

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ		
Total Suspended Particulate	- High Volume Air Sampler No. B25, B26, B33	- Digital Balance
PM ₁₀	- High Volume PM ₁₀ No. B05, B20, B32	- Digital Balance
Sulfur Dioxide	- Gas Sampler Box No. B08, B10, B11	- Spectrophotometer
Nitrogen Dioxide	- NO ₂ Analyzer No. B07, R02, R09	-
ระดับเสียง		
L _{eq} 24 hr	- Acoustic Calibrator - Sound Level Meter No. ACO-C1-B02, ACO-C1-B03, ACO-C1-B04, ACO-C1-B05	-
คุณภาพน้ำ		
pH	-	- pH Meter
Total Suspended Solids	-	- Digital Balance
Total Dissolved Solids	-	- Digital Balance
BOD ₅	-	- BOD Analyzer
COD	-	- COD Reactor
Mercury	-	- AAS
Lead	-	- ICP
Total Chromium	-	- ICP
Cadmium	-	- ICP
Nickel	-	- ICP
Copper	-	- ICP
Manganese	-	- ICP
Zinc	-	- ICP
TKN	-	- Block Digestion
Grease & Oil	-	- Digital Balance
Total Coliform Bacteria	-	- Incubator

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศ



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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@spcon.com, www.spcon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	02/05/2025	$y = 1.180x - 4.939$	0.999
B02	B02	02/05/2025	$y = 1.156x - 3.058$	0.999
B03	B03	02/05/2025	$y = 1.139x - 4.505$	0.998
B04	B04	05/05/2025	$y = 1.168x - 4.342$	0.997
B05	B05	05/05/2025	$y = 1.181x - 7.813$	0.997
B06	B06	01/05/2025	$y = 1.185x - 4.081$	0.998
B07	B07	01/05/2025	$y = 1.173x - 5.069$	0.997
B08	B08	01/05/2025	$y = 1.141x - 3.533$	0.996
B09	B09	01/05/2025	$y = 1.163x - 3.805$	0.999
B10	B10	01/05/2025	$y = 1.079x - 2.229$	0.997
B11	B11	02/05/2025	$y = 1.169x - 3.130$	0.999
B12	B12	02/05/2025	$y = 1.173x - 3.515$	0.998
B13	B13	02/05/2025	$y = 1.187x - 4.231$	0.996
B14	B14	02/05/2025	$y = 1.157x - 4.001$	0.999
B15	B15	02/05/2025	$y = 1.093x - 2.530$	0.999
B16	B16	01/05/2025	$y = 1.168x - 5.027$	0.997
B17	B17	01/05/2025	$y = 1.149x - 3.125$	0.997
B18	B18	01/05/2025	$y = 1.120x - 1.685$	0.998
B19	B19	02/05/2025	$y = 1.166x - 4.175$	0.997
B20	B20	02/05/2025	$y = 1.107x - 0.981$	0.999
B21	B21	01/05/2025	$y = 1.184x - 6.199$	0.998
B22	B22	01/05/2025	$y = 1.162x - 2.993$	0.996
B23	B23	05/05/2025	$y = 1.155x - 2.556$	0.997
B24	B24	05/05/2025	$y = 1.158x - 4.429$	0.999
B25	B25	05/05/2025	$y = 1.127x - 1.558$	0.998
B26	B26	05/05/2025	$y = 1.137x - 3.875$	0.997
B27	B27	01/05/2025	$y = 1.185x - 6.360$	0.999
B28	B28	01/05/2025	$y = 1.180x - 6.028$	0.996
B29	B29	01/05/2025	$y = 1.148x - 2.869$	0.998
B30	B30	01/05/2025	$y = 1.125x - 0.258$	0.996
B31	B31	01/05/2025	$y = 1.154x - 4.528$	0.996
B32	B32	02/05/2025	$y = 1.179x - 4.299$	0.997
B33	B33	02/05/2025	$y = 1.144x - 1.976$	0.999
B34	B34	05/05/2025	$y = 1.135x - 2.931$	0.998

