

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

ลำดับที่ 1	คุณภาพอากาศในบรรยากาศ
ลำดับที่ 2	คุณภาพอากาศจากแหล่งกำเนิด
ลำดับที่ 3	ระดับเสียง
ลำดับที่ 4	คุณภาพน้ำ
ลำดับที่ 5	คุณภาพอากาศในการทำงาน
ลำดับที่ 6	ระดับความร้อนในการทำงาน

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ระยะดำเนินการ)**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศในบรรยากาศ Total Suspended Particulate (TSP)	High Volume Air Sampler Rec No.Blow No. R13, R14	Digital Balance
Particulate Matter less than 10 microns (PM-10)	High Volume PM-10 Air Sampler Rec No.Blow No. R13, R14	Digital Balance
Nitrogen Dioxide (NO _x)	NO/NO ₂ /NO _x Analyzer No. R01, R03	NO/NO ₂ /NO _x Analyzer No. R01, R03
2. คุณภาพอากาศจากแหล่งกำเนิด Total Suspended Particulate (TSP)	Console No. R04 Pitot Tube No. B45	Digital Balance
Oxides of Nitrogen (NO _x)	Vacuum Gauge	Spectrophotometer
3. ระดับเสียง L _{eq} 24 hr, L ₉₀ , L _{max} และ L _{dn}	Acoustic Calibrator Sound Level Meter No. ACO-R14, R25, R30, R31	-
L _{eq} 1 hr, L _{eq} 8 hr และ Noise Dose	Acoustic Calibrator Sound Level Meter ACO No. B36, B41, B43	-
4. คุณภาพน้ำ pH	-	pH Meter
Total Dissolved Solids (TDS)	-	Digital Balance
Total Suspended Solids (TSS)	-	Digital Balance
Biochemical Oxygen Demand (BOD ₅)	-	BOD Analyzer
Chemical Oxygen Demand (COD)	-	COD Reactor
Grease & Oil	-	Digital Balance
Temperature	-	Thermometer
Lead (Pb)	-	Atomic Absorption Spectrophotometer
Aluminium (Al)	-	ICP
5. คุณภาพอากาศในสถานที่ทำงาน Total Dust	Personal Pump SKC No. B71, R33 Rotameter No. H-R06	Digital Balance
Respirable Dust	Personal Pump SKC No. B55 Rotameter No. H-R06	Digital Balance
Aluminum	Personal Pump SKC No. B33, R12 Rotameter No. H-R06	ICP

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ระยะดำเนินการ) (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
5. คุณภาพอากาศในสถานที่ทำงาน (ต่อ) Hydrogen Fluoride	Personal Pump SKC No. R40 Rotameter No. L-R06	Ion Chromatography
Oil Mist	Personal Pump SKC No. R19 Rotameter No. H-R06	Ion Chromatography
6. ระดับความร้อนในการทำงาน WBGT	Heat Stress WBGT Meter No. B21, B32	-

คุณภาพอากาศในบรรยากาศ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompet, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spicon.com, www.spicon.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
B35	B35	05/05/2025	y = 1.179x-3.347	0.996
B36	B36	05/05/2025	y = 1.166x-3.602	0.998
B37	B37	05/05/2025	y = 1.086x+1.195	0.998
B38	B38	01/05/2025	y = 1.149x-5.480	0.998
B39	B39	01/05/2025	y = 1.130x-3.044	0.999
B40	B40	01/05/2025	y = 1.142x-3.372	0.999
B41	B41	01/05/2025	y = 1.180x-3.769	0.997
B42	B42	01/05/2025	y = 1.158x-2.865	0.998
B43	B43	05/05/2025	y = 1.170x-3.980	0.996
B44	B44	05/05/2025	y = 1.143x-1.683	0.997
R01	R01	05/05/2025	y = 1.132x-2.374	0.999
R02	R02	05/05/2025	y = 1.146x-3.852	0.997
R03	R03	02/05/2025	y = 1.128x-2.825	0.999
R04	R04	02/05/2025	y = 1.149x-3.932	0.998
R05	R05	02/05/2025	y = 1.107x+0.389	0.997
R06	R06	01/05/2025	y = 1.145x-2.356	0.996
R07	R07	01/05/2025	y = 1.072x-0.849	0.999
R08	R08	01/05/2025	y = 1.161x-4.426	0.996
R09	R09	02/05/2025	y = 1.129x-2.040	0.996
R10	R10	02/05/2025	y = 1.167x-4.503	0.998
R11	R11	02/05/2025	y = 1.139x-3.520	0.996
R12	R12	02/05/2025	y = 1.110x-1.762	0.996
R13	R13	05/05/2025	y = 1.187x-6.302	0.998
R14	R14	05/05/2025	y = 1.144x-2.722	0.996
R15	R15	05/05/2025	y = 1.137x-4.842	0.999
R16	R16	05/05/2025	y = 1.183x-5.960	0.998
R17	R17	01/05/2025	y = 1.158x-3.663	0.998
R18	R18	01/05/2025	y = 1.185x-4.771	0.997
R19	R19	01/05/2025	y = 1.173x-5.427	0.998
R20	R20	01/05/2025	y = 1.175x-6.682	0.999

