

ภาคผนวก ง

ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Particulate Matter (PM10)	High Volume	BKK_FS0385	-	-	On site Calibration
Ambient	Particulate Matter (PM10)	Digital Balance	BKK_EN0403	30-May-25	30-May-26	12
Ambient	Total Suspended Particulate	High Volume	BKK_FS0363	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0403	30-May-25	30-May-26	12
Ambient	Carbon Monoxide	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Ambient	Carbon Monoxide	DRYCAL FLOWMETER	BKK_FS0619	10-Sep-25	9-Sep-26	12
Ambient	Carbon Monoxide	CO Analyzer	BKK_EN0375	4-Jul-25	3-Jul-26	12
Ambient	Total Hydrocarbon	DRYCAL FLOWMETER	BKK_FS0614	10-Sep-25	9-Sep-26	12
Ambient	Total Hydrocarbon	DRYCAL FLOWMETER	BKK_FS0619	10-Sep-25	9-Sep-26	12
Ambient	Total Hydrocarbon	Total Hydrocarbon Analyzer	BKK_FS1068	8-Jun-26	8-Jun-27	12
Ambient	Nitrogen Dioxide	NO _x Analyzer	BKK_FS1070	5-Jan-26	5-Jul-26	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	BKK_FS1069	5-Jan-26	5-Jul-26	6
Water Lab	Total Coliform	Autoclave	BKK_MIL0041	4-Jul-25	4-Sep-26	18
Water Lab	Total Coliform	Incubator	BKK_MIL0231	21-Aug-25	21-Aug-26	12
Water Lab	Total Coliform	Hot Air Oven	BKK_MIL0013	9-Oct-25	9-Sep-27	18
Water Lab	Fecal Coliform	Autoclave	BKK_MIL0041	4-Jul-25	4-Sep-26	18
Water Lab	Fecal Coliform	Incubator	BKK_MIL0231	21-Aug-25	21-Aug-26	12
Water Lab	Fecal Coliform	Hot Air Oven	BKK_MIL0013	9-Oct-25	9-Sep-27	18
Water Lab	Fecal Coliform	Water Bath	BKK_MIL0056	4-Feb-26	4-Feb-27	12
Water Lab	pH at 25 °C	pH meter	BKK_EN0342	9-Oct-25	9-Oct-26	12
Water Lab	Settleable Solids	Chamber (Cooling Room)	BKK_EN0187	4-Jun-25	4-Oct-26	18
Water Lab	Sulfide	Burette	BKK_EN0422	9-Sep-25	9-Sep-26	12
Water Lab	Sulfide	Chamber (Cooling Room)	BKK_EN0167	4-Jun-25	4-Oct-26	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0003	17-Jul-25	17-Jul-26	12
Water Lab	Oil & Grease	Water Bath	BKK_EN0439	9-Oct-25	9-Oct-26	12
Water Lab	BOD	DO Meter	BKK_EN0017	20-May-25	20-Jun-26	18
Water Lab	BOD	Incubator	BKK_EN0305	23-Oct-25	23-Dec-26	12
Water Lab	BOD	Burette	BKK_EN0422	9-Sep-25	9-Sep-26	12
Water Lab	COD	Hot Block	BKK_EN0222	5-Jul-26	5-Mar-27	12
Water Lab	COD	Spectrophotometer	BKK_EN0356	8-Oct-25	8-Oct-26	12
Water Lab	Total Kjeldahl Nitrogen	Digestion Unit	BKK_EN0366	2-Jul-26	2-Mar-27	12
Water Lab	Total Kjeldahl Nitrogen	Discrete analyzer	BKK_EN0438	3-Sep-25	3-Sep-26	12
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0003	17-Jul-25	17-Jul-26	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0425	6-Oct-25	6-Oct-26	12
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0003	17-Jul-25	17-Jul-26	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0425	6-Oct-25	6-Oct-26	12
Water Lab	Ammonia Nitrogen	Discrete analyzer	BKK_EN0438	3-Sep-25	3-Sep-26	12
Water Lab	Total Alkalinity	Burette	BKK_EN0422	9-Sep-25	9-Sep-26	12
Water Lab	Calcium Hardness	Burette	BKK_EN0296	29-May-24	29-May-26	18
Water Lab	Residual Free Chlorine	Chlorine Meter	CHM_FS0109	8-Nov-24	8-Nov-25	12
Water Lab	Residual Chlorine	Chlorine Meter	CHM_FS0109	8-Nov-24	8-Nov-25	12
Water Lab	Nitrate	Ion Chromatography	BKK_EN0427	21-Nov-24	21-Nov-25	12
Water Lab	Chloride	Ion Chromatography	BKK_EN0427	21-Nov-24	21-Nov-25	12
Water Lab	Staphylococcus aureus	Autoclave	BKK_MIL0041	4-Jul-25	4-Sep-26	18
Water Lab	Staphylococcus aureus	Incubator	BKK_MIL0231	21-Aug-25	21-Aug-26	12
Water Lab	Staphylococcus aureus	Hot Air Oven	BKK_MIL0013	23-Aug-24	23-Oct-25	18
Water Lab	Pseudomonas aeruginosa	Autoclave	BKK_MIL0041	4-Jul-25	4-Sep-26	18
Water Lab	Pseudomonas aeruginosa	Incubator	BKK_MIL0231	21-Aug-25	21-Aug-26	12
Water Lab	Pseudomonas aeruginosa	Water Bath	BKK_MIL0054	2-Jan-25	2-Jan-26	12
Water Lab	Pseudomonas aeruginosa	Hot Air Oven	BKK_MIL0013	23-Aug-24	23-Oct-25	18
Water Lab	Escherichia coli	Autoclave	BKK_MIL0041	4-Jul-25	4-Sep-26	18
Water Lab	Escherichia coli	Incubator	BKK_MIL0231	21-Aug-25	21-Aug-26	12
Water Lab	Escherichia coli	Hot Air Oven	BKK_MIL0013	23-Aug-24	23-Oct-25	18
Water Lab	Escherichia coli	Water Bath	BKK_MIL0056	4-Jul-25	4-Mar-26	12
Water Lab	Cyanuric acid	Spectrophotometer	SOF_CL0100	25-Oct-24	25-Dec-25	12

1

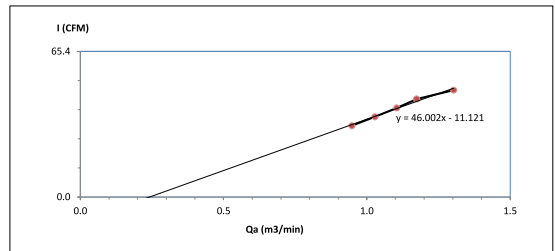
alsglobal.com



High Volume Air Sampler Calibration Worksheet

Project Site :	Dcondo Rin Juristic Person Condominium	Barometric Pressure (mm Hg) :	730.4
Calibrate Location :	บริเวณด้านข้างถนน 3.1.1.1.	Temperature (°C) :	33.6
Calibrate Date :	7-Apr-26	High Volume ID :	BKK_FS0385
CalibrationSheet No.:	C-070426-BKK_FS0385	High Volume Model :	TE-5009X
Calibrator ID:	BKK_FS0624	High Volume S/N :	4789
Calibrator Model :	TE-5028A	Calibrator Slope :	1.03094
Calibrator S/N :	2584	Calibrator Intercept :	-0.01512

Test No.	Delta H ₂ O (inch)	Qa (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.947	32	Slope : 46.0023
2	2.6	1.028	36	Intercept : -11.1211
3	3.0	1.104	40	Correlation Coefficient : 0.9928
4	3.4	1.174	44	
5	4.2	1.303	48	



Calibrated by K. Taveerat
(Mr. Keerati Taveerat)
BKK Field Services Scientist (1)

Approved by : Warakorn P.
(Mr. Warakorn Pookrak)
Field Services Supervisor

FORM NO. F-06-074 REVISION NO.2 ISSUE DATE: 20/11/23

SARTORIUS



Accredited by

NSC-TISI-TIS 17025
Calibration 0426

Calibration certificate

Calibration Certificate No. 25BCI0197

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Ohaus	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	EX225D/AD	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.
Serial QM Ident. no.	C309774648 BKK_EN0403	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand)Co., Ltd.	
	104 Phatthanakarn 40,Phattanakarn Rd.,Khwaeng Phatthanakarn ,Khet Suan Luang,Bangkok 10250	
Order no.	261969	REVIEW BY <u>Junda K</u>
Number of pages	6	APPROVED BY <u>Warakorn P</u>
Date of calibration	30 May 2025	NEXT CAL DATE: 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	Person in charge
		<u>Chonchai</u>	<u>Chonchai</u>
		Mr. Chonchai Inthana	Chonchai Inthana

Calibration certificate No.: 25BCI0197

Calibration Certificate

Calibration object

Multi range instrument

Model	EX225D/AD
Serial Number	C309774648
QM Ident. no Inventory no.	BKK_EN0403 —
Range	1 2
Maximum capacity (Max. load)	120.00000 g 220.0000 g
Measured range	120.00000 g 220.0000 g
Scale interval	0.00001 g 0.0001 g

Place of calibration

Address	According to page 1
Department Cost center	Environment Department. —
Building Floor	— 1st Floor.
Room	Laboratory Room.
Maximum temperature variation at place of calibration	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

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. <i>T</i> _{weights} - <i>T</i> _{place}	21,7 °C 0,5 K
Measuring conditions	The installation site is suitable, The device was leveled, 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	49,99996 g
1	0,99993 g	99,99971 g	49,99993 g
2	0,99991 g	99,99971 g	49,99993 g
3	0,99992 g	99,99974 g	49,99994 g
4	0,99993 g	99,99973 g	49,99990 g
5	0,99992 g	99,99974 g	
6	0,99991 g	99,99970 g	
7	0,99993 g	99,99973 g	
8	0,99994 g	99,99972 g	
9	0,99995 g	99,99971 g	
10	0,99995 g	99,99969 g	
<i>s</i> = 0,000014 g <i>s</i> = 0,000017 g		Maximum deviation from centric loading indication Δ <i>f</i> _{ecc} _{max} = 0,00006 g	

Testload <i>L</i>	Indication <i>I</i>	Error <i>E</i>	Expansion factor <i>k</i>	Uncertainty <i>U</i> (<i>E</i>)	Uncertainty relative <i>U</i> _{rel} (<i>E</i>)
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		<i>E</i> _{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.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented 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.