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	01/05/2025	$y = 1.153x - 2.438$	0.997
B02	B02	01/05/2025	$y = 1.035x - 2.182$	0.996
B03	B03	01/05/2025	$y = 1.142x - 2.910$	0.999
B04	B04	01/05/2025	$y = 1.114x - 3.501$	0.998
B05	B05	01/05/2025	$y = 1.164x - 3.721$	0.998
B06	B06	05/05/2025	$y = 1.140x - 3.499$	0.999
B07	B07	05/05/2025	$y = 1.122x - 2.162$	0.999
B08	B08	05/05/2025	$y = 1.129x - 0.902$	0.997
B09	B09	02/05/2025	$y = 1.072x - 0.100$	0.998
B10	B10	02/05/2025	$y = 1.135x - 3.160$	0.999
B11	B11	02/05/2025	$y = 1.120x - 0.536$	0.996
B12	B12	01/05/2025	$y = 1.135x - 3.160$	0.999
B13	B13	01/05/2025	$y = 1.157x - 3.957$	0.999
B14	B14	05/05/2025	$y = 1.144x - 5.087$	0.998
B15	B15	05/05/2025	$y = 1.171x - 4.683$	0.999
B16	B16	05/05/2025	$y = 1.074x - 2.235$	0.997
B17	B17	05/05/2025	$y = 1.130x - 0.424$	0.996
B18	B18	01/05/2025	$y = 1.127x - 1.787$	0.999
B19	B19	01/05/2025	$y = 1.116x - 1.623$	0.997
B20	B20	01/05/2025	$y = 1.155x - 4.985$	0.997
B21	B21	01/05/2025	$y = 1.146x - 1.542$	0.998
B22	B22	05/05/2025	$y = 1.122x - 2.579$	0.996
B23	B23	01/05/2025	$y = 1.156x - 4.245$	0.998
B24	B24	02/05/2025	$y = 1.134x - 3.252$	0.999
B25	B25	02/05/2025	$y = 1.151x - 4.884$	0.997
B26	B26	02/05/2025	$y = 1.122x - 1.950$	0.999
B27	B27	02/05/2025	$y = 1.150x - 4.716$	0.999
B28	B28	02/05/2025	$y = 1.120x - 3.327$	0.997
B29	B29	02/05/2025	$y = 1.140x - 4.128$	0.999
B30	B30	02/05/2025	$y = 1.131x - 3.253$	0.998
B31	B31	02/05/2025	$y = 1.110x - 0.747$	0.996
B32	B32	01/05/2025	$y = 1.062x - 0.235$	0.999
B33	B33	02/05/2025	$y = 1.124x - 2.762$	0.998
B34	B34	01/05/2025	$y = 1.109x - 0.497$	0.999

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

Calibration Data

No.	Rotameter	Date	Setting (Constant Flow) (mL/min)	Actual Flow Rate (mL/min)			
				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition	Normal Condition	Standard Condition
B01	2 (A&B)	02/06/2025	200	200.4	200.3	200.6	200.5
B02	2 (A&B)	03/06/2025	200	200.6	200.5	200.5	200.4
B03	2 (A&B)	03/06/2025	200	200.4	200.3	199.9	199.8
B04	2 (A&B)	02/06/2025	200	200.5	200.4	200.6	200.5
B05	2 (A&B)	04/06/2025	200	199.6	199.5	200.5	200.4
B06	2 (A&B)	02/06/2025	200	200.3	200.2	200.9	200.8
B07	2 (A&B)	03/06/2025	200	200.8	200.7	200.6	200.5
B08	2 (A&B)	02/06/2025	200	200.6	200.5	200.8	200.7
B09	2 (A&B)	04/06/2025	200	200.5	200.4	199.9	199.8
B10	2 (A&B)	04/06/2025	200	199.9	199.8	200.2	200.1
B11	2 (A&B)	05/06/2025	200	200.7	200.6	200.5	200.4
B12	2 (A&B)	02/06/2025	200	199.8	199.7	200.3	200.2
B13	2 (A&B)	05/06/2025	200	199.7	199.6	200.4	200.3
B14	2 (A&B)	02/06/2025	200	200.5	200.4	200.7	200.6
B15	2 (A&B)	03/06/2025	200	200.4	200.3	199.9	199.8
B16	2 (A&B)	03/06/2025	200	200.5	200.4	200.2	200.1
B17	2 (A&B)	03/06/2025	200	199.9	199.8	200.4	200.3