Calibrated by :  (Mr. Adul Dangklom) Approved by :  (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
R01	R01	01/05/2025	y = 1.147x-4.883	0.998
R02	R02	01/05/2025	y = 1.086x-1.102	0.998
R03	R03	01/05/2025	y = 1.090x-1.868	0.999
R04	R04	01/05/2025	y = 1.168x-7.323	0.998
R05	R05	01/05/2025	y = 1.105x-3.631	0.999
R06	R06	01/05/2025	y = 1.136x-2.713	0.997
R07	R07	01/05/2025	y = 1.127x-2.374	0.998
R08	R08	02/05/2025	y = 1.093x-1.200	0.998
R09	R09	05/05/2025	y = 1.164x-4.809	0.996
R10	R10	05/05/2025	y = 1.144x-3.534	0.996
R11	R11	05/05/2025	y = 1.094x-1.578	0.998
R12	R12	05/05/2025	y = 1.161x-4.197	0.997
R13	R13	05/05/2025	y = 1.147x-5.163	0.996
R14	R14	05/05/2025	y = 1.169x-5.334	0.999
R15	R15	01/05/2025	y = 1.126x-4.188	0.999
R16	R16	02/05/2025	y = 1.141x-1.730	0.997
R17	R17	02/05/2025	y = 1.149x-5.064	0.998
R18	R18	02/05/2025	y = 1.137x-5.529	0.997
R19	R19	02/05/2025	y = 1.104x-0.129	0.998
R20	R20	02/05/2025	y = 1.123x-4.294	0.998

Calibrated by :  (Mr. Adul Dangklom) Approved by :  (Mr. Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	01 June 2025	BRAND :	API	MODEL :	200E
NO.	NOX-R01	SERIAL NO.	769		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-5	
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	1010	mmbar	Temp.	24.6	°C
			% RH	50	
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	399.7	-0.075	400.0	1.005
NO ₂ Span	400	400.1	0.025	400.0	1.009
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	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	674	V	420 - 900 constant		
RCCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.8	°C	315 ± 5		
RCCELL PRESS	8.3	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	1.005	-	1.0 ± 0.3		
NO ₂ Slope	1.009	-	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 :

(Mr.Kaseam Simaphon)

Approved by :

(Mr.Yuthana Thanataranit)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	01 June 2025	BRAND :	API	MODEL :	200E
NO.	NOX-R03	SERIAL NO.	4410		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-5	
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.	24.6	°C
			% RH	50	
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	399.9	-0.025	400.0	1.008
NO ₂ Span	400	400.2	0.050	400.0	1.012
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	506	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCCELL PRESS	8.4	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 ₂ Span Conc	400	PPB	20 - 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO ₂ Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.5	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 :

(Mr.Kaseam Simaphon)

Approved by :

(Mr.Yuthana Thanataranit)



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 : 

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.



F-G010 REV 03



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.

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

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000071 g
4. 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. : 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 : 
(Thanakul Petchurai)

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



Cert. No. : 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
RM-DL	640.50	640.4	-0.10	0.16	2.00
	740.09	739.9	-0.19	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

451-451/1 Sirinthorn Road, Bangbunru, 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 (A)	Certified Absorbance (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

คุณภาพอากาศจากแหล่งกำเนิด



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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sale@spscon.com, www.spscon.com

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	DH _g (mmH ₂ O)
B01	1563	02/06/2025	0.997	49.56
B02	8002514	04/06/2025	0.998	49.74
B03	1503016	02/06/2025	1.007	49.69
B04	00006659	04/06/2025	0.999	50.11
B05	00007428	02/06/2025	1.006	49.65
R01	1561	04/06/2025	1.003	49.70
R02	8002513	03/06/2025	0.998	49.82
R03	1570	03/06/2025	1.005	49.88
R04	8002519	02/06/2025	1.004	49.76
R05	1503015	04/06/2025	0.997	50.04

