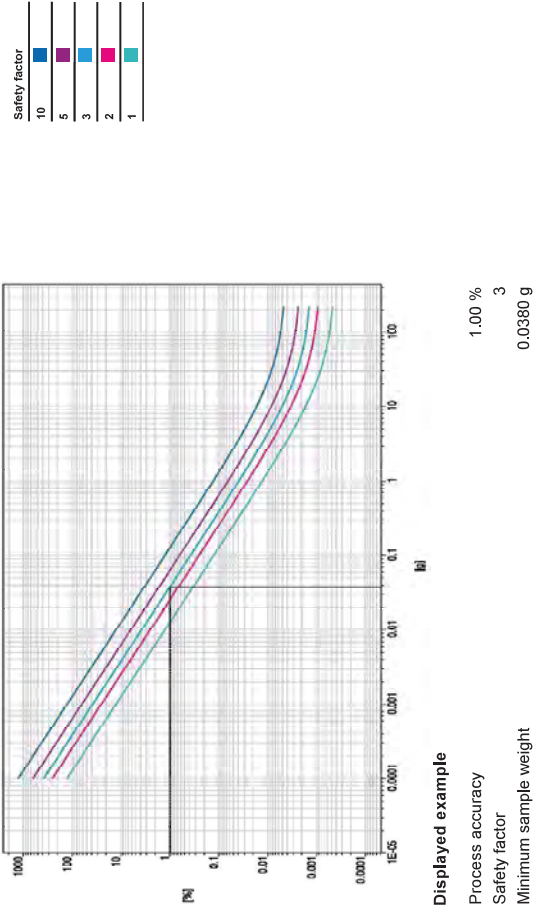
Yes
1.5 K (isoCAL active)
 $1 \cdot 10^{-5} \text{K}$

$U_{gl}(W) = 0.00013 \text{ g} + 4.19 \cdot 10^{-5} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an expansion factor $k=2$ in accordance with the European Calibration Guideline ECUA/NEC 199-16, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

Indication in % from max load	Net indication R	Uncertainty $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00036 g	0.00066 %
50 %	110.0000 g	0.00059 g	0.00054 %
75 %	165.0000 g	0.00082 g	0.00050 %
100 %	220.0000 g	0.0011 g	0.00048 %

Graphic realization of the relative uncertainty of measurement | process accuracy



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL 0-2717-3000-28 FAX 0-2719-9484



MSC-18-17517923
CALIBRATION 0008

Certificate of Calibration

Cert. No.: 24TM1618
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE29
Serial No. : L622.0282
ID No. : BKK_EN0439

REVIEW BY *Jinda K*

APPROVED BY *Siluk P*

NEXT CAL DATE 29/10/25

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : Organic Preparation Lab

Received Order : 29 October 2024
Calibration Date : 29 October 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpalboon

Kunchit

Approved by : Approved Signatory

() Ponpan Paipim
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 30 October 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.



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2410-0782OC-4

Cert. No.: 24TM1618
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 (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 MY57013711 24LM115 TPA 13 Jul 2025

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.

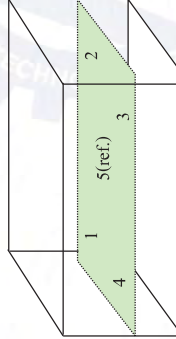
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply (Volt)
	(°C)	(%R.H.)	
Beginning of Calibration	25	54	222
Finished of Calibration	25	57	226



Front



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2410-0782OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM1618
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.)	
85.0	85.0	85.0	85.133	85.212	85.150	84.983	85.096	0.22

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
85.0	0.21	0.13	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-



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.: 25TM528
Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 29
Serial No. : L622.0282
ID No. : BKK_EN0439

Submitted by :
Location :
Received Order :
Calibration Date :
Ambient Temperature :
Relative Humidity :
AC Line Voltage :

08 October 2025
09 October 2025
(26 ± 10) °C
(50 ± 30) %
(220 ± 22) V

Calibrated by : Kunchit Promprat

Approved by :
Approved Signatory

() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Suwit Imjai

Issue Date : 28 October 2025

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.