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 15 June 2025

BRAND : API

MODEL : 200E

NO. NOX-B07

SERIAL NO. 4338

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 05 August 2024 Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : A007265V
Certified Date : 05 January 2023 Expired Date : 05 January 2026 Cylinder Conc. : 48.8 ppm

CALIBRATING CONDITION

Pressure : 1011 mmbar Temp. : 24.5 °C % RH : 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.11	-	0	-
NO Span	400	399.9	-0.025	400.0	1.008
NO _x Span	400	400.1	0.025	400.0	1.011

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	509	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.1	mV	-20 - 150
AZERO	93.9	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	28.9	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	315.4	°C	315 ± 5
RCCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.008	-	1.0 ± 0.3
NO ₂ Slope	1.011	-	1.0 ± 0.3
NO Offset	1.4	mV	-20 to +150
NO ₂ Offset	0.9	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	15 June 2025	BRAND :	API	MODEL :	200E
NO :	NOX-R02	SERIAL NO.	2285		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	05 August 2024		Serial No. :	911	
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)		Cylinder No. :	A00726SV	
Certified Date :	05 January 2023	Expired Date :	05 January 2026	Cylinder Conc. :	48.8 ppm
CALIBRATING CONDITION					
Pressure :	1011	mmbar	Temp. :	24.5	°C
% RH :	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.003
NO _x Span	400	399.8	-0.050	400.0	1.007
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	513	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.2	mV	-20 - 150		
HVPS	671	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO ₂ Span Conc	400	PPB	20 - 20,000		
NO Slope	1.003	-	1.0 ± 0.3		
NO ₂ Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO ₂ Offset	0.7	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	15 June 2025	BRAND :	API	MODEL :	200E
NO :	NOX-R09	SERIAL NO.	252		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	05 August 2024		Serial No. :	911	
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)		Cylinder No. :	A00726SV	
Certified Date :	05 January 2023	Expired Date :	05 January 2026	Cylinder Conc. :	48.8 ppm
CALIBRATING CONDITION					
Pressure :	1011	mmbar	Temp. :	24.5	°C
% RH :	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.010
NO _x Span	400	400.2	0.050	400.0	1.013
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	511	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.0	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.5	°C	8 - 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO ₂ Span Conc	400	PPB	20 - 20,000		
NO Slope	1.010	-	1.0 ± 0.3		
NO ₂ Slope	1.013	-	1.0 ± 0.3		
NO Offset	1.7	mV	-20 to +150		
NO ₂ Offset	1.0	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY : PONGSAK J.

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
ID No : BA05/50
AIR PRESSURE : 1009mbar \pm 1mbar
AMBIENT TEMPERATURE : 24° C \pm 1° C
MODEL : XS105DU
S/N : 1126422905
RECEIVED DATE : 07-Mar-25
CALIBRATION DATE : 07-Mar-25
RELATIVE HUMIDITY : 54 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 120 g WAS 0.000055 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000065
0.02	0.01999	0.00001	0.000065
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50002	-0.00002	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00000	0.00000	0.000070
20.00	20.00004	-0.00004	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.00001	-0.00001	0.00019
120.00	120.00002	-0.00002	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
OFF-CENTER LOADING	0.0000

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A
COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



Cert. No. : SP24020
Pages 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY

Condition As Found : GOOD

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.