Remark : Accept Value of y (test) is $0.97 < y < 1.03$

Accept Value of DH_g (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sale@spscon.com, www.spscon.com

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	01/05/2025	0.84	0.84
B37	S	0.99	01/05/2025	0.84	0.83
B38	S	0.99	01/05/2025	0.85	0.84
B39	S	0.99	01/05/2025	0.85	0.84
B40	S	0.99	01/05/2025	0.84	0.83
B41	S	0.99	01/05/2025	0.85	0.84
B44	S	0.99	01/05/2025	0.84	0.84
B45	S	0.99	02/05/2025	0.84	0.84
B46	S	0.99	02/05/2025	0.84	0.83
B47	S	0.99	02/05/2025	0.83	0.84
B48	S	0.99	02/05/2025	0.85	0.84
B49	S	0.99	01/05/2025	0.84	0.84
B54	S	0.99	01/05/2025	0.84	0.85
B56	S	0.99	01/05/2025	0.85	0.84
B57	S	0.99	01/05/2025	0.84	0.84
B58	S	0.99	05/05/2025	0.83	0.84

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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 : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
CLID. NO. : 212301419
JOB CONTROL NO. : 240720076545
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 : 20 July 2024

DATE OF ISSUED : 23 July 2024

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

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
23 July 2024



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. Q24076545

F3-011-05/12-23

page 1 of 3



@clccalibration



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REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
DATE OF CALIBRATION : 22 July 2024
DUE DATE OF CALIBRATION : 22 July 2025

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 10) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPP-05 according to DKD-R 6-1 as calibration guidelines.

The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 741B S/N. 8295020 with Pressure Module Model 700PD5 S/N. 89404505.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand). Certificate No. MP-0040-24, Due Date 08 February 2025.

UNCERTAINTY :

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k=2$. It has been evaluated according to the "Calibration of Pressure Gauges (DKD-R 6-1)" which provides a level of confidence approximately 95%.

Certificate No. Q24076545

F3-011-05/12-23

page 2 of 3



@clccalibration



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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 DUC was exercised by applying a known pressure from its zero to full scale 1 times. Then 2 series of known gauge pressure were applied. The STD reading were recorded and the means value were reported in the table below.

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (kPa)		Conversion to inHg		Correction (inHg)	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-15.58	-15.58	-4.6	-4.6	+0.4	+0.4
-10	-32.51	-32.84	-9.6	-9.7	+0.4	+0.3
-15	-49.44	-49.77	-14.6	-14.7	+0.4	+0.3
-20	-66.70	-66.70	-19.7	-19.7	+0.3	+0.3
-25	-83.63	-83.97	-24.7	-24.8	+0.3	+0.2
-30	-100.90	-100.90	-29.8	-29.8	+0.2	+0.2

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 43 of 67

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

End of Certificate

Certificate No. Q24076545

F3-011-05/12-23

page 3 of 3



@clccalibration

ระดับเสียง



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 :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

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.

Ambient Environment

Temperature : (23 + 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory

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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

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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 20µPa at 1000 Hz

Acoustic Output in dB re 20µPa, 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 :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Khuaypa)

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.

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FM.BL.MTC.002 Rev.5

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

Noise R_220/25

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-B36	ACO	6236	00192027	08 April 2025	93.9	93.9
ACO-B41	ACO	6236	00192032	08 April 2025	93.9	93.9
ACO-B43	ACO	6236	00192034	08 April 2025	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB	

Calibrated by :

(Mr. Adul Liangkom)

Approved by :

(Mr. Peera Detudom)

คุณภาพน้ำ



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Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

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Khwaeng Phatthanakan Khet Suan

TAX ID : 0105540004859

chanattagarn.imchom@alsglobal.com
227158760

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Location:

Room
Bldg
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Dept

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Agilent Technologies (Thailand) Limited, Head Office
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968 Rama 4 Road, Silom, Bangrak,
Bangkok 10500 Thailand
Tax ID : 0105542068218

SERVICE REPORT

Customer Purchase Order Number:	Customer Number: 70371013
Service Request:	Service Request Date:
Service Order: 6006676060	Service Confirmation: 6905905441