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2510-00420C-13
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 MY58041391 25LM20 TPA 08 Feb 2026

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

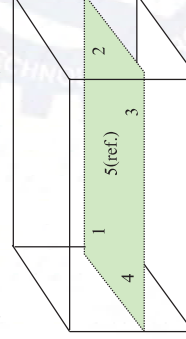
3. This measurement result is traceable to the International System of Unit maintained through :
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply (Volt)
	(°C)	(%R.H.)	
Beginning of Calibration	24	63	224
Finished of Calibration	24	58	224



Front

Position :	Ref. Std. ID No.:
1	70RC143
2	70RC144
3	70RC145
4	70RC146
5(ref.)	70RC147



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2510-0042OC-13
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 25TM528
Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)					Uncertainty (± °C)
			Position					
			1	2	3	4	5 (ref.)	
85.0	85.0	85.0	84.863	84.748	84.869	84.990	84.966	0.21

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor <i>k</i>
85.0	0.33	0.12	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 %.

-000-



Metrological Center

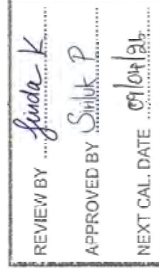
SCI ECO Services Company Limited
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 566 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T250578

Page 1 of 4

Certificate of Calibration

Equipment : Digestion Unit
Manufacturer : SCP Science
Model : DigiPRER HT
Serial No. : HTC1120480658
Customer Code : BKK_EN0366
ID No. : T2635A5
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250



Customer Location : Wet Chemistry Lab 1
Date of Receipt : 2 April 2025
Calibrated By : Atiphong Rongrat (Technician)
Approved By : [Signature] / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 13 MAY 2025

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



Metrological Center

SCI ECO Services Company Limited

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

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

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

Certificate No. T250578

Page 2 of 4

Calibration Report

Equipment : Digestion Unit

Date of Calibration : 9 April 2025

Environment : Temperature : 23.9 - 26.3 °C

Line Voltage : 221.8 - 225.9 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert four standard thermocouples type S into its chamber, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to WFI-T10.

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

2. Reference Standard Instrument :

Instrument	Model	Instrument/No.	Certificate No.	Due Date
TC	Type S	MT-(CHI-CH4)	T242035	04 December 2025
DATA LOGGER	34970A	T121	T242035	04 December 2025

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 40 Minute At 380 °C
Fresh Air Dumper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By.

[Signature]

FM-L13 108/30-05-57



Metrological Center

SCI ECO Services Company Limited

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

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

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

Certificate No. T250578

Page 3 of 4

Calibration Report

MT-CHI Block 1	MT-CHI Block 2	MT-CHI Block 3	MT-CHI Block 4	MT-CHI Block 5	MT-CHI Block 6	MT-CHI Block 7	MT-CHI Block 8
MT-CHI Block 9	MT-CHI Block 10	MT-CHI Block 11	MT-CHI Block 12	MT-CHI Block 13	MT-CHI Block 14	MT-CHI Block 15	MT-CHI Block 16
MT-CHI Block 17	MT-CHI Block 18	MT-CHI Block 19	MT-CHI Block 20	MT-CHI Block 21	MT-CHI Block 22	MT-CHI Block 23	MT-CHI Block 24
MT-CHI Block 25	MT-CHI Block 26	MT-CHI Block 27	MT-CHI Block 28	MT-CHI Block 29	MT-CHI Block 30	MT-CHI Block 31	MT-CHI Block 32
MT-CHI Block 33	MT-CHI Block 34	MT-CHI Block 35	MT-CHI Block 36	MT-CHI Block 37	MT-CHI Block 38	MT-CHI Block 39	MT-CHI Block 40

FRONT

Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
				MT-CHI Block 1	MT-CHI Block 2	MT-CHI Block 3	MT-CHI Block 4	MT-CHI Block 5	MT-CHI Block 6	MT-CHI Block 7	MT-CHI Block 8
°C	°C	°C	Reading								
			Max °C	380.0	381.0	380.9	379.6	380.3	380.5	381.3	380.1
			Min °C	379.6	380.8	380.6	379.3	379.9	380.5	380.5	379.6
			Average °C	379.8	380.9	380.7	379.5	380.1	380.7	381.1	379.9
			Stability ± °C	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
				MT-CHI Block 9	MT-CHI Block 10	MT-CHI Block 11	MT-CHI Block 12	MT-CHI Block 13	MT-CHI Block 14	MT-CHI Block 15	MT-CHI Block 16
°C	°C	°C	Reading								
			Max °C	378.9	378.7	379.8	381.0	382.8	381.3	381.7	380.4
			Min °C	378.3	378.2	379.3	380.7	382.1	380.5	381.3	380.0
			Average °C	378.6	378.5	379.5	380.9	382.4	380.9	381.5	380.2
			Stability ± °C	0.3	0.2	0.3	0.1	0.3	0.4	0.2	0.2

Approved By.