Location : WET CHEMISTRY LABORATORY IV

Ambient Temperature : (28.1 ± 5) °C
Relative Humidity : (47.2 ± 25) %

Received Date : 27 AUGUST 2024
Calibration Date : 27 AUGUST 2024
Date of Issue : 27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

Cert. No. : SP24020
Job No. : VC67SP0013
Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01
The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution
The calibration procedure used was based on ASTM E275-01, ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0185-24	14/05/2026

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

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

- 3.1 The UK National Physical Laboratory (NPL)
- 3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.7	-0.12	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	739.9	-0.19	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

T. Petchur

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunmu, Bangplud, Bangkok, 10700 Thailand
 Tel. +66 2433 8331 Email : calibration@sithiporn.com

SITHIPORN
 associates



Cert. No. : SP24020
 Job No. : VC67SP0013
 Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance	Certified (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0550	0.0033	0.0029	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0029	2.00
		29381	0.5	0.5416	0.5431	0.0015	0.0030	2.00
	546.1	29360	1.0	0.9821	0.9820	-0.0001	0.0028	2.00
		29914	0.7	0.6961	0.6958	-0.0003	0.0028	2.00
		29381	0.5	0.5073	0.5080	0.0007	0.0029	2.00
	590.0	29360	1.0	1.0222	1.0210	-0.0012	0.0028	2.00
		29914	0.7	0.7237	0.7221	-0.0016	0.0029	2.00
		29381	0.5	0.5361	0.5361	0.0000	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9745	-0.0008	0.0028	2.00
		29914	0.7	0.6910	0.6900	-0.0010	0.0029	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422	0.2418	-0.0004	0.0101	2.00	
		40	0.4866	0.4852	-0.0014	0.0115	2.00	
		60	0.7414	0.7389	-0.0025	0.0067	2.00	
		80	0.9858	0.9842	-0.0016	0.0093	2.00	
		100	1.2442	1.2414	-0.0028	0.0086	2.00	

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S14123010

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm	
Transimission T(%)	Absorbance(A)
0.0117	3.8659

**Specific Acceptance :

Transmission \leq 1.0 T(%), Absorbance \geq 2.0 A

**Stray light not TISI Accredited

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

End of Calibration Certificate

T. Petch

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียง



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 44/0268

CALIBRATION CERTIFICATE

Submitted by : S.P.S.Consulting Service Co.,Ltd.

Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :	Ambient Environment
Description : Sound Calibrator	Temperature : (23 ± 3) °C
Manufacturer : ACO	Relative Humidity : (50 ± 15) %
Model : 2127	Ambient Pressure : (101.325 ± 1.500) kPa
Serial No. : 130006	

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

Date of Receipt : 19 Feb. 2025

Date of Calibration : 21 Feb. 2025

1/2

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
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Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoo Mai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 44/0268

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 HzAcoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.81	-0.19	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	0.95	± 0.50	±3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Signature)
(Mr. Weerachai Deechaiyae)

Approved by :

(Signature)
(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 2011268021900739001

End of Certificate

2 / 2

The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

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(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

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Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

Noise B_292/25

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	21 February 2025
		Due Date	21 February 2026

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-C1-B02	ACO	6238	00223039	15 June 2025	93.9	93.9
ACO-C1-B03	ACO	6238	00223040	15 June 2025	93.8	93.9
ACO-C1-B04	ACO	6238	00223041	15 June 2025	93.8	93.9
ACO-C1-B05	ACO	6238	00223042	15 June 2025	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB	

Calibrated by :


 (Mr. Abdul Dangklom)

Approved by :

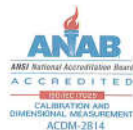

 (Mr. Peera Detudom)

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24 ROAD, JOMPOL,
CHATUCHAK, BANGKOK 10900

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Sechanart
Wenick Inchaisri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
20 June 2025



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q25070523

F3-011-05/12-23

page 1 of 4



@clccalibration



CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
DATE OF CALIBRATION : 18 June 2025

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPCH-01 [pH Meter]. The calibration was performed by direct measurement with Certified Reference Material (CRM).

This instrument was calibrated under procedure No. CLC-CPTH-04 [Temperature] based on ASTM E 644-04 as calibration guidelines. The calibration was performed by using Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664260,11754256, Lot Number CC787362.
3. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F250 S/N. 1334023800.
5. IPRT, Wika Model CTP5000-250-D S/N. PO00043543-1-10-1.