Interpretation of measurement results | Appendix to the calibration certificate

Uncertainty of measurement in use

Range 1

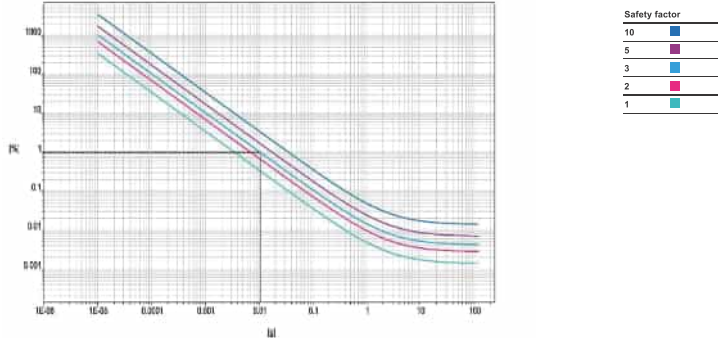
Device adjusted before measurement	Yes
Temperature deviation considered	5 K
Temperature coefficient considered	2 · 10 ⁻⁴ /K

Uncertainty of the weighing result *U*_{g1}(*W*)*U*_{g1}(*W*) = 0.000035 g + 1.38 · 10⁻⁵ · *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-18, 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 <i>R</i>	Uncertainty <i>U</i> _{g1} (<i>W</i>)	Uncertainty relative <i>U</i> _{g1} (<i>W</i>) _{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

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. <i>T</i> _{weights} - <i>T</i> _{place}	21,7 °C 0,5 K
Measuring conditions	The installation site is suitable, The device was leveled, 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	99,99984 g
1	199,9998 g	99,99998 g	99,99990 g
2	199,9998 g	99,99998 g	99,99983 g
3	199,9998 g		99,99979 g
4	200,0000 g	99,99979 g	
5	199,9998 g		
6	199,9999 g		
7	199,9999 g		
8	200,0000 g		
9	199,9998 g		
10	199,9999 g		
<i>s</i> = 0,00008 g		Maximum deviation from centric loading indication Δ <i>f</i> _{ecc} _{max} = 0,00006 g	

Testload <i>L</i>	Indication <i>I</i>	Error <i>E</i>	Expansion factor <i>k</i>	Uncertainty <i>U</i> (<i>E</i>)	Uncertainty relative <i>U</i> _{rel} (<i>E</i>)
0,00000 g	0,00000 g	0,00000 g	2,00	0,000030 g	---
20,00002 g	19,99986 g	-0,00016 g	2,00	0,000069 g	0,00034 %
50,00002 g	49,99978 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 %
130,00011 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		<i>E</i> _{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.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented 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

Interpretation of measurement results | Appendix to the calibration certificate

Uncertainty of measurement in use

Range 2

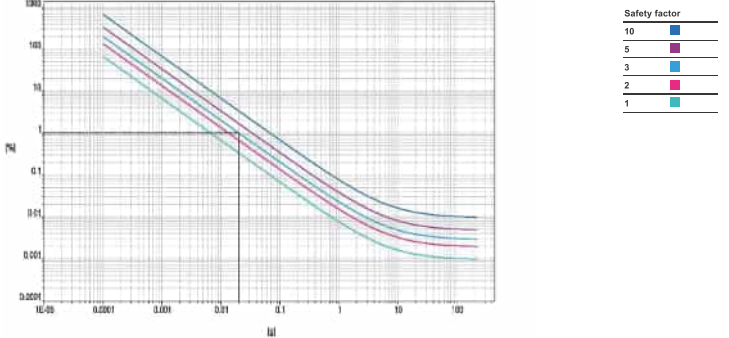
Device adjusted before measurement	Yes
Temperature deviation considered	5 K
Temperature coefficient considered	2 · 10 ⁻⁴ /K

Uncertainty of the weighing result *U*_{g1}(*W*)*U*_{g1}(*W*) = 0.000067 g + 9.52 · 10⁻⁶ · *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-18, 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 <i>R</i>	Uncertainty <i>U</i> _{g1} (<i>W</i>)	Uncertainty relative <i>U</i> _{g1} (<i>W</i>) _{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 %	165,0000 g	0,0016 g	0,00099 %
100 %	220,0000 g	0,0022 g	0,00098 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

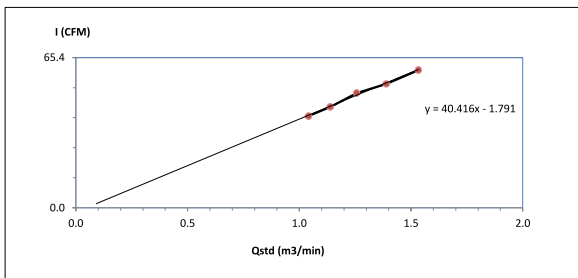
Process accuracy	1,00 %
Safety factor	3
Minimum sample weight	0,02019 g



High Volume Air Sampler Calibration Worksheet

Project Site :	Dcondo Rin Juristic Person Condominium	Barometric Pressure (mm Hg) :	730.4
Calibrate Location :	บริเวณด้านข้างตึก 25.1.6	Temperature (°C) :	33.6
Calibrate Date :	7-Apr-26	High Volume ID :	BKK_FS0363
Calibration Sheet No.:	C-070426-BKK_FS0363	High Volume Model :	TE-5009X
Calibrator ID :	BKK_FS0624	High Volume S/N :	4160
Calibrator Model :	TE-5028A	Calibrator Slope :	1.64598
Calibrator S/N :	2584	Calibrator Intercept :	-0.02439

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.0	1.0414	40	Slope : 40.4164 Intercept : -1.7910 Correlation Coefficient : 0.9973
2	3.6	1.1385	44	
3	4.4	1.2561	50	
4	5.4	1.3889	54	
5	6.6	1.5329	60	



Calibrated by K Tanweerat
(Mr. Keerati Taweerat)
BKK Field Services Scientist (1)

Approved by : Warakorn P.
(Mr. Warakorn Pookrak)
Field Services Supervisor

FORM NO.: F 06-073 REVISION NO.:2 ISSUE DATE: 20/11/23

Certificate No : 25-AFM-208
Request No : Req-2025-1986

Result of Calibration : Without Adjustment

STD Resulting			UUC Resulting			Error (cc/min)	Uncertainty	
Temperature (°C)	Pressure (kPa)	Flow (cc/min)	Temperature (°C)	Pressure (kPa)	Flow (cc/min)		(cc/min)	(kPa)
25.5	100.98	100	-	-	100.02	0.0	3.6	1.0
25.7	100.97	303	-	-	300.81	-2.2	9.3	1.0
25.8	100.89	1003	-	-	1000.1	-3	19	1.0
26.1	100.88	2000	-	-	2001.9	2	38	1.0
26.5	100.83	3014	-	-	3002.2	-12	57	1.0
26.7	100.81	4027	-	-	4000.8	-26	76	1.0
27.0	100.74	5048	-	-	5001.8	-46	95	1.0

Note STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At atmospheric pressure and room temperature condition, Air □
- Flow Rate was corrected for non-standard operating condition by using equation :

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

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

End of Certificate:

Certificate of Calibration

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

Certificate No : 25-AFM-208
Request No : Req-2025-1986

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Mesa Lab
Model : 200-510M
Serial Number : 151114
ID : BKK_FS0614
Sensor Model : -
Sensor Serial Number : -
Instrument Status : Used

Location of Calibration : LAB 4 AIR FLOW METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 3 September 2025
Calibration Date : 10 September 2025

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Semidyn	5 May 2026
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Semidyn	6 May 2026
Temperature meter	GT 11	08000057	Qesora	15 October 2025
Pressure meter	CPG2400	41000KID1651082	TPA	21 October 2025

Traceability :

This Certificate is traceable to SI Unit through Semidyn AZLA Accreditation No. 3913.01 and MET NSC-TIS-TIS Accreditation No. 0052

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 Luangrat
Service Calibration Engineer

Approved By : Mr. Paet Mathavorn
Calibration Engineer Supervisor
Issue Date : 10 September 2025

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.