[Signature]

FM-L13 108/30-05-57



Metrological Center

SCIECO Services Company Limited

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

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

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

Certificate No. T250578

Page 4 of 4

Calibration Report

Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
(°C)	(°C)	(°C)		MP-CH1	MP-CH2	MP-CH3	MP-CH4	MP-CH5	MP-CH6	MP-CH7	MP-CH8
				Block 17	Block 18	Block 19	Block 20	Block 21	Block 22	Block 23	Block 24
		Max °C		379.3	379.2	379.1	379.5	380.3	381.1	382.5	381.3
		Min °C		379.1	379.0	378.8	379.2	380.5	380.8	382.1	381.1
380.0	380.0	Average °C		379.2	379.1	379.0	379.3	380.5	380.9	382.3	381.2
		Stability ± °C	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
(°C)	(°C)	(°C)		MP-CH1	MP-CH2	MP-CH3	MP-CH4	MP-CH5	MP-CH6	MP-CH7	MP-CH8
		Max °C		378.5	378.2	379.5	378.5	380.4	380.8	380.4	380.9
		Min °C		378.2	377.9	379.2	378.2	380.0	380.5	380.1	380.6
380.0	380.0	Average °C		378.3	378.0	379.4	378.3	380.2	380.7	380.2	380.8
		Stability ± °C	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
(°C)	(°C)	(°C)		MP-CH1	MP-CH2	MP-CH3	MP-CH4	MP-CH5	MP-CH6	MP-CH7	MP-CH8
		Max °C		379.9	380.0	379.8	379.7	380.1	380.2	379.7	379.8
		Min °C		379.6	379.6	379.5	379.3	379.8	379.9	379.4	379.5
380.0	380.0	Average °C		379.8	379.8	379.7	379.5	379.9	380.1	379.5	379.7
		Stability ± °C	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1

The expanded uncertainty of temperature measurement was ± 2.36 °C

The calibration result apply only the above calibrated item.

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

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing

a level of confidence of approximately 95 %.

Approved By: 

PAGE 1 OF 12



SmartChem® 600 - Maintenance report Rev.03

Smartchem 600



REVIEW BY Apirom M
APPROVED BY Sirulok P
NEXT CAL DATE 15 Jan 2025

Maintenance report

Instrument S/N: 2401055

Installed at: ALS Laboratory Group (Thailand) Co., Ltd.