Certificate No. Q25070523

F3-011-05/12-23

page 2 of 4



@clccalibration



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2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Lot Number. 080124 , 120124. Due Date 23 January 2026.
2. The measurements are traceable to International System of Units (SI) , through Control Company.
Certificate No. 4281-14495731 , Due Date 27 September 2025.
3. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.
Certificate No. Q24120999, Due Date 26 November 2025.
4. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 1042/67, Due Date 16 October 2025.
5. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Certificate No. TT-0146-24, Due Date 28 October 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q25070523

F3-011-05/12-23

page 3 of 4



CALIBRATION LABORATORY Co.,LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of pH meter.

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of pH Measurement (\pm pH)	k Factor
4.003	4.005	168.2	-0.002	0.010	2,00
7.005	7.010	-8.1	-0.005	0.013	2,00
10.015	10.010	-177.7	+0.005	0.014	2,00

Technical Note. Setting function CAL 3 point (4,7,10).

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 4 of 68

2. TEMPERATURE RESULT

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty \pm (°C)
100	25.00	25.0	0.00	0.07

Technical Note. Type of sensor : Thermistor

Probe \varnothing 3 mm

Materials : Metal Sheath.

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2,00$.

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 56 of 68

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q25070523

F3-011-05/12-23

page 4 of 4





CERTIFICATE No : 25M2256
REFERENCE No : 76365-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591843
ID No : BA09/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 07-Mar-25

APPROVED BY : PONGSAK J.
ISSUED DATE : 13-Mar-25
RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2256

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
ID No : BA09/61
AIR PRESSURE : 1009mbar \pm 1mbar
AMBIENT TEMPERATURE : 24° C \pm 1° C
MODEL : BSA224S-CW
S/N : 36591843
RECEIVED DATE : 07-Mar-25
CALIBRATION DATE : 07-Mar-25
RELATIVE HUMIDITY : 52 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS NOT ADJUSTED BEFORE CALIBRATION. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0.000071 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.0000	0.0000	0.00012
0.10	0.1000	0.0000	0.00012
0.20	0.2000	0.0000	0.00012
0.50	0.5000	0.0000	0.00012
1.00	1.0000	0.0000	0.00012
2.00	2.0000	0.0000	0.00012
5.00	5.0000	0.0000	0.00012
10.00	10.0000	0.0000	0.00012
20.00	20.0001	-0.0001	0.00012
50.00	50.0000	0.0000	0.00014
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0000

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A
COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT





CERT.No.: HS-W015C

Harikul Science Co.,Ltd.
694 Soi Ratchadaniwet 24, Pracharatbamphen,
Samsaennok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com
Certificate of Calibration

Calibration Date : 18 Mar 25

Submitted by : S.P.S CONSULTING SERVICE CO.,LTD

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,

Chatuchak, Bangkok, Thailand 10900

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 15B100751

Probe : YSI 5010

S/N : 22D100097

ID NO. : -

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : -

ID NO. HS001

Technician : Kittipong M.

Calibration Details

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

Mean Measurement	9.07	mg/l	-	-
Inaccuracy	0.02	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature
(Kittipong Maekwong)

Laboratory Manager
(Natenapha Pisatkunchon)

**QUALITY CALIBRATION CO., LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkac, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

www.qcalibration.com

CERTIFICATE No : 25T0520
REFERENCE No : 75853-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0497

ID No : DRB 05/59

CONDITION AS RECEIVED : USED ITEM

SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 27-Jan-25

APPROVED BY :
PONGSAK J.