FM-708-AFM-01 Rev.05 Issue date 21/2/25

Certificate No : 25-AFM-208
Request No : Req-2025-1986

Certificate of Calibration

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

Certificate No : 25-AFM-207
Request No : Req-2025-1987

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Mesa Lab
Model : 200-510M
Serial Number : 130026
ID : BKK_FS0618
Sensor Model : -
Sensor Serial Number : -
Instrument Status : Used

Location of Calibration : LAB 4 AIR FLOW METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 3 September 2025
Calibration Date : 10 September 2025

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

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Semidyn	5 May 2026
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Semidyn	6 May 2026
Temperature meter	GT 11	08000057	Qesora	15 October 2025
Pressure meter	CPG2400	41000KID1651082	TPA	21 October 2025

Traceability :

This Certificate is traceable to SI Unit through Semidyn AZLA Accreditation No. 3943.01 and MET NSC-TIS-TIS Accreditation No. 0052

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 Luangrat
Service Calibration Engineer

Approved By : Mr. Paet Mathavorn
Calibration Engineer Supervisor
Issue Date : 10 September 2025

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.

FM-708-AFM-01 Rev.05 Issue date 21/2/25

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.

FM-708-AFM-01 Rev.05 Issue date 21/2/25

Certificate No : 25-AIM-207
Request No : Req-2025-1987

Result of Calibration : Without Adjustment

STD Reading			UUC Reading			Error	Uncertainty	
Temperature (°C)	Pressure (kPa)	Flow (cc/min)	Temperature (°C)	Pressure (kPa)	Flow (cc/min)		(cc/min)	(°C) (kPa)
25.5	100.88	25	-	-	20.042	0.0	1.6	1.0 0.50
25.5	100.90	50	-	-	49.921	-0.1	3.0	1.0 0.50
25.5	100.91	100	-	-	100.09	0.1	3.6	1.0 0.50
25.4	100.88	150	-	-	150.34	0.3	5.4	1.0 0.50
25.6	100.91	199	-	-	200.17	1.2	7.2	1.0 0.50
25.6	100.95	301	-	-	300.05	-1	11	1.0 0.50
25.7	100.98	402	-	-	401.03	-1	14	1.0 0.50
25.7	100.95	503	-	-	500.28	-1	19	1.0 0.50

Note: STD : Standard UUC : Unit Under Calibration
+ UUC Reference Condition : At atmospheric pressure and room temperature condition, Air
+ Flow Rate was corrected for non-standard operating conditions 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-accepted

End of Certificate

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

FM-708-AFM 01 Rev.26 Issue date 23/2/25

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co.Ltd.

EQUIPMENT NAME : CO Analyzer

MANUFACTURER : Teledyne - API MODEL : T300

SERIAL NO : 5947

STANDARD GAS CONCENTRATION (PPM) : 808.9 CERTIFIED DATE : CC739972

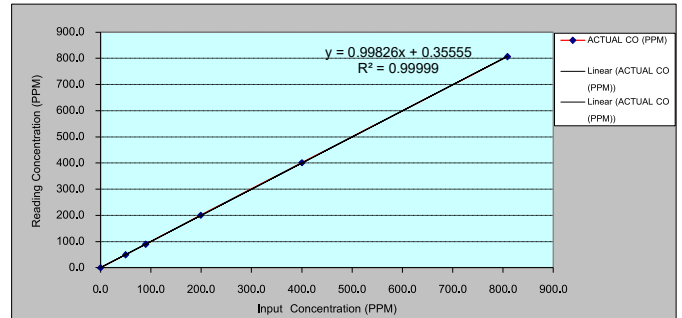
CYLINDER PRESSURE (psig) : 900 CERTIFIED DATE : Nov .05 .2020

CERTIFIED BY : AIRGAS SPECIALTY GASES EXPIRED DATE : Nov .05 .2028

CALIBRATION RESULTS

POINT NO	CALIBRATION RESULTS			
	IDEAL (PPM)	ACTUAL CO (PPM)	ERROR CO (PPM)	% ERROR CO
ZERO	0.00	0.010	0.010	-
1	50.00	49.541	-0.459	-0.918
2	90.00	89.472	-0.528	-0.587
3	199.20	200.522	1.322	0.664
4	400.30	401.311	1.011	0.253
5	808.90	806.978	-1.922	-0.238
AVERAGE (%)				0.523

REVIEW BY: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 03/08/26



CALIBRATED BY : คุณอนาคคม มหาอาจ

DATE : 4 สิงหาคม 2568

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณอนาคคม มหาอาจ โทรศัพท์: 02-515-8987

เลขที่ 388 ถนนรัชดาภิเษก แขวงจันทรมงคล เขตจตุจักร กรุงเทพฯ 10900 โทรศัพท์: 0-2515-8999 โทรสาร: 0-2515-8988 E-Mail: Info@kinetics.co.th

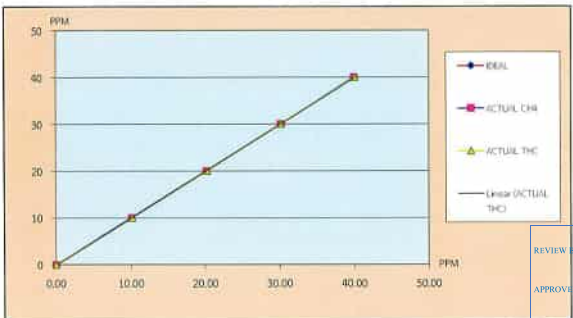


TEST REPORT

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท เอลเอส กรุ๊ป (ประเทศไทย) จำกัด)	
EQUIPMENT NAME : THC Analyzer	
MANUFACTURER : HORIBA	MODEL : APHA-370
SERIAL NO : WJ09N9M	
STANDARD GAS CONCENTRATION (PPM) (CH4) : 50±1 PPM	CYLINDER NO : CC734373
CYLINDER PRESSURE (psig) : 1,600 PSI	CERTIFIED DATE : 12/05/2020
CERTIFIED BY : AIRGAS	EXPIRED DATE : 12/05/2028

TEST RESULTS

POINT NO	TEST RESULTS						
	IDEAL	ACTUAL CH4	ERROR CH4	MEASUREMENT CH4	ACTUAL THC	ERROR THC	MEASUREMENT THC
ZERO	0.00	0.00	0.00	-	0.00	0.00	-
1	10.00	10.10	0.10	1.00	10.20	0.20	2.00
2	20.00	20.19	0.19	0.95	20.25	0.25	1.25
3	30.00	30.17	0.17	0.57	30.13	0.13	0.43
4	40.00	39.97	-0.03	-0.08	40.06	0.06	0.15
AVERAGE (%)				0.61		0.96	



REVIEW BY: *[Signature]*
APPROVED BY: *[Signature]*
NEXT CAL DATE: 08/01/27

CALIBRATED BY: *[Signature]* DATE: 8/1/69
CHECKED BY: *[Signature]* DATE: 8/1/69

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่บริการเชิงพาณิชย์ โทร 02-868-0812 # 15-16, E-Mail: Engineer@janatee.com
เลขที่ 63/14-15,67/35-36 ซอยนครเกษม 7,7/1 ถนนรัชดาภิเษก แขวงจันทรมงคล เขตจตุจักร กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889



CHECK LIST

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co., Ltd. (บริษัท เอลเอส กรุ๊ป (ประเทศไทย) จำกัด)	
EQUIPMENT NAME : THC Analyzer	
MANUFACTURER : HORIBA	MODEL : APHA-370
SERIAL NO : WJ09N9M	

TEST VALUES

NO.	THC Analyzer (APHA - 370)	UNIT	BEFORE	AFTER
1	Signal (CH4)	mV	0.90	22.60
2	Signal (THC)	mV	1.30	36.90
3	Detector	Temp °C, Standard Value : Ambient temp(15°C to 15°C)	47.70	47.70
4	Ambient	Pressure kPa, Standard Value : (Ambient/1013±100-20)±4kPa	81.40	81.40
5	Purifier	kPa current atmospheric pressure	102.00	102.00
6	Temp °C	°C, Standard Value : 390 °C to 430 °C	421.00	421.90
7	DC 24 V	kPa, Normal value : 8 kPa to 25 kPa	7.30	7.30
8	DC 5 V	°C, Standard Value : 250 °C to 260 °C	244.00	244.00
9	Bypass (Optional)	V, Standard Value : 24 V ± 0.5 V	23.90	23.90
10	Over Flow (Optional)	V, Standard Value : 5 V ± 0.5 V	5.00	5.00
11	CH4 Sampling Reading	L/min, Normal value : 0.9 L/min ± 0.3 L/min	-	-
12	THC Sampling Reading	L/min, Standard Value : 0.8 L/min or More	-	-
13	CH4 Sampling Reading	PPM	-0.06	2.46
14	THC Sampling Reading	PPM	0.06	0.14
15	Zero Gas CH4/THC	PPM	0.00	2.60
16	Span Gas	PPM	-0.06/0.00	0.0/0.0
17	Gas H2	20 PSI	26.31/38.83	39.97/40.06
18			20	20