Address: 104 Phathanakan 40 Alley, Phathanakan, Suan Luang, Bangkok Thailand

Contact: Arraya Meechai Telephone: 02 760 3000

E-mail: arraya.meechai@alsglobal.com

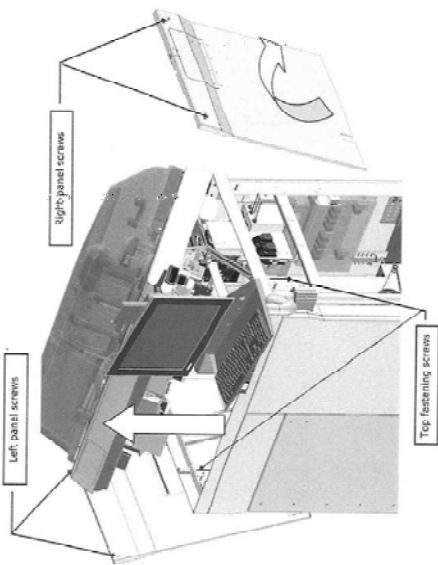
Date of maintenance: 15-Jul-2025

Service engineer: Apirom, Samphan

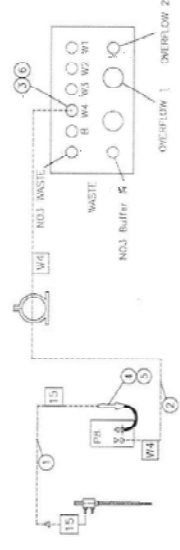
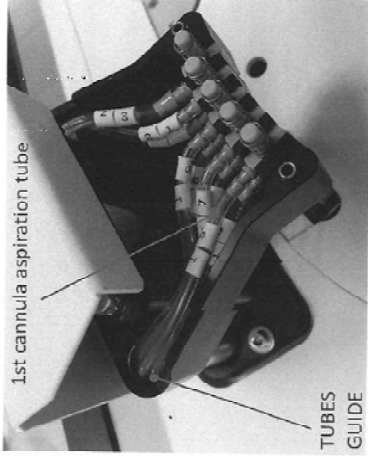
Maintenance procedure

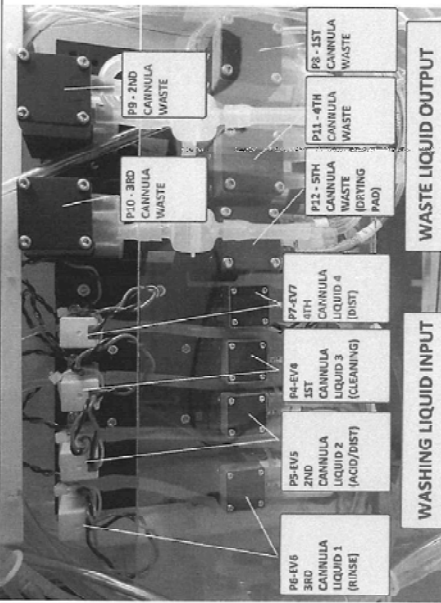
Preliminary checks	
1)	Check problems encountered by the operator while using the instrument Remarks: ✓
2)	Check of the "Event logs" ➤ Access the "Event logs" page ("Archive" → "Event logs") ➤ Filter at least the past two months in order to check if any error have occurred Remarks: ✓
3)	Verify results of WBL (to verify correct operation of the spectrometer, reagents arms and reactions plate) Remarks: ✓
4)	Check for leaks/overflows ➤ Check the coloration of the washing wells (washing wells should be white without any trace of coloration) ➤ Check the absence of dry stain under and inside the instrument (it could be evidence of old leaks/overflows) Remarks: ✓
5)	Check the correct execution of the Home procedure ➤ Access diagnostic area ("Maintenance" → "Diagnostic") ➤ Select the "Home all motors" item in order to perform the general reset of the instrument and wait until the procedure is completed ➤ Make sure that all the Home Sensor's light up in green Remarks: ✓

Maintenance procedure

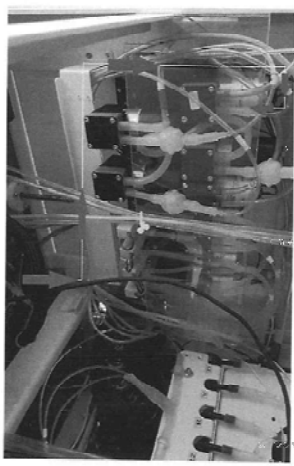
1)	Instrument preparation ➤ Remove the right side panel ➤ Remove the left side panel ➤ Unscrew the two top fastening screws and then lift up the top till the security lock falls and secure the machine in opened position ➤ Open the main door and gates of the Hydraulic compartment on the back right side ➤ Open the door of the Electronic compartment on the back left side  ✓	Remarks:
2)	Washing station - emptying the drain line of the 1st cannula ➤ Access diagnostic area ("Maintenance" → "Diagnostic") and open the "Washing station" page ➤ Activate the "Probe 1 empty..." for at least 10 seconds Remarks: ✓	Remarks:

3)	Drain the hydraulic circuit of the EC module (if installed) ➤ Access diagnostic area ("Maintenance" → "Diagnostic") ➤ Perform the mechanical reset of the instrument ("Main" page → "Home all motors") ➤ Remove the cannula from the "D1 water" bottle Access the "EC" page and run 10 times the "Purge" feature Remarks: Don't installed.	☐
4)	Drain the hydraulic circuit of the NO3 module (if installed) ➤ Access diagnostic area ("Maintenance" → "Diagnostic") ➤ Perform the mechanical reset of the instrument ("Main" page → "Home all motors") ➤ Remove the cannula from the "Imidazole" bottle ➤ Access the "NO3" page and run 2 times the "Liquids prime" feature Remarks: Customer stop to use NO3 module because the Cadmilum Coil was defective.	☐
5)	Perform all updates ➤ Windows update ➤ Software update Remarks: For Windows update: We will cooperate with IT of ALS to update Windows For Software update: We will make appointment with ALS to update Software when we have new version of Software.	☒
6)	Instrument cleaning ➤ Clean the fan of the power supply (using a vacuum cleaner if possible) ➤ Internal and external cleaning of the instrument to eliminate traces of old liquid leaks ➤ Remove all tubings from the inlet tanks and wash the inlet tanks with 5% sodium hypochlorite or 5% HCl ➤ Manually check the correct dispensation of each cannula of the washing station using a syringe with distilled water NOTE: do not inject air in order to prevent any kind of damage of the power supply due to injection of the dust inside it Remarks:	☒

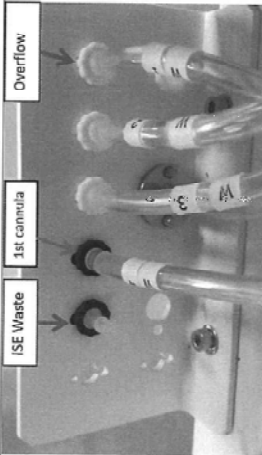
7)	Washing station - tube replacement on 1st cannula  WARNING! BIOHAZARD RISK WHEN REMOVING TUBES. USE APPROPRIATE PROTECTIONS ➤ Locate the 1st washing station cannula loading tube "ID 15". Unplug it from the 1st cannula and slide it down through the tubes guide  ➤ Unplug the tube "ID 15" from "UP8" in washing station pump compartment	☒
----	--	-------------------------------------



➤ Install the new tube "ID 15" respecting the routing shown in the figure



➤ Replace tube "W4" from pump "up8" to the waste tubes panel

		
Remarks:		
8)	Filters replacement on drain lines WARNING! BIOHAZARD RISK WHEN REMOVING TUBES. USE APPROPRIATE PROTECTIONS	☒
9)	Maintenance of inlet tanks ➤ Wash all inlet tanks at least 3 times with DI water ➤ Fill all inlet tanks with fresh solutions ➤ Wash the "DI water" bottle and fill it with fresh "DI water" (if the EC module is installed) Remarks:	☒
10)	Switch on instrument and software	☒
11)	Workplans backup (delete archived workplans in order to lighten the database)	☒
12)	Mechanical checking and adjustments ➤ Alignment between reactions plate and photometer ➤ Alignment between washing station and reactions plate ➤ Home position of all sampling arms ➤ Alignment of Samples arm on sample carousels and reactions plate ➤ Alignment of Reagents arm on reagents plate and reactions plate ➤ Alignment of Mixer scoops on reactions plate	☒

1.3)	Remarks: The needle of R1 Reagent Sampling probe is bent then we have adjusted the R1 Reagent Sampling Arm for the needle position is in center of the Washing well.	
	Functional checks of the drain lines - Washing well of Samples arm - Manually fill the washing well - Access diagnostic area ("Maintenance" → "Diagnostic") and open the "Samples arm (S)" page - Activate the "Washing well empty pump (P20)" and verify that washing well has been emptied	☒
	- Washing well Reagents arm R1 - Manually fill the washing well - Access diagnostic area ("Maintenance" → "Diagnostic") and open the "Reagents arm 1 (R1)" page - Activate the "Washing well empty pump (P21)" and verify that washing well is emptied	☒
	- Washing well Reagents arm R2 - Manually fill washing the well - Access diagnostic area ("Maintenance" → "Diagnostic") and open the "Reagents arm 2 (R2)" page - Activate the "Washing well empty pump (P22)" and verify that washing well is emptied	☒
	- Washing wells Mixer - Manually fill both washing wells - Access diagnostic area ("Maintenance" → "Diagnostic") and open the "Mixer (MX)" page - Activate the "Scoop 1 washing well empty pump (P19)" and verify that washing well is emptied - Activate the "Scoop 2 washing well empty pump (P18)" and verify that washing well is emptied	☒