ISSUED DATE : 27-Jan-25

RECEIVED DATE : 15-Jan-25

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

F-G010 REV : 03

**QUALITY CALIBRATION CO., LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkac, Bangkok 10160

Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 25T0520

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

ID NUMBER : DRB 05/59

RECEIVED DATE : 15-Jan-25

AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200

SERIAL NUMBER : 15110C0497

CALIBRATION DATE : 27-Jan-25

RELATIVE HUMIDITY : 53 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

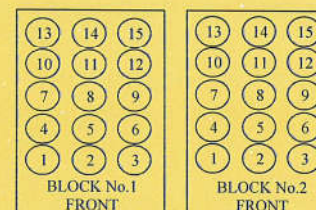
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON POINTS AND LOCATED AS THE PICTURE.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	6635300	24T6468	26-Jun-25

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO., LTD.**RESULT OF CALIBRATION :-** WITHOUT ADJUSTMENT

Block No.	1	2
Calibration Point (°C)	150	150
Controller temperature (°C)	144	144
Indicating Temperature	144	144
Measured Temperature (°C) at Spread Locations	1	150.01
	2	150.69
	3	150.40
	4	150.22
	5	150.27
	6	150.51
	7	150.24
	8	150.20
	9	150.14
	10	149.70
	11	149.58
	12	149.46
	13	148.77
	14	148.99
	15	149.02
Uncertainty of Measurement(± °C)	0.87	0.87

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.

NOTE 3 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT



F-G010 REV : 03

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

Customer : S.P.S.Consulting Service Co.,Ltd	Date Tested: July 1, 2025
Address : 7 Soi Phaholyothin 24	Recommendation Recertification
Paholyothin Road	Period 6 Months
Jompol Chatuchak, Bangkok 10900	Recertification Due: January 1, 2026
User Name: K.Phenpha Vipasthawatt	Date Last Certified: January 6, 2025
Phone: 083-9269252	Visit Number: 1 of 2
Fax: 02-513-4221	PerkinElmer Phone: 02-719-6420 ext 8
	PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
FIAS 100	100S14090404	Syngistix version 7.3
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Mercury (Hg) Std	N9300174	JUN 30, 2026

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

SERIAL NUMBER 100S14090404	DATE TESTED July 1, 2025
-----------------------------------	---------------------------------

- INSTRUMENT CHECKS**
 - A. The light part, quartz windows and detector. Clean if necessary. ☐ OK
 - B. Inspect the mercury lamp. Alignment if necessary. ☐ OK
 - C. Inspect the mercury filter. Replace if necessary. ☐ OK
 - D. Inspect and clean or replace the dust filter. ☐ OK
 - E. Inspect peristaltic pump tubes. Replace if necessary. ☐ OK
- ELECTRONICS CHECKS**
 - A. Electronic power supplies

+ 5 Volts (\pm 0.3)	+ 4.98 Volts
+ 15 Volts (\pm 1.0)	+ 15.03 Volts
- 15 Volts (\pm 1.0)	- 15.07 Volts
+ 40 Volts (\pm 1.0)	+ 40.02 Volts
- GAS SYSTEM CHECK**
 - A. Leak test all internal and external gas box joints. ☐ OK
 - B. Inspect solenoid valve and pressure switch. ☐ OK
 - C. Inspect non return valve. Replace sleeve if necessary. ☐ OK
 - D. Inspect flow meter and needle valve. Clean if necessary. ☐ OK
- MECHANICAL CHECKS**
 - A. Inspect pump motor and pump roller. ☐ OK
 - B. Inspect and clean switching valve. ☐ OK
 - C. Inspect, clean and lubricant autosample. ☐ OK



O-11540406/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

SERIAL NUMBER	100S14090404	DATE TESTED	July 1, 2025
PARAMETER		SPECIFICATION	ACTUAL VALUE
5. PERFORMANCE TEST			
A. Baseline Noise Test			
(measure peak area at 10 replicates without any sample)			
	SD	≤ 0.0015 A*s	0.0025 A*s
B. Sensitivity Check			
(10 ppb Hg Standard at 11 replicates)			
	Mean Absorbance	≥ 0.0800 Abs.	0.1201 Abs.
C. Characteristic mass(m_0)			
(10 ppb Hg Standard at 11 replicates)			
	m_0	≤ 314 pg	183.2 pg/0.0044A
D. Precision Check (%RSD)			
(10 ppb Hg Standard at 11 replicates)			
	%RSD	≤ 2.5 %	1.65 %

Page 3 of 4



O-11540406/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

SERIAL NUMBER 100S14090404 DATE TESTED July 1, 2025

Remarks :

This is to certify that the above tests have been performed and the configuration tested

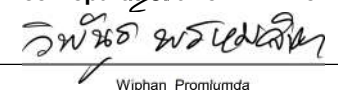
☒ meets
☐ does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department PerkinElmer Ltd.