Remark: Reference: EK-EN-017-56, Ambient HC Monitor APHA-370 Operation Manual Page #81

Remark: (Ambient temperature = 5 °C to 40 °C)

รายการที่ตรวจพบ

- Maintenance

รายละเอียดการดำเนินการ

- เปลี่ยน Air Filter, 0.3 Micro, ทำ Calibration Zero/Span, Multipoint

ผลการดำเนินการ

- เครื่องมือ เครื่องมือสำหรับการตรวจวัดได้มาตรฐาน

CALIBRATED BY: *[Signature]* DATE: 8/1/69
CHECKED BY: *[Signature]* DATE: 8/1/69

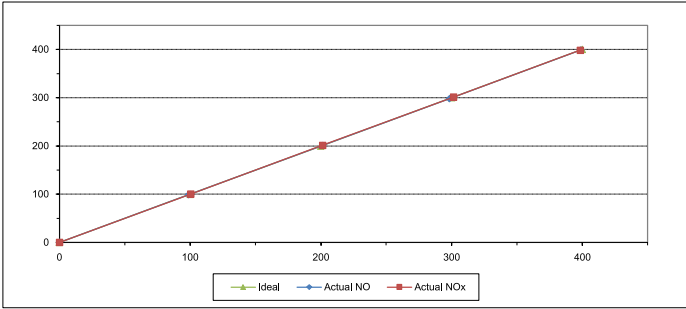
ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่บริการเชิงพาณิชย์ โทร 02-868-0812 # 15-16, E-Mail: Engineer@janatee.com
เลขที่ 63/14-15,67/35-36 ซอยนครเกษม 7,7/1 ถนนรัชดาภิเษก แขวงจันทรมงคล เขตจตุจักร กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889



MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-26	Equipment Name	NOx Analyzer
Manufacturer	HORIBA	Model	APNA-370
Serial No.	PPGM9HKH	Equipment ID	BKK_FS1070
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	55.88	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.90	-1.10	-1.10	100.50	0.50	0.50
2	200.00	201.30	1.30	0.65	201.40	1.40	0.70
3	300.00	298.30	-1.70	-0.57	301.50	1.50	0.50
4	400.00	398.80	-1.20	-0.30	398.60	-1.40	-0.35
AVERAGE (%)				-0.24			0.29



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

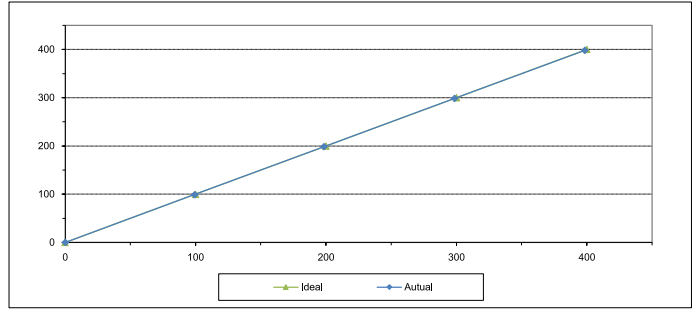
FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date	5-Jan-26	Equipment Name	SO2 Analyzer
Manufacturer	HORIBA	Model	APSA-370
Serial No.	70Y1R8R0	Equipment ID	BKK_FS1069
Calibrator Manufacturer	Teledyne API	Model	700
Serial No.	947		
Std. Gas Concentration (PPM)	56.3	Cylinder No.	GN0027222
Cylinder Pressure (psi)	1800	Certified By	Airgas Inc.
Certified Date	9-Feb-22	Expired Date	9-Feb-30

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.30	-0.70	-0.70
2	200.00	198.50	-1.50	-0.75
3	300.00	298.50	-1.50	-0.50
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.45



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

Approved By

(Mr. Sarayuth Jitranont)
Assistant General Manager

ALS Laboratory Group

FORM NO.: F 06-056 REVISION NO.: - ISSUE DATE: 02/04/12



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T. Banpa, A. Kaengkhoh, 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,
Khet Suan Luang, Bangkok 10250

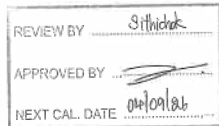
Customer Location : Washing Room

Date of Receipt : 26 February 2025

Calibrated By : Boonchai Suriyawong (Site Calibration Manager)

Approved By : / Sujar 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. Kaengkhoh, 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

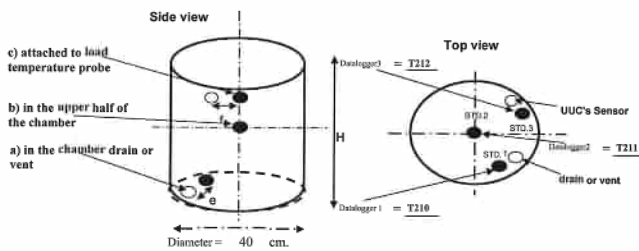
Condition of this results of calibration :

- 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.
- 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
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good
Equipment Description :
Pressure Indicator 0.11-0.12 MPa At 121 °C Holding time 20 minute
- Adjustment :
(X) without adjustment () after adjustment

Approved By:

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	121.2	121.1	121.1

Autoclave		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)
	Min	Max				
121	-	121	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.

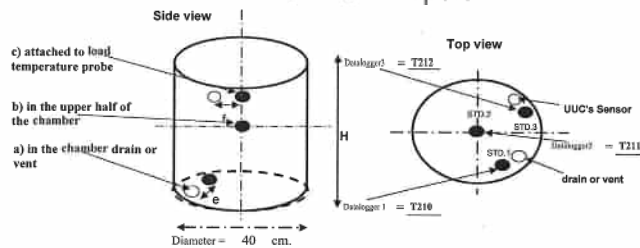
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

End of Certificate

Approved By: _____

FM-L15 118/18-08-66

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

Autoclave		Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)
	Min	Max				
121	-	121	121.16	0.10	0.10	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-L13 108/30-05-57



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANI LUANG, SUANI LUANG BANGKOK 10250
TEL. 0-2717-3000-29 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 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Khit Ruttanaprapachai

Approved by : _____

() Chakrit Waewwanjua
() Suwit Imjai
(✓) 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.



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

Cert. No.: 25TM1235
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 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 :

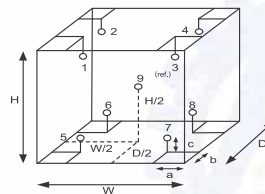
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- () Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : 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

Position :	Ref. Std. ID No.:
1	25-01RTD-01
2	25-01RTD-02
3	25-01RTD-03
4	25-01RTD-04
5	25-01RTD-05
6	25-01RTD-06
7	25-01RTD-07
8	25-01RTD-08
9 (ref.)	25-01RTD-09



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 <i>k</i>
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	37.045	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 %.

-o-o-



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.: 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 : Kunchit
Approved Signatory

() Chakrit Waewwanjua
() Suwit Imjai
(✓) 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

Cert. No.: 25TM525
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 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)

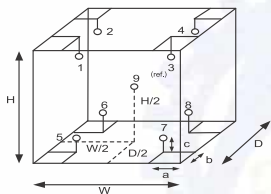
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	23	24
REL.Humid. (%)	54	56
AC Supply (Volt)	220	221

Position :	Ref. Std. ID No.:
1	23-20TC-01
2	23-20TC-02
3	23-20TC-03
4	23-20TC-04
5	23-20TC-05
6	23-20TC-06
7	23-20TC-07
8	23-20TC-08
9 (ref.)	23-20TC-09



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 :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

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

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
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 %.

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Certificate of Calibration

Cert. No.: 26TM111
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 February 2026
Calibration Date : 04 - 05 February 2026
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hlahib

Approved by :

- () Chakrit Waewwanjua
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 16 February 2026

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..... 04/02/27



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2602-0026OC-1
Procedure Used :-

Cert. No.: 26TM111
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY59003411	25LM177	TPA	26 Dec 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 :

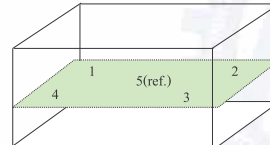
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	25	55	220
Finished of Calibration	20	69	220



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2602-0026OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 26TM111
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.)	
44.5	44.4	44.4	44.462	44.470	44.480	44.460	44.457	0.15
45.0	44.9	44.9	44.958	44.971	44.983	44.965	44.966	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
44.5	0.051	0.025	2
45.0	0.047	0.032	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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Certificate of Calibration

Cert.No.: 25CH1162
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 : 08 October 2025
Calibration Date : 09 October 2025
Reference : 2510-0271DSC-1
Submitted by :

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 : Walalak Sirithean

Approved by :

- () Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 10 October 2025

REVIEW BY *Jinda K*
APPROVED BY *Saithip P*
NEXT CAL DATE..... 09/10/26

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 Serial No. ID No. Cert. No. Due Date

- 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., ANS-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1114384	12 June 2027
pH 6.965	CPA chem	1066667	18 Jan 2026
pH 10.010	CPA chem	1135355	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 mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: 252063043080	4.007	3.996	176.6	0.0046	2.00
	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 k
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 %.