14)	- Washing station – cannulas - Access diagnostic area ("Maintenance" → "Diagnostic") - Perform the mechanical reset of the instrument ("Main" page → "Home all motors") - Manually fill the 4 cuvettes located below the cannulas - Open the "Washing station (WS)" page and activate the "Probe 1 empty...", "Probe 2 empty...", "Probe 3 empty..." and "Probe 4 empty..." - Set "Movement length (mm)" to 10 mm and click on "Move down" till the cannulas will be near to the bottom of cuvettes and check that the cuvettes have been emptied - Disable all empty pumps and click on "Reset" to perform the mechanical reset of the washing station	☒
	- EC module (if installed) - Access diagnostic area ("Maintenance" → "Diagnostic") - Manually fill the washing well of the EC module - Open the "EC" page; click on "Maintenance" button and check that washing well have been emptied	☐
	- NO3 module (if installed) - Access diagnostic area ("Maintenance" → "Diagnostic") - Manually fill the washing well of the NO3 module - Open the "NO3" page; click on "Activate pump P2" button and check that washing well have been emptied	
	Remarks: EC module don't installed. Customer stop to use NO3 module because the Cadmium Cold was defective.	
	Prime the hydraulic circuit of the instrument - Insert tubings inside relative inlet tanks - Perform 2 "Prime liquids" and 1 "Wash all cuvettes" Remarks:	☒
15)	Washing station - hydraulic operating check - Access "Diagnostic" area and click on "Home all motor" - Open the "Washing station (WS)" page and perform the "Liquid level diagnosis"	☒
	Remarks:	

16)	Samples arm - hydraulic operating check ➤ Access "Diagnostic" area and click on "Home all motor" ➤ Open the "Samples arm" page and perform at least 2 times the "Hydraulic check"	☒
	Remarks:	
17)	Reagent arm 1 - hydraulic operating check ➤ Access "Diagnostic" area and click on "Home all motor" ➤ Open the "Reagent arm 1" page and perform at least 2 times the "Hydraulic check"	☒
	Remarks:	
18)	Reagent arm 2 - hydraulic operating check ➤ Access "Diagnostic" area and click on "Home all motor" ➤ Open the "Reagent arm 2" page and perform at least 2 times the "Hydraulic check"	☒
	Remarks:	
19)	Wash and Prime the hydraulic circuit of the instrument ➤ Insert the cannulas inside a beaker with washing solution (5% HCl or sodium hypochlorite 5%) ➤ Perform 2 "Prime liquids" checking that all tubes are filled ➤ Wait for fifteen minutes. ➤ Clean and dry the four cannulas and then insert them into a bottle containing distilled water ➤ Perform 4 "prime liquids" to remove any trace of washing solution ➤ Clean and dry the four cannulas and then insert them inside the relative tanks ➤ Perform 2 "Prime liquids" in order to fill each line with the working solutions	☒
	Remarks:	

20)	Prime the hydraulic circuit of the EC module (if installed) ➤ Insert the cannulas inside the DI tank ➤ Perform at least 3 "Purge"	☐
	Remarks: Don't installed	
21)	Prime the hydraulic circuit of the NO3 module (if installed) ➤ Insert the cannula into the "Imidazole" bottle ➤ Perform at least 2 "Liquids Prime"	☐
	Remarks: Customer stop to use NO3 module because the Cadmium Colid was defective	
22)	Cuvettes replacement and reset of WBL results ➤ Access diagnostic area ("Maintenance" → "Diagnostic") ➤ Click on "Disengage all motor" in order to be able to move the reactions plate freely by hand ➤ Replace all cuvettes ➤ Access the WBL page ("Checks" → "Water blank level") ➤ Click in the center of the reactions plate picture on the screen and select the "Replace cuvettes" feature to reset WBL results	☒
	Remarks:	
23)	Drying pad replacement Customer have replaced the Drying pad before.	☒