Customer Service Engineer:


(Wiphan Promlunda)
Service Engineer

Page 4 of 4

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	<u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested:	<u>July 1, 2025</u>
Address :	<u>7 Soi Phaholyothin 24</u>	Recommendation Recertification	
	<u>Paholyothin Road</u>	Period	<u>6 Months</u>
	<u>Jompol Chatuchak, Bangkok 1090</u>	Recertification Due:	<u>January 1, 2026</u>
User Name:	<u>K.Phenpha Viphasthawat</u>	Date Last Certified:	<u>January 6, 2025</u>
Phone:	<u>083-9269252</u>	Visit Number:	<u>1of 2</u>
Fax:	<u>02-513-4221</u>	PerkinElmer Phone:	<u>02-719-6420 ext 206</u>
		PerkinElmer Fax:	<u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
IPV Methods		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Multielement Standard	N069-1579	December 30, 2024
Wavecal Solution	N058-2152	March 30, 2024
VIS Wavecal solution	N930-2946	February 28, 2024
Instrument Cal. STD4	N930-0221	November 30, 2024
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
2 % HNO3		
10 % HNO3		



MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER	DATE TESTED
077C7042401	July 1, 2025
1. MECHANICAL CHECKS	
A. Inspect and clean all fans and filters.	OK
B. Inspect and replace as necessary, all torch components including the RF coil.	OK
C. Inspect all tubing for sign of clacking or leaking.	OK
D. Adjust water and gas pressure regulator settings.	OK
E. Inspect and leak check pneumatics drawers.	OK
F. Clean the exterior of the instrument.	OK
2. OPTICAL CHECKS	
A. Inspect and clean all optical components.	OK
B. As required, check and replace all purgefilters.	OK
C. Recheck optical alignment.	OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	OK
B. Flush out the chiller every year.	N/A
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	OK
B. Wavelength Calibration.	OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401		DATE TESTED : July 1, 2025	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00570
	Ni 231.604 nm	≤ 0.008	0.00734
	Ni 341.476 nm	≤ 0.012	0.00763
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01627
	Ba 455.403 nm	≤ 0.025	0.02428
Precision			
	As 193.656 nm	% RSD < 1.0	0.82 %
	Zn 213.856 nm	% RSD < 1.0	0.83 %
	Mn 257.610 nm	% RSD < 1.0	0.20 %
	La 379.478 nm	% RSD < 1.0	0.89 %
	Ba 455.403 nm	% RSD < 1.0	0.92 %
	Ba 493.408 nm	% RSD < 1.0	0.75 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	10.65 ppb
	As 193.696 nm	3(sd)	2.48 ppb
	Pb 220.353 nm	3(sd)	3.09 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	331.50 ppb
	Zn 213.856 nm	3(sd)	0.98 ppb
	Mn 257.610 nm	3(sd)	0.34 ppb
	La 379.478 nm	3(sd)	2.54 ppb
	Ba 455.403 nm	3(sd)	2.19 ppb
	Ba 493.408 nm	3(sd)	4.32 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	140.03
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	24.17



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER	077C7042401	DATE TESTED	July 1, 2025
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Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been performed and the configuration tested

☒ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.

Service Department PerkinElmer Ltd.