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Metrology Center SCI ECO Services Company Limited

51 Moo 8, Tubkiwang, Kaeng Khoi, Saraburi, Thailand 18260
Bangkok Tel : +668 9205 6851 , +669 81924 0059
Saraburi Tel : +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Certificate No. T250873

Certificate of Calibration

Page 1 of 4

Equipment : Chamber (Cooling Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

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 :  / 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.



Metrology Center SCI ECO Services Company Limited

51 Moo 8, Tubkiwang, Kaeng Khoi, Saraburi, Thailand 18260



Certificate No. T250873

Calibration Report

Page 2 of 4

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

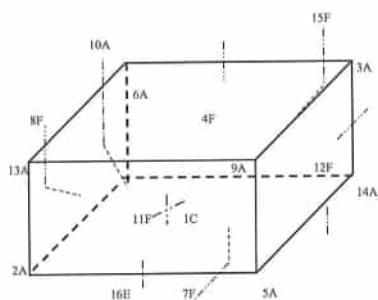
Condition of this results of calibration :

- This equipment was calibrated by insert 16 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 .
- 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
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244)
- Condition of calibrated item : good
Equipment Description :
Time Constant : 2 Hour 20 Minute At 3 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
- Adjustment :
(X) without adjustment () after adjustment

Approved By : 

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 102/27-03-68

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)											
	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				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min	Max					
3.0	2.8	3.9	3.4	1.20	1.30	1.90	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: _____

FM-TL07 102/27-03-68



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.: 25CG3385
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 : 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	2511740	TPA	17 Jan 2026

This measurement result 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
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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Calibration certificate

Object	Electronic non-automatic weighing instrument	This calibration certificate documents the traceability to national standards.
Manufacturer	Sartorius	Uncertainties of measurements are taken into account when only statements of compliance are made.
Type	MSE224S-100-DU	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.
Serial QM Ident. no.	27405555 BKK_EN0003	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand)Co., Ltd. 104 Phatthanakarn 40,Phattanakarn Rd.,Khwaeng Phatthanakarn ,Khet Suan Luang,Bangkok 10250	REVIEW BY <i>Jinda K</i> APPROVED BY <i>Siriluk P</i> NEXT CAL DATE.....17/07/26
Order no.	265054	
Number of pages	4	
Date of calibration	17 Jul 2025	

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

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
Tweights - Tplace	
Measuring conditions	The installation site is suitable. The device is level. Balance was loaded up to Max before test.
Comments	Humidity 58,0 %RH.

Measurement results | Measurement uncertainties

Repeatability	Eccentricity	
Test load (nominal): 10 g 200 g	Test load (nominal): 100 g	
10 g	200 g	
1	10,0000 g	200,0000 g
2	10,0000 g	199,9999 g
3	10,0000 g	200,0000 g
4	10,0000 g	200,0000 g
5	10,0001 g	199,9999 g
6	10,0000 g	200,0000 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	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative
	L	I	E	k	U(E)	Urel(E)
	0,0100 g	0,0100 g	0,0000 g	2,00	0,00012 g	1,2 %
	0,1000 g	0,1000 g	0,0000 g	2,00	0,00013 g	0,13 %
	1,0000 g	1,0000 g	0,0000 g	2,00	0,00013 g	0,013 %
	2,0000 g	2,0000 g	0,0000 g	2,00	0,00013 g	0,0065 %
	5,0000 g	5,0000 g	0,0000 g	2,00	0,00013 g	0,0026 %
	10,0000 g	10,0000 g	0,0000 g	2,00	0,00013 g	0,0013 %
	20,0000 g	20,0000 g	0,0000 g	2,00	0,00014 g	0,00068 %
	50,0000 g	50,0000 g	0,0000 g	2,00	0,00015 g	0,00029 %
	100,0000 g	100,0000 g	0,0000 g	2,00	0,00018 g	0,00018 %
	200,0000 g	200,0000 g	0,0000 g	2,00	0,00028 g	0,00014 %
	220,0000 g	220,0001 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.

Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented 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

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	Teslo 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

Interpretation of measurement results | Appendix to the calibration certificate

Uncertainty of measurement in use

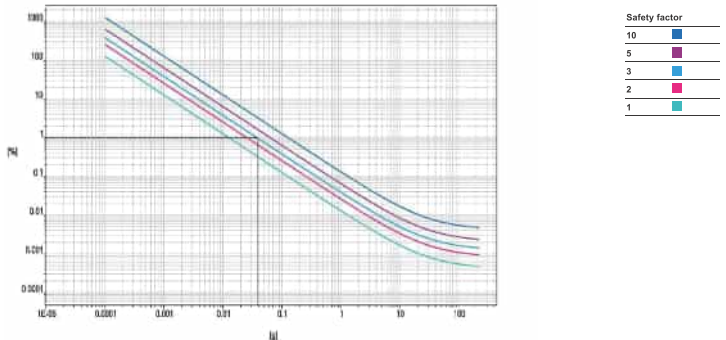
Device adjusted before measurement	Yes
Temperature deviation considered	1,5 K (isoCAL active)
Temperature coefficient considered	1 · 10 ⁻⁶ /K

Uncertainty of the weighing result U_g(W) U_g(W) = 0.00013 g + 4.19 · 10⁻⁶ · 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-18, 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	Uncertainty	Uncertainty relative
	R	U _g (W)	U _g (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



Displayed example	
Process accuracy	1.00 %
Safety factor	3
Minimum sample weight	0.0380 g



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2510-0042OC-13
Procedure Used :-

Cert. No.: 25TM528
Page : 2 of 3

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 : 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 : 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 : Kunchit Promprat

Approved by :

() 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 either than in full, except with the prior written approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

REVIEW BY: Jinda K
APPROVED BY: Siruk P
NEXT CAL DATE: 09/10/26

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	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 :

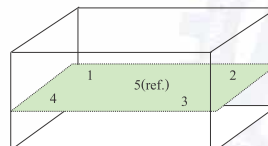
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
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 k
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 %.

-00-



Certificate of Testing

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

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-230V
Serial No. : 09J101147
ID No. : BKK_EN0017
Received Date : 19 May 2025
Test Date : 20 May 2025
Reference : 2505-0593DSC-1
Submitted by :

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

Laboratory Condition :

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

Test Procedure :

Tested by :

Walalak Sirithean

Approved by :

Saithip
Approved Signatory

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

Issue Date :

20 May 2025

REVIEW BY: Jinda K
APPROVED BY: Siruk P
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)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(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

-000-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0 2717 3000-29 FAX.0 2719 9404



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 Lernagatrakul
Kunchit
Approved by : Approved Signatory

() 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	2411022	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 Center
SCI ECO Services Company Limited
51 Moo 8, Tubkhwang, Kaeng Khol, Saraburi, Thailand 18260
Bangkok Tel : +668 9205 6851 , +669 81924 0059
Saraburi Tel : +668 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



Certificate No. T252280

Certificate of Calibration

Page 1 of 4

Equipment : Chamber (Incubator)

Manufacturer : Memmert

Model : ICP 750

Serial No. : F818.0075

Customer Code : BKK_EN0305

ID No. : T9571A4

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 : 17 December 2025

Calibrated By : Atiphong Rongrat (Technician)

Approved By : *Boonchui Suriyawong* / Boonchui Suriyawong (Site Calibration Manager)

Date of Issue : 12 JAN 2026

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.

Calibration Report

Equipment : Chamber (Incubator)
Date of Calibration : 23 December 2025
Environment : Temperature : 23.4-24.9 °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 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-(CHI-10)	T250835	24 May 2026
RTD	100 ohm	32-(CHI-10)	T250835	24 May 2026
DATA LOGGER	34970A	T193	T250835	24 May 2026

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

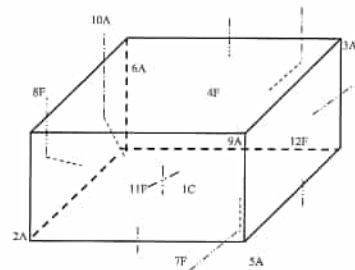
Time Constant : 2 Hour
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By: 

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-TL07 102/27-03-68

FM-TL07 102/27-03-68

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	20.14	20.33	20.04	20.35	20.01	19.97	19.92	20.24	20.29	20.20	19.93	19.81

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
25	24.96	25.23	25.12	25.17	25.24	24.99	24.99	24.97	25.37	25.08	25.31	25.17

Chamber (Incubator)		Temperature Distribution					
Setting (°C)	Reading (°C)		Average (°C)	Stability (±°C)	Uniformity (°C)	Uncertainty (±°C)	Coverage Factor k
	Min , Max	Average					
20.0	-	20.0	20.09	0.10	0.41	0.38	2.02
25.0	-	25.0	25.13	0.10	0.37	0.38	2.02

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 t-distribution, providing a level of confidence of approximately 95 % .