24) Photometer checking and adjustment ➢ Replacement of the lamp ➢ Checking and adjustment of Lamp voltage (5,8 V) • Voltage: ➢ Checking and adjustment of Offset (750 counts) and Gain (7.500.000 counts) for each wavelength: • Access "Diagnostic" area and click on "Home all motor" • Manually fill cuvette #1, which is in front of the spectrometer, with at least: 300 µl of Rinse solution • Open the "Spectrometer" page and click on "Lamp on" in order to switch off the lamp • Setup the Offset at 750 counts for each wavelength • Click on "Lamp on" in order to switch on the lamp and wait the end of the lamp warm-up time "Warm-up (remaining time)" • Setup the Gain at 7.500.000 counts for each wavelength Remarks: Voltage: 5.8 Volt	25) Temperature ➢ Reaction plate: 38.7 C ➢ Reagents plate: 8.4 C ➢ Sampling arm: 23.5 C ➢ Room: 23.5 C Remarks:	1) Run calibration and quality controls to confirm correct performance <table border="1"> <tr> <td>Method name:</td> <td>☒ Pass</td> <td>☐ Fail</td> <td>☒ Printout enclosed</td> </tr> <tr> <td>Method name:</td> <td>☒ Pass</td> <td>☐ Fail</td> <td>☒ Printout enclosed</td> </tr> <tr> <td>Method name:</td> <td>☒ Pass</td> <td>☐ Fail</td> <td>☒ Printout enclosed</td> </tr> </table> Remarks: The calibration and quality controls done by the user which have that document.	Method name:	☒ Pass	☐ Fail	☒ Printout enclosed	Method name:	☒ Pass	☐ Fail	☒ Printout enclosed	Method name:	☒ Pass	☐ Fail	☒ Printout enclosed
Method name:	☒ Pass	☐ Fail	☒ Printout enclosed											
Method name:	☒ Pass	☐ Fail	☒ Printout enclosed											
Method name:	☒ Pass	☐ Fail	☒ Printout enclosed											

Maintenance completed successfully: ☒ Yes ☐ No

Service engineer signature: *DM*



Metrology
SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhroi, Saraburi 18110, Thailand.
Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100
Bangkok Tel : +668 9205 6851 , +668 8247 2360
Website: www.sceco.co.th E-Mail : calibrate@sceco.com



Certificate No. T241770

Page 1 of 3

Certificate of Calibration

Equipment	: Chamber (Oven)
Manufacturer	: Memmert
Model	: UF 110
Serial No.	: B423.1549
Customer Code	: BKK_EN0425
ID No.	: T4671A5
Customer	: ALS Laboratory Group (Thailand) Co., Ltd.
	104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanaka
	Khet Suan Luang, Bangkok 10250
Customer Location	: Oven Room
Date of Receipt	: 22 October 2024



Calibrated By: Dr. Chaiyaporn / Chaiyaporn V



Metrology

SCI ECO Services Company Limited

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



Certificate No. T241770

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)

Date of Calibration : 29 October 2024

Environment : Temperature : 22.4-27.7 °C

Line Voltage : 221.7-225.9 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by inserting nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement. The calibration was done in according to W1-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986). All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No	Due Date
RTD	100 ohm	31-(CH1-10)	T240399	16 March 2025
DATA LOGGER	34970A	T193	T240399	16 March 2025

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-17025 CALIBRATION 6044).

4. Condition of calibrated item : good

Equipment Description

Time Constant : 1 Hour 35 Minute A: 104 °C
Fresh Air Damper : ☐ Open ☒ Min ☐ Medium ☐ Max
☐ Close
☐ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By _____



Metrology

SCI ECO Services Company Limited

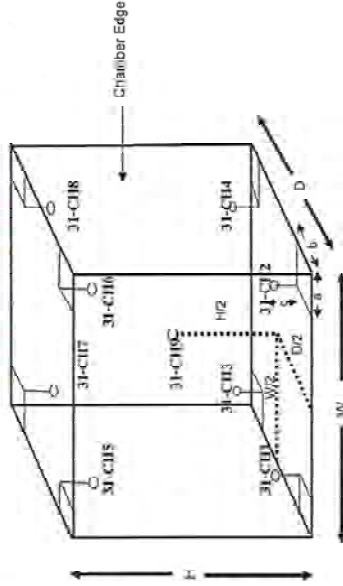
33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.