Authorized Representative: Wiphan Promlumda

(Wiphan Promlumda)

Service Engineer



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwack Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



CALIBRATION CERTIFICATE

Certificate No. : L202407024-0001

Date Issued : 31-Jul-24

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900

Equipment : Block Digestion (Gerhardt, TR)

Manufacturer : Gerhardt

Model : -

Serial No. : 4061832

ID No./Tag No. : KJ 01/43

Date Received : 18-Jul-24

Date Calibrated : 30-Jul-24

Calibrated by : Surat Aumarb

Calibration Method or Calibration Procedure Used

In-house method : CP-49 base on TLAS G-20 by comparing against Standard Thermometer.

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

Result of Calibration

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

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

Approved by:

Sorayuth T.
(Sarayuth Toehua)



Page 1 of 2

Certificate No. : L202407024-0001

Environment : Ambient Temperature : Start record 26.8 °C, Stop record 26.9 °C

Relative Humidity : Start record 54.4 %RH, Stop record 57.1 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
380	380	380	1.34	2.28	3.27

Calibration Temperature (°C)	Standard Reading (°C), Probe No. 20 is Reference Probe					Uncertainty ⁴ (±°C)
380	No. 1	No. 2	No. 3	No. 4	No. 5	2.2
	380.07	379.54	380.96	379.66	379.31	
	No. 6	No. 7	No. 8	No. 9	No. 10	
	380.63	380.22	379.71	380.41	380.72	
	No. 11	No. 12	No. 13	No. 14	No. 15	
	380.40	380.28	380.03	379.69	380.47	
380	No. 16	No. 17	No. 18	No. 19	No. 20	2.2
	380.11	379.97	379.93	379.81	379.58	

Decision Rule with Guard Band

Calibration Temperature (°C)	Pass / Fail					MPE (±°C)
380	No. 1	No. 2	No. 3	No. 4	No. 5	5
	Pass	Pass	Pass	Pass	Pass	
	No. 6	No. 7	No. 8	No. 9	No. 10	
	Pass	Pass	Pass	Pass	Pass	
	No. 11	No. 12	No. 13	No. 14	No. 15	
	Pass	Pass	Pass	Pass	Pass	
380	No. 16	No. 17	No. 18	No. 19	No. 20	5
	Pass	Pass	Pass	Pass	Pass	

Pass = $|\text{error}| \leq |\text{MPE}|$ MPE = Maximum Permissible Error

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

Without adjustment

No.1	No.2	No.3	No.4
No.5	No.6	No.7	No.8
No.9	No.10	No.11	No.12
No.13	No.14	No.15	No.16
No.17	No.18	No.19	No.20

Top view position

Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202403007-0003 for Digital Thermometer with Probe (Agilent) Module 2 (172) Type K Serial No. US37011204, Due 10-Sep-24

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

End of Certificate



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



CALIBRATION CERTIFICATE

Certificate No. : S2024090374-0003

Date Issued : 23-Sep-24

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

ID No./Tag No. : IN 05/56

Date Received : 16-Sep-24

Date Calibrated : 16-Sep-24

Calibrated by : Anusak Songliam

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

Result of Calibration

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

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

Approved by:

Sarayuth T.
(Sarayuth Tochua)



Page 1 of 2

Certificate No. : S2024090374-0003

Environment : Ambient Temperature : Start record 23.7 °C, Stop record 23.5 °C
Relative Humidity : Start record 54.6 %RH, Stop record 54.4 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.04	0.21	0.38
41.5	41.5	41.5	0.07	0.19	0.30

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty ⁴ (±°C)
35	34.81	35.12	34.93	34.92	35.02	34.82	34.92	35.13	34.98	0.23
41.5	41.31	41.49	41.33	41.34	41.41	41.31	41.52	41.32	41.46	0.23

Decision Rule with Guard Band

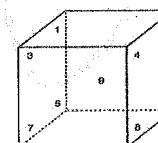
Calibration Temperature (°C)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	MPE (±°C)
35	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5
41.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5

Pass = $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$ MPE = Maximum Permissible Error

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

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202407373-0005 for Temperature Indicator with Sensor Serial No. US37020317, Due 31-Jan-25

- Notes :
- The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
 - The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
 - Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
 - The uncertainty of measurement is included temperature stability.
 - The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

Page 2 of 2