Approved By: 

Certificate of Calibration

Equipment : HOT BLOCK
Manufacturer : Environmental Express
Model : B3000- 240
Serial No. : 2017CODW116
Customer Code : BKK_EN0222
ID No. : T6769A4
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

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

Customer Location : Wet Chemistry Lab2

Date of Receipt : 25 February 2026

Calibrated By : Atiphong Rongrat (Technician)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 24 APR 2026

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.

FM-TL07 102/27-03-68

FM-TL04 102/27-03-68

Calibration Report

Equipment : HOT BLOCK
Date of Calibration : 5 March 2026
Environment : Temperature : 24.8-25.5 °C
Line Voltage : 222.1-227.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 29 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.
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN241-TN250	T250838	24 May 2026
TC	TYPE T	TN251-TN260	T250838	24 May 2026
DATA LOGGER	34970A	T193	T250838	24 May 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 30 Minute At 150 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By. 

FM-TL05 102/27-03-68

Calibration Report

Measurement Results

CAL-POINT		Average Standard Reading at each position (°C)									
		TN201 Hole 1	TN202 Hole 2	TN203 Hole 3	TN204 Hole 4	TN205 Hole 5	TN206 Hole 6	TN207 Hole 7	TN208 Hole 8	TN209 Hole 9	TN210 Hole 10
150	Max	150.33	148.50	149.89	149.66	151.02	148.31	149.60	149.13	150.29	149.92
	Min	150.18	148.28	149.82	149.42	150.81	148.03	149.41	148.82	150.17	149.82
	Average	149.32	150.10	150.10	149.53	148.39	149.33	149.37	149.60	149.42	149.87
	Max	150.38	149.94	150.85	149.17	149.93	150.16	149.94	150.09	149.48	149.87
	Min	150.42	149.74	150.66	148.94	149.81	149.73	149.82	149.85	149.34	149.75
	Average	150.50	149.84	150.75	149.06	149.87	149.95	149.88	149.97	149.40	149.81
	Max	150.94	149.86	149.65	149.81	149.74	149.51	149.32	149.72	150.00	149.23
	Min	149.85	149.60	149.32	149.07	149.58	149.34	149.16	149.60	149.86	148.98
	Average	149.94	149.73	149.49	148.74	149.66	149.43	149.24	149.66	149.93	149.10
	Max	149.58	149.90	150.38	149.43	149.21	149.82	149.84	149.10	148.92	149.80
	Min	149.42	149.77	149.19	149.11	149.11	149.66	149.71	148.79	149.71	149.68
	Average	149.50	149.83	149.78	149.27	149.16	149.74	149.78	148.95	149.82	149.74
	Max	149.51	149.78	149.28	149.43	149.46	149.54	149.16	149.48	149.53	149.03
	Min	149.38	149.65	149.14	149.20	149.35	149.40	148.97	149.38	149.36	148.89
	Average	149.44	149.71	149.21	149.35	149.40	149.47	149.07	149.43	149.45	148.96
	Max	149.78	149.59	150.56	149.47	149.35	149.38				
	Min	149.62	149.39	150.38	149.25	149.10	149.21				
	Average	149.70	149.49	150.47	149.36	149.22	149.30				

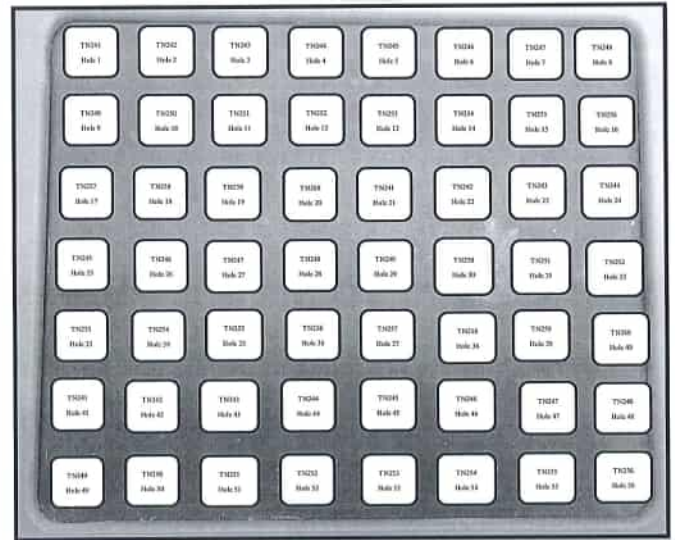
HOT BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min	Max		
150.2	150.2	150.3	0.22	0.84

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. 

FM-TL05 102/27-03-68

Calibration Report



FRONT CONTROL

Approved By. 

FM-TL05 102/27-03-68



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.: 25CH0537
Page.: 1 of 3

Equipment : Spectrophotometer
Manufacturer : HACH
Model : DR3900
Serial No. : 2021559
ID No. : BKK_EN0356
Condition As-Received: Used Item
Received Date : 08 October 2025
Calibration Date : 08 October 2025
Reference : 2510-00420C-11
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.,
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Calibration Place : Wet Chemistry Lab 2
Ambient Temperature : (21.9 to 21.9) °C (On-Site)
Relative Humidity : (62 to 65) % (On-Site)
Calibration Procedure : In - house method :
CP-OCH4 based on ASTM E 275-08
Calibrated by : Uthen Kankawi
Approved by : 
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 9 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. : 25CHO537
Page : 2 of 3

Condition of calibration result

1. Reference Standard Material :

Material	Serial No.	Certificate No.	Due date
1. Absorbance Standard set	44487	122584	31 May 2026
2. Wavelength Standard set	36730	118120	15 Jan 2026
3. Wavelength Standard set	36730	118121	15 Jan 2026

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certificate is traceable to the International System of Unit maintained through :
- Starna Scientific Ltd.

4. Spectral BandWidth : 5 nm
Scan Speed : - nm/min

Calibration Results : without adjustment

Wavelength Accuracy

Certified Values of Reference Material (nm)	UUC Reading (nm)	Uncertainty of Measurement (± nm)	Coverage Factor k
418.40	418	0.59	2.00
479.88	480	0.59	2.00
513.75	513	0.59	2.00
537.00	536	0.59	2.00
638.00	638	0.59	2.00
747.61	748	0.59	2.00
807.04	807	0.59	2.00



Cert. No. : 25CHO537
Page : 3 of 3

Calibration Results : without adjustment

Photometric Accuracy

Wavelength (nm)	Certified Values of Reference Material (Abs)	UUC Reading (Abs)	Uncertainty of Measurement (± Abs)	Coverage Factor k
420.0	Zero	0.000	0.0028	2.00
	0.5750	0.573	0.0028	2.00
	0.7156	0.713	0.0028	2.00
	1.0176	1.014	0.0028	2.00
440.0	Zero	0.000	0.0028	2.00
	0.5598	0.557	0.0028	2.00
	0.7037	0.700	0.0028	2.00
	1.0013	0.997	0.0028	2.00
465.0	Zero	0.000	0.0028	2.00
	0.5222	0.522	0.0028	2.00
	0.6646	0.664	0.0028	2.00
	0.9444	0.945	0.0028	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5234	0.523	0.0028	2.00
	0.7007	0.700	0.0028	2.00
	0.9992	0.999	0.0028	2.00
590.0	Zero	0.000	0.0028	2.00
	0.5573	0.556	0.0028	2.00
	0.7760	0.773	0.0028	2.00
	1.1104	1.108	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5648	0.565	0.0028	2.00
	0.7654	0.765	0.0028	2.00
	1.0961	1.096	0.0028	2.00

Remark

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer
- 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 %.

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Metrology Center
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Saraburi Tel : +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T260371

Certificate of Calibration

Page 1 of 4

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 : 25 February 2026
Calibrated By : Atiphong Rongrat (Technician)
Approved By :  / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 05 MAY 2026

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.



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

Certificate No. T260371

Calibration Report

Page 2 of 4

Equipment : Digestion Unit
Date of Calibration : 2 March 2026
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 WI-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 | M15-(C111-C114) | T250749 | 14 May 2026 |
| DATA LOGGER | 34970A | T193 | T250749 | 14 May 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 40 Minute At 380 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
5. Adjustment :
(X) without adjustment () after adjustment

Approved By : 

Calibration Report



FRONT

Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
(°C)	(°C)	(°C)	Reading	M15-C01	M15-C02	M15-C03	M15-C04	M15-C05	M15-C06	M15-C07	M15-C08
380.0	380.0	379.8 - 380.2	Max °C	379.9	380.7	380.9	381.1	381.3	381.5	380.5	379.5
			Min °C	379.5	380.2	380.5	380.7	381.0	381.1	380.2	379.7
			Average °C	379.7	380.5	380.7	380.9	381.2	381.3	380.4	379.4
			Stability ± °C	0.2	0.3	0.2	0.2	0.1	0.2	0.2	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
(°C)	(°C)	(°C)	Reading	M15-C01	M15-C02	M15-C03	M15-C04	M15-C05	M15-C06	M15-C07	M15-C08
380.0	380.0	379.8 - 380.2	Max °C	380.1	380.3	380.6	381.1	380.4	380.6	380.3	380.7
			Min °C	379.6	379.8	380.2	380.6	380.1	380.2	379.7	380.4
			Average °C	379.8	380.1	380.4	380.9	380.5	380.4	380.0	380.5
			Stability ± °C	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.2