Certificate No. T241770

Page 3 of 3

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 55 cm. , H (Height) = 55 cm and D (Depth) = 41 cm.
Size of Installed Standard sensor number 31-CH1 to number 31-CH8 : $\phi = 5$ mm, $\theta = 5$ mm.
Size of Installed Standard sensor number 31-CH9 : W/2 = 56 cm/2 , H/2 = 55 cm/2 and D/2 = 41 cm/2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	31-CH1	31-CH2	31-CH3	31-CH4	31-CH5	31-CH6	31-CH7	31-CH8	31-CH9			
104	104.49	106.80	103.83	104.26	106.02	104.34	103.76	104.42	103.96			
180	180.29	180.00	179.84	186.15	179.27	180.23	180.36	180.68	180.73			

Chamber (Oven)			Temperature Distribution			
Setling (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Coverage Factor t
	Min	Max				
04.0	103.9	104	104.9	104.14	6.14	3.32
80.0	179.9	180	180.9	180.23	6.27	3.10

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

End of Certificate

Approved By _____



Metrology Center
SCI ECO Services Company Limited
51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260
Bangkok Tel : +668 9205 6351 , +669 81924 0059
Saraburi Tel : +669 8247 2360

Website : www.sciaco.co.th E-Mail : calibrate@sco.co.th

Certificate No. T251785

Certificate of Calibration

Page 1 of 3

Equipment : Chamber (Oven)

Manufacturer : Memmert

Model : UF110

Serial No. : B423.1549

Customer Code : BKK_EN0425

ID No. : T4671A5

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Oven Room

Date of Receipt : 1 October 2025

Calibrated By : Sujjar Nakrakred (Site Calibration Manager)

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 10 OCT 2025

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

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

REVIEW BY	<u>Jude K</u>
APPROVED BY	<u>Sujjar P</u>
NEXT CAL. DATE	06/10/26



Metrology Center
SCI ECO Services Company Limited
51 Moo 8, Tubkwang, Kaeng Khoi, Saraburi, Thailand 18260

Certificate No. T251785

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 6 October 2025
Environment : Temperature : 24.4-25.8 °C
Line Voltage : 220.5-225.2 V
Relative Humidity : 55- 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2019) and AS2853-1986) .
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	23-(CH1-10)	T250314	6 April 2026
DATA LOGGER	34970A	T195	T250314	6 April 2026

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244 .
4. Condition of calibrated item : good

Equipment Description :

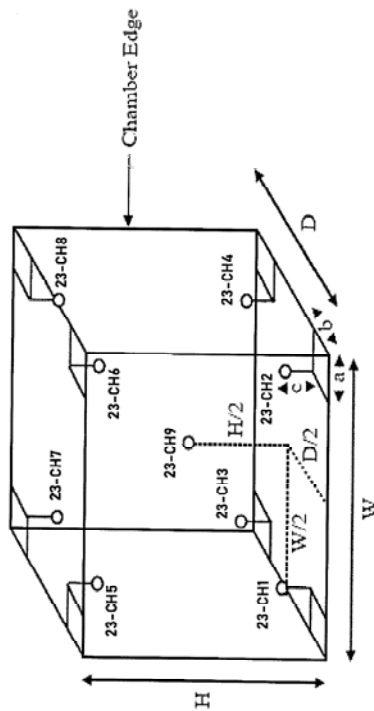
Time Constant : 2 Hour 14 Minute At 104 °C
Fresh Air Damper : ☒ Open ☐ Medium ☐ Max
☐ Close ☐ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By : Boonchai

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm., L (Height) = 48 cm. and D (Depth) = 40 cm.

Size of Installed Standard sensor number 23-CH8 : a = 5 cm, b = 5 cm, and c = 5 cm.

Size of Installed Standard sensor number 23-CH9 : W/2 = 56 cm./2 , H/2 = 48 cm./2 and D/2 = 40cm./2

Measurement Results

		Average Standard Reading at each position (°C)											
		23-CH1	23-CH2	23-CH3	23-CH4	23-CH5	23-CH6	23-CH7	23-CH8	23-CH9	23-CH10	23-CH11	23-CH12
104		104.13	103.54	103.92	104.37	104.40	104.51	104.18	103.86	103.80			
180		180.05	179.52	179.64	179.52	181.20	180.29	180.19	179.35	179.89			

* "The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t -distribution, providing

a level of confidence of approximately 95 %.

End of Certificate.

Approved By. Don Ly