**Direct Inquiries to:**

Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

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Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama 1 Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6905905441

Service Confirmation Date: 08.10.2024

Service Instrument:

Model Number	Model Description	Serial Number	System Handle	Parent Asset
SYS-IM- 7900	ICPMS 7900 System			
G8410A	SPS 4 Autosampler	AU15430722	ICP MS 7900	SYS-IM-7900
G8411A	ISIS 3 for Agilent 7850/7900/8900	JP15510227	ICP MS 7900	SYS-IM-7900
G3292A	PSC 6106T Chiller	2U15A1948	ICP MS 7900	SYS-IM-7900
G8403A	Agilent 7900 ICP-MS	JP15471169	ICP MS 7900	SYS-IM-7900

Service Items:

Item	Service/Part #	Description	Qty	Entitlement	Service Start	Service End
1000	E00	Enterprise Operational Qualification	1.00	Agreement Entitlement 100 % covered	04.10.2024	04.10.2024
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement 100 % covered		

Additional Information:

Service Confirmation Number: 6905905441

Service Confirmation Date: 08.10.2024

Service Information:

Problem Description: *WU-EQ-Q-IM-7900-5001253655		
Service Provided: Perform OQ Hardware. Test CDS logon, auto sampler, Auto tune, BG and 20 Min stability. I calibrate the instrument No BKK_EL0043 test all pass.		
Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service		
Reported Hours: 7.0	Travel Hours: 2.0	
Customer Field Service Representative Name: Panthep Kurasathain	Customer Field Service Representative Signature: [Signature]	Date: 08 Oct 2024
Customer Name: Supakwan Mak	Customer Signature: [Signature]	Date: 08 Oct 2024
Additional Comments:		



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.: 24TM632

Page : 1 of 3

Equipment :	Hot Air Oven	REVIEW BY ... [Signature] APPROVED BY ... [Signature] NEXT CAL DATE..... 21/09/25
Manufacturer :	Memmert	
Model :	UFE 500	
Serial No. :	G511.1572	
ID No. :	RYG_EN0010	
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) 616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng, Rayong 21140 Thailand	
Location :	Oven Room	
Received Order :	21 March 2024	
Calibration Date :	21 March 2024	
Ambient Temperature :	(26 ± 10) °C	
Relative Humidity :	(50 ± 30) %	
Calibrated by :	Man Pattanapongpaiboon [Signature]	
Approved by :	[Signature] Approved Signatory	
() Pornthippa Tameyakul () Unnopphol Harachai (✓) Suwit Imjai		
Issue Date :	22 March 2024	

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1

Cert. No.: 24TM632

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Traceable</u>	<u>Due Date</u>
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

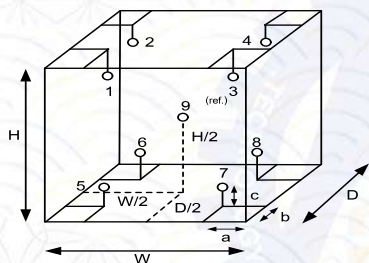
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

Dimension of Chamber :

a =	5.0	cm	D =	0.40	m
b =	5.0	cm	W =	0.56	m
c =	5.0	cm	H =	0.48	m
Capacity =			0.11	m ³	

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	57	59
AC Supply (Volt)	222	224

Ref. Std. ID No. : @ Calibration Point		
Position :	(180) °C	(104) °C
1	18-18TC-01	18-18RTD-01
2	18-18TC-02	18-18RTD-02
3	18-18TC-03	18-18RTD-03
4	18-18TC-04	18-18RTD-04
5	18-18TC-05	18-18RTD-05
6	18-18TC-06	23-18RTD-06
7	18-18TC-07	18-18RTD-07
8	18-18TC-08	22-18RTD-08
9 (ref.)	18-18TC-09	18-18RTD-09



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1

Cert. No.: 24TM632

Page : 3 of 3

Result of Calibration :-

(*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.051	0.59	0.62	2
180.0	180.0	180.0	0.15	1.3	1.7	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	103.921	103.786	103.757	103.759	103.950	103.817	104.213	103.672	103.673	0.42
180.0	179.614	179.270	179.145	179.599	180.001	180.423	180.293	180.629	179.429	1.1