Approved By:

FM-TL05 102/27-03-68

Calibration Report

Measurement Results

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
(°C)	(°C)	(°C)	Reading	M15-C01	M15-C02	M15-C03	M15-C04	M15-C05	M15-C06	M15-C07	M15-C08
380.0	380.0	379.8 - 380.2	Max °C	381.0	380.6	380.7	381.2	380.0	380.6	379.5	381.0
			Min °C	382.4	379.8	380.1	380.6	379.3	380.1	378.8	380.5
			Average °C	382.7	380.2	380.4	380.9	379.6	380.4	379.1	380.7
			Stability ± °C	0.3	0.4	0.3	0.3	0.3	0.2	0.3	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
(°C)	(°C)	(°C)	Reading	M15-C01	M15-C02	M15-C03	M15-C04	M15-C05	M15-C06	M15-C07	M15-C08
380.0	380.0	379.8 - 380.2	Max °C	381.3	380.1	380.6	381.4	380.9	381.3	379.9	380.6
			Min °C	381.0	379.7	380.1	380.9	380.5	380.8	379.3	380.2
			Average °C	381.1	379.9	380.3	381.2	380.7	381.0	379.6	380.4
			Stability ± °C	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.2

Cal. Point	Setting	Reading	STD.	Position of Standards at Block							
(°C)	(°C)	(°C)	Reading	M15-C01	M15-C02	M15-C03	M15-C04	M15-C05	M15-C06	M15-C07	M15-C08
380.0	380.0	379.8 - 380.2	Max °C	381.3	381.0	381.2	382.3	380.2	380.3	380.2	381.0
			Min °C	380.9	382.4	382.5	381.9	379.9	380.0	379.8	380.7
			Average °C	381.1	382.7	382.0	382.1	380.0	380.2	380.0	380.8
			Stability ± °C	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.1

The expanded uncertainty of temperature measurement was ± 1.68 °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:

FM-TL05 102/27-03-68

บริษัท ซีจี ไซแอนติฟิค จำกัด
CG SCIENTIFIC CO., LTD.

BKK_EN0438

Report number CGS250901

Calibration Instrument Report

Instrument: Automated Discrete Analyzer
Manufacturer: AMS
Model: SmartChem 600
Serial number: 2401055Customer: ALS Laboratory Group (Thailand) Co., Ltd.
Address: 104 Phatthanakan 40 Alley, Phatthanakan, Suan Luang, Bangkok 10250Calibration date: 3 Sep 2025
Place: ALS Laboratory Group (Thailand) Co., Ltd.

Check fluid to validate the correct functioning of the instrument

INTENDED USE

Check fluid to validate the correct functioning of the instrument.

Purpose

The purpose of this document is to aim at the correct execution of the method and the installation of the Check fluid to validate the correct functioning of the instrument.

COMPOSITION

Fluidic Test CHECK-01 20 x 4.5 mL (liquid) Lot number: 45751 Expiry date: 2027-04

PROCEDURE

The reagent is ready to use. Check fluid to validate the correct functioning of the instrument following method CHECK-01 and WORKPLAN CHECK01 DILUTION.

Results For the correct operation of the machine, the expected results are as follows:

1. Evaluation of calibration Results: R²

Result	Range
1	>0.995 - 1

2. Evaluation of Samples Results:

Dilution	Replicates	Results mg/L	Range	CV% calculated	CV%
1/1	x10	0.604	0.599 - 0.610	0.17	≤ 1
1/10	x10	0.611	0.590 - 0.625	1.37	≤ 2
1/20	x10	0.643	0.635 - 0.675	3.49	≤ 5
1/50	x10	0.689	0.610 - 0.750	7.70	≤ 10
1/75	x10	0.758	0.500 - 0.895	11.11	≤ 15

Validation by:
Apirom Ekviriyakul

แบบฟอร์มการประเมินเครื่อง Discrete Analyzer หลังการสอบเทียบ

ชื่อเครื่อง: Discrete Analyzer

ID No. BKK_EN0438

S/N :2401055

Parameter	Range	Test Results	Pass	Fail	Remark
Evaluation of calibration	>0.995 - 1	1.00	☒	☐	
CV% calculated Dilution 1/1	≤ 1	0.17	☒	☐	
CV% calculated Dilution 1/10	≤ 2	1.4	☒	☐	
CV% calculated Dilution 1/20	≤ 5	3.5	☒	☐	
CV% calculated Dilution 1/50	≤ 10	7.70	☒	☐	
CV% calculated Dilution 1/75	≤ 15	11.11	☒	☐	

ผู้ตรวจสอบ:
(Arraya Meechai)
(05/09/2025)ผู้อนุมัติ:
(Siriluk Bunnak)
(05/09/2025)

Certificate No. T251785

Page 1 of 3

Certificate of Calibration

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 Naknakred (Site Calibration Manager)
Approved By : Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 10 OCT 2025

REVIEW BY funda k
APPROVED BY Siriluk P
NEXT CAL DATE: 06/10/26

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

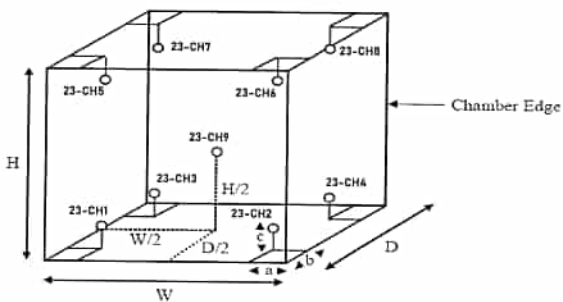
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding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

FM-TL06 102/27-03-68

Certificate No. T251785

Page 3 of 3

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm, H (Height) = 40 cm, and D (Depth) = 40 cm.
Size of installed Standard sensor number 23-CH1 to 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 = 40 cm/2 and D/2 = 40 cm/2

Measurement Results

Calibration Point	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
104	104.13	103.54	103.82	104.37	104.40	104.51	103.86	103.80	
180	180.05	179.82	179.64	179.52	181.20	180.29	180.19	179.35	179.89

Chamber (Oven)		Temperature Distribution					
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min, Max	Average					
104.0	-	104.0	104.08	0.28	0.87	0.45	2.00
180.0	180.0, 180.1	180.0	179.99	0.37	1.49	0.61	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: Boonchai SuriyawongBoonchai Suriyawong

FM-TL07 102/27-03-68

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 :

- 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 .
- 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
- This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244.
- Condition of calibrated item : good
Equipment Description :
Time Constant 2 Hour 14 Minute At 104 °C
Fresh Air Damper ☒ Open ☒ Min ☐ Medium ☐ Max
☐ Close
☐ Not Available
- Adjustment :
() without adjustment (X) after adjustment

Approved By: Boonchai SuriyawongBoonchai Suriyawong

FM-TL07 102/27-03-68



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.: 24CG4714
Page.: 1 of 2

Equipment : Burette
Capacity : 10 mL
Serial No. : -
ID. No. : BKK_EN0296
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 : 758 mmHg
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Sa-ngueunkam Wongsra

Approved by : Siriluk P
Approved Signatory

(√) Srisuda Khamtha
() Ponpan Paipim
() Unnopphol Harachai

Issue Date : 29 November 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 : Burette
Received Date : 27 November 2024
Condition As-Received : Used Item
Calibration Date : 29 November 2024
Reference : 2411-0850DSC-1

Cert.No.: 24CG4714
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	24019652	140EC015	24H1926	TPA	13 Sep 2025
3) Thermometer	-	1594592	140EC010	24I175	TPA	20 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 ($\pm$ mL)	k Factor
1	1.0047	0.0036	2.00
5	5.0020	0.0036	2.00
10	10.0056	0.0038	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 %.