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

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

UUC* : Unit Under Calibration

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

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

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



Certificate of Calibration

Cert. No.: 24TM633

Page : 1 of 3

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 110

Serial No. : B416.2420

ID No. : RYG_EN0012

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140 Thailand

Location : Oven Room


Received Order : 21 March 2024

Calibration Date : 21 March 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by : 
Approved Signatory

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Suwit Imjai

Issue Date : 23 March 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Hot Air Oven

Condition As-Received : Used Item

Reference : 2403-0563OC-2

Cert. No.: 24TM633

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and 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	MY57013711	23LM115	TPA	11 Jul 2024

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

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

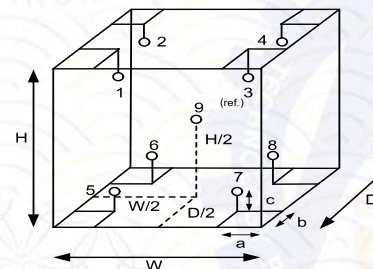
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	27
REL.Humid. (%)	57	59
AC Supply (Volt)	222	224



Probe Installation Details : Dimension of Chamber :

a =	5.0	cm	D =	0.40	m
b =	5.0	cm	W =	0.56	m
c =	5.0	cm	H =	0.48	m
			Capacity =	0.11	m ³

Ref. Std. ID No.: @ Calibration Point		
Position :	(180) °C	(104) °C
1	18-18TC-01	22-18RTD-2/1
2	18-18TC-02	18RTD-2/2
3	18-18TC-03	18RTD-2/3
4	18-18TC-04	18RTD-2/4
5	18-18TC-05	18RTD-2/5
6	18-18TC-06	18RTD-2/6
7	18-18TC-07	18RTD-2/7
8	18-18TC-08	18RTD-2/8
9 (ref.)	18-18TC-09	18RTD-2/9



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM633

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
104.0	104.0	104.0	0.18	0.76	1.2	2
180.0	180.0	180.0	0.39	1.3	2.1	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.359	103.787	104.309	103.986	103.887	103.924	103.558	103.988	104.122	0.47
180.0	180.767	179.618	180.576	180.407	180.279	180.368	179.463	180.088	180.363	1.1

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

Equipment: SPECTROPHOTOMETER
Model: DR6000
Serial No. (or ID.): 1627845 (RYG_EN0037)
Manufacturer: HACH
Condition: In Condition

Certificate No.: C06250108
Issued Date: 18 March 2025
Job No.: WO-00064379
Page: 1 of 3

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

APPROVED BY

NEXT CAL. DATE 18/09/26

Environment Condition: Temperature 24.4 °C ± 0.3 °C
Humidity 60.8 %RH ± 3.5 %RH

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr.Preecha Phooarsai
Calibration Date: 18 March 2025
The Method used: In house method, CAL-WI-24, base 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 Sarna Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584
The standard for Photometric Certificate No. 9114984 and 111588
The standard for Stray light Certificate No. 111586 and 111585
The standard for Spectral resolution Certificate No. 111587

(Mr. Preecha Phooarsai)

Person in charge

(Miss Kaewkan Suradech)

Authorized signatory

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

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

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

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

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CAL-FM-C06-16: 11 Mar 2024

Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.61	418.5	0.11	0.13
536.66	536.7	-0.04	0.13
637.98	638.3	-0.32	0.13
748.48	748.8	-0.32	0.13
807.03	807.5	-0.47	0.13

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.291	0.0020	0.0045
	0.5168	0.518	-0.0012	0.0045
	1.0298	1.031	-0.0012	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.285	0.0017	0.0045
	0.5073	0.508	-0.0007	0.0045
	1.0083	1.009	-0.0007	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.250	0.0016	0.0045
	0.4595	0.461	-0.0015	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.246	0.0001	0.0045
	0.4652	0.466	-0.0008	0.0045
	0.9468	0.948	-0.0012	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.259	0.0004	0.0045
	0.5040	0.505	-0.0010	0.0045
	1.0032	1.004	-0.0008	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.258	-0.0001	0.0045
	0.4971	0.497	0.0001	0.0045
	0.9720	0.973	-0.0010	0.0045

Calibration Results:

Without Adjustment

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
235 nm	0.0000	0.000	0.0000	0.0080
	0.7355	0.738	-0.0025	0.0080
257 nm	0.0000	0.000	0.0000	0.0080
	0.8574	0.857	0.0004	0.0080
313 nm	0.0000	0.000	0.0000	0.0080
	0.2864	0.290	-0.0036	0.0080
350 nm	0.0000	0.000	0.0000	0.0080
	0.6374	0.637	0.0004	0.0080

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
260.62 +/- 0.11 nm	260.6	1.7	1.770
391.44 +/- 0.11 nm	391.4	1.4	1.854

Spectral Resolution *

Nominal Concentration 0.02 % v/v	Peak	Trough	Ratio	SBW
Standard Wavelength (nm)	268.66	266.69	1.38	2.00
UUC: Wavelength (nm)	268.2	266.2		
Std Absorbance (A)	0.4566	0.2780		
UUC: Absorbance (A)	0.413	0.299		

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
18 Mar 2025			18 Mar 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swich)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	*
<input checked="" type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	13.5 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	893.0 Hours
<input checked="" type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ขอแนะ : * 656.1nm = 656.1nm

* 486.0nm = 485.7nm

Mr.Preecha Phooarsai

Service Engineer

บริษัท ดีเคเอสเอช (ประเทศไทย) จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
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CAL-FM-R31-03: 20 Jul 2022

SARTORIUS



Accredited by

NSC-TISI-TIS 17025

Calibration 0426

Calibration certificate

Calibration Certificate No. 25BKL0002

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	MCE224S-2S00-U	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.	38101399 RYG_EN0163	This certificate relate and apply this equipment only.
Customer	ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)	
	616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.	
Order no.	2230	
Number of pages	4	
Date of calibration	20 Feb 2025	

REVIEW BY

APPROVED BY.....

NEXT CAL DATE.....20/02/26.....

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	06 Mar 2025	Approval of the Calibration Certificate	Person in charge
		Mr. Chonchai Inthana	Kachen Lalee

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

Verical®
Version 6.5

Calibration certificate No.: 25BKL0002	
Calibration Certificate	
Calibration object	
Single range instrument	
Model	MCE224S-2S00-U
Serial Number	38101399
QM Ident. no Inventory no.	RYG_EN0163 ---
Maximum capacity (Max. load)	220.0000 g
Measured range	220.0000 g
Scale interval	0.0001 g

Place of calibration

Address	According to page 1
Department Cost center	Laboratory Department. ---
Building Floor	--- 1st Floor.
Room	Balance 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	MHB-382SD s/nB011342 Traceable to SI unit through DKSH	21 Aug 2025
Test weight set OIML R111 E2	Certificate No.M2308197S ,E2(Traceable to SI unit through TCS)	23 Aug 2025

Calibration certificate No.: 25BKL0002	
Calibration Certificate	
Adjustment Status	
The measuring device was internally adjusted before the calibration.	
Environmental and measuring conditions	
Date of calibration	20 Feb 2025
Temperature at place of calibration Temp. diff. <i>T</i> _{weights} - <i>T</i> _{place}	24.4 °C 0.6 K
Measuring conditions	The installation site is suitable. The device was levelled. 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	Center	100.0000 g
2	10.0000 g	200.0000 g	Front left	100.0000 g
3	10.0000 g	200.0001 g	Back left	100.0000 g
4	9.9999 g	200.0000 g	Back right	100.0000 g
5	9.9999 g	200.0000 g	Front right	99.9999 g
6	10.0000 g	200.0001 g	Maximum deviation from centric loading indication	
7	10.0000 g	200.0000 g	Δ <i>e</i> _{ecc} max = 0.0001 g	
8	10.0000 g	200.0000 g		
9	9.9999 g	200.0001 g		
10	10.0000 g	200.0000 g		
<i>s</i> = 0.00005 g		<i>s</i> = 0.00005 g		

Error of indication						
Testload	Indication	Error	Expansion factor	Uncertainty	Uncertainty relative	
<i>L</i>	<i>I</i>	<i>E</i>	<i>k</i>	<i>U</i> (<i>E</i>)	<i>U</i> _{rel} (<i>E</i>)	
0.0100 g	0.0100 g	0.0000 g	2.00	0.00013 g	1.3 %	
0.1000 g	0.1000 g	0.0000 g	2.00	0.00013 g	0.13 %	
0.5000 g	0.5000 g	0.0000 g	2.00	0.00013 g	0.026 %	
1.0000 g	1.0000 g	0.0000 g	2.00	0.00013 g	0.013 %	
5.0000 g	5.0000 g	0.0000 g	2.00	0.00013 g	0.0026 %	
10.0000 g	9.9999 g	-0.0001 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	50.0001 g	0.0001 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	220.0000 g	0.0000 g	2.00	0.00032 g	0.00015 %	
Maximum error of indication		<i>E</i>] _{max} = 0.0001 g				
<i>U</i> _{rel} (<i>E</i>) is the quotient of <i>U</i> (<i>E</i>) and test load <i>L</i> . The uncertainty of measurement <i>U</i> (<i>E</i>) is valid only if error <i>E</i> 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