-00-



REVIEW BY *Chingthun P.*
APPROVED BY *Minakorn P.*
NEXT CAL. DATE 08/11/25

Ref. Job number J0541

Test Report

Customer	ALS Laboratory Group (Thailand) Co., Ltd.
Equipment	Colorimeter
Manufacturer	HACH
Controller Model	DR3000
ID No.	CHM_F80108
Controller Serial No.	22110800655
Sensor Serial No.	-
Date of test	08/11/2024
Period	1 Year
Environment temperature	25.6 °C
Humidity	62.1 %RH

Results

Instrument Checked

Item	Characteristic	Before	After	Remark
1	Visual Inspect	Pass	Pass	
2	Power Supply (4.5 ~ 6.0 VDC)	5.8 VDC	5.8 VDC	
3	Display Check	Pass	Pass	
4	Keyboard Check	Pass	Pass	
5	Function System Program	Pass	Pass	

Warning and Error Checked

Item	Event	Before	After
1	Error list	None	None

Check with Standard

Item	Characteristic	Before	After	Remark
DPO-CHLORINE-LR				
7	Blank (0.0 mg/l)	0.00 mg/l	0.00 mg/l	
8	Standard C2 No. 1 (0.24 ± 0.09 mg/l)	0.26 mg/l	0.25 mg/l	
9	Standard C2 No. 2 (0.91 ± 0.1 mg/l)	0.92 mg/l	0.92 mg/l	
10	Standard C2 No. 3 (1.59 ± 0.14 mg/l)	1.61 mg/l	1.61 mg/l	
DPO-CHLORINE-HR				
11	Blank (0.0 mg/l)	0.0 mg/l	0.0 mg/l	
12	Standard C2 No. 1 (2.3 ± 0.3 mg/l)	2.3 mg/l	2.3 mg/l	
13	Standard C2 No. 2 (3.8 ± 0.3 mg/l)	3.8 mg/l	3.8 mg/l	
14	Standard C2 No. 3 (7.1 ± 0.6 mg/l)	7.0 mg/l	7.0 mg/l	

บริษัท ฮาช (ประเทศไทย) จำกัด : อาคาร 6 ชั้น 11 ชั้น 3 เลขที่ 735/4 หมู่ 5 ตำบลบ้านใหม่ อำเภอบางพลี จังหวัดสมุทรปราการ 10250
Tel : +66 (02) 026-3529 | Fax : +66(02) 026-3572 | Tax ID : 0105552107330 | Email : thmarketing@hach.com | www.th.hach.com



Ref. Job number J0541

Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือสามารถทำงานได้ปกติและมีประสิทธิภาพ)
☐ The instrument can work but it's requiring to maintenance. (เครื่องมือยังสามารถทำงานได้แต่ต้องบำรุงรักษา)
☐ The instrument could not work it's requiring to repair. (เครื่องมือยังไม่สามารถทำงานได้และต้องซ่อมบำรุง)

Remark:

Standard Equipment Used

Equipment	Equipment I.D.
Standard Absorbance DPO-CHLORINE-LR	Lot No. A4150 Exp. date : Jun-25
Standard Absorbance DPO-CHLORINE-HR	Lot No. A4152 Exp. date : Jun-25
Digital multi meter	S/N : 97829680 Due date : 15-Jul-25
Thermo hygrometer	S/N : 41432448 Due date : 14-Oct-24

Test By :

(Mr. Puttipong Duangswat)

Service Engineer



(Suman Saityangkool)

Assistant Service Division Manager

บริษัท ฮาช (ประเทศไทย) จำกัด : อาคาร 6 ชั้น 11 ชั้น 3 เลขที่ 735/4 หมู่ 5 ตำบลบ้านใหม่ อำเภอบางพลี จังหวัดสมุทรปราการ 10250
Tel : +66 (02) 026-3529 | Fax : +66(02) 026-3572 | Tax ID : 0105552107330 | Email : thmarketing@hach.com | www.th.hach.com

REVIEW BY *Tanyatorn M.*
APPROVED BY *K.L. Al.*
NEXT CAL. DATE 21 Nov 25



Certificate of Calibration

Shimadzu LC-HIC

This certificate is to verify that instrument below are calibrated
by Bara Scientific Co., Ltd

Instrument	Serial No.
DGU-403	L22166050657
SIL-20AC	L20176012374
CTO-40S	L22236003442
LC-20ADSP	L20106096217
SPD-40	L22256002616
CDD-10Avp	C21346004484
CBM-40lite	L22126103139

For

ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature: *Thawatchai* Date: 21 November 2024

(Mr.Thawatchai Toros)

Service Engineer



Bara Scientific Co., Ltd
11 Chu Läng Building Floor 7 368 Route 4 Road Silem Bangrak Bangkok 10250
Thailand Tel : 02-4324330 (ext 20 lines) Fax : 02-4325488 7 www.barascientific.com

อุปกรณ์ที่ 3 วันที่ 2553

FM-SS-13 Rev00



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2501-0001OC-1
Procedure Used :-

Cert. No.: 25TM1
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument Serial No. Cert. No. Traceable Due Date
1) Data Acquisition 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.

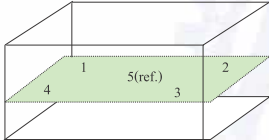
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	20	62	221
Finished of Calibration	21	57	221



Front

Position :	Ref. Std. ID No.:
1	4803988-001
2	4803988-002
3	4803988-003
4	4803988-004
5(ref.)	4803988-005



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2501-0001OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 25TM1
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.)	
42.0	42.0	42.0	42.035	41.994	42.010	42.013	42.023	0.15
44.0	44.0	44.0	44.010	43.969	43.983	43.989	44.008	0.15
44.5	44.5	44.5	44.497	44.458	44.470	44.476	44.497	0.15
46.0	46.0	46.0	46.020	45.976	45.992	45.998	46.016	0.15

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Coverage Factor k
42.0	0.047	0.018	2
44.0	0.060	0.025	2
44.5	0.062	0.023	2
46.0	0.057	0.016	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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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 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 : 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

REVIEW BY :
APPROVED BY :
NEXT CAL DATE : 23/10/25



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0439OC-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.

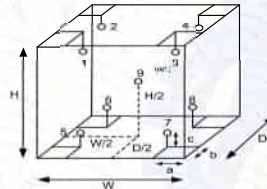
Remark : TPA : Technology Promotion Association (Thailand - Japan)

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

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 : 2404-0439OC-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)
	Position									
	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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SCIMET Co., Ltd.
1194 Soi Wachirathamsathit 57, Bangkok,
Phrakhanong, Bangkok 10260 Thailand
Email: scimet2022@gmail.com, Tel: 02 460 9239
https://www.scimet.co.th



Certificate No. C07240192

Calibration Certificate

Equipment: SPECTROPHOTOMETER

Model: DR 3900

Serial No.(or ID): 2403637

Manufacturer: HACH

Condition: New

Job No.: KSM72403543

Received Date: 25 December 2024

Issued Date: 25 December 2024

Page: 1 of 3

Customer

ALS Laboratory Group (Thailand) Co., Ltd

114/1 Moo 8, Kamchanawanich Rd. T. Ban Phru, A Hatyai, Songkhla 90250

Calibration Place

Hach (Thailand) Limited.

Branch 00001, Building D Room No. D3 11, 3rd Floor, No. 735/4, Srinakharin Road,
Pattanaikarn, Suanluang, Bangkok 10250 Thailand.

Calibration Date

25 December 2024

Environment Condition

Temperature: 22.2 °C ± 0.5 °C

Humidity: 59.2 %RH ± 2.3 %RH

The Method used

In-house method, W107, based on ASTM E 275-08 and
ASTM E 387-04

Traceability

This certificate is traceable to the CRM maintained by National Institute
of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 108801 and 108692

The standard for Photometric Certificate No. 109010, 114855

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

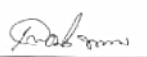
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

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


(Mr. Siwapan Srijan)

Person in charge




(Mr. Thaleangkut Pongnam)

Authorized signatory

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Condition of reference standards Instruments / CRM:

Instruments	Set No.	Certificate No.	Due date
Mercury Oxide Glass Reference	121512	108691	25-Jan-25
Dysprosium Oxide Glass Reference	119722	108692	25-Jan-25
Neutral Density Filter Reference	12270	109010, 114855	2 Feb-25

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm

Standard Wavelength (nm)	Unit Under Calibration (nm)	Correction (nm)	Uncertainty of Measurement (± nm)
333.67	333	0.67	0.59
361.02	361	0.02	0.59
417.80	417	0.80	0.59
441.29	441	0.29	0.59
479.86	480	-0.12	0.59
513.75	513	0.75	0.59
520.59	520	0.59	0.59
537.75	537	0.75	0.59
585.56	585	0.56	0.59
641.95	642	-0.05	0.59
684.70	685	-0.30	0.59
747.01	748	-0.39	0.59
807.04	807	0.04	0.59
870.65	880	-0.32	0.59



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Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance (Abs)	Unit Under Calibration (Abs)	Correction (Abs)	Uncertainty of Measurement (± Abs)
420 nm	0.0000	0.000	0.0000	0.0045
	0.2373	0.234	0.0033	0.0045
	0.5617	0.561	0.0007	0.0045
	0.7392	0.738	0.0012	0.0045
440 nm	1.0550	1.050	-0.0010	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2335	0.231	0.0025	0.0045
	0.5513	0.550	0.0013	0.0045
465 nm	0.7230	0.722	0.0010	0.0045
	1.0324	1.032	0.0004	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2126	0.210	0.0026	0.0045
546.1 nm	0.5036	0.506	-0.0024	0.0045
	0.6735	0.676	-0.0025	0.0045
	0.9615	0.965	-0.0035	0.0045
	0.0000	0.000	0.0000	0.0045
590 nm	0.2201	0.217	0.0031	0.0045
	0.5176	0.520	-0.0024	0.0045
	0.6930	0.694	-0.0010	0.0045
	0.9908	0.994	-0.0032	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2443	0.241	0.0033	0.0045
	0.5530	0.564	-0.0110	0.0045
	0.7196	0.719	0.0006	0.0045
835 nm	1.0301	1.031	-0.0009	0.0045
	0.0000	0.000	0.0000	0.0045
	0.2646	0.261	0.0036	0.0045
	0.5370	0.530	-0.0010	0.0045
	0.6862	0.687	-0.0008	0.0045
	0.9822	0.984	-0.0018	0.0045

The End of Certificate

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