Uncertainty of measurement in use

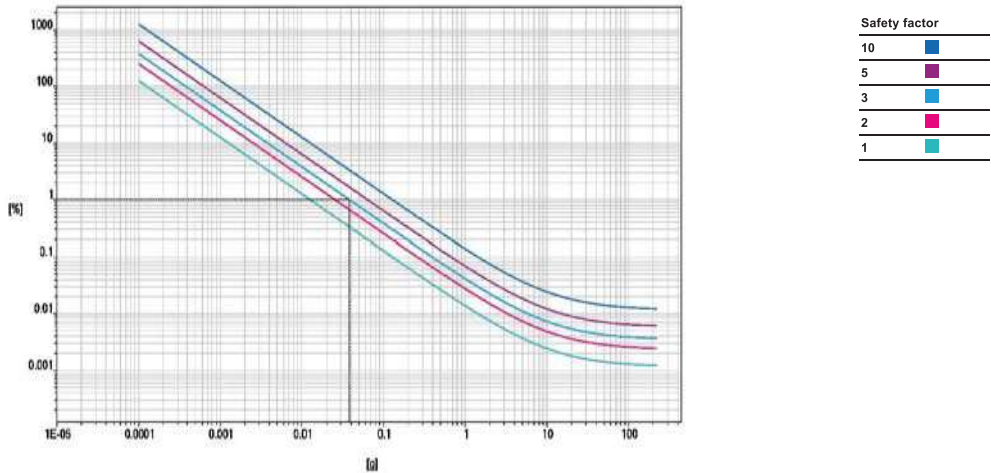
Device adjusted before measurement Yes
Temperature deviation considered 1.5 K (isoCAL active)
Temperature coefficient considered $1 \cdot 10^{-6}/K$

Uncertainty of the weighing result $U_{g1}(W)$ $U_{g1}(W) = 0.00013 \text{ g} + 1.16 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-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 R	Uncertainty $U_{g1}(W)$	Uncertainty relative $U_{g1}(W)_{rel}$
1 %	2.2000 g	0.00016 g	0.0071 %
25 %	55.0000 g	0.00077 g	0.0014 %
50 %	110.0000 g	0.0014 g	0.0013 %
75 %	165.0000 g	0.0020 g	0.0012 %
100 %	220.0000 g	0.0027 g	0.0012 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy 1.00 %
Safety factor 3
Minimum sample weight 0.0381 g



Certificate of Calibration

Equipment: SPECTROPHOTOMETER
Model: DR3900
Serial No. (or ID.): 2021761 (RYG_EN0179)
Manufacturer: HACH
Condition: In Condition
Certificate No.: C06250109
Issued Date: 18 March 2025
Job No.: WO-00064379
Page: 1 of 3
Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.
Environment Condition: Temperature 24.3 °C ± 0.3 °C
Humidity 60.0 %RH ± 4.4 %RH
Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.
Calibration By: Mr.Preecha Phooarsai
Calibration Date: 18 March 2025
The Method used: In house method, CAL-WI-24, base 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.

REVIEW BY [Signature]
APPROVED BY [Signature]
NEXT CAL. DATE 18/09/26

The standard for Wavelength Certificate No. 111583 and 111584
The standard for Photometric Certificate No. 9114984
The standard for Stray light Certificate No. 111585



(Mr. Preecha Phooarsai)
Person in charge



(Miss Kaewkan Suradech)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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

Calibration Results:

Without Adjustment

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

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.40	418	0.40	0.59
537.00	536	1.00	0.59
638.00	638	0.00	0.59
747.61	748	-0.39	0.59
807.04	807	0.04	0.59

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.2930	0.289	0.0040	0.0045
	0.5168	0.515	0.0018	0.0045
	1.0298	1.028	0.0018	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.2867	0.282	0.0047	0.0045
	0.5073	0.503	0.0043	0.0045
	1.0083	1.003	0.0053	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.2516	0.248	0.0036	0.0045
	0.4595	0.460	-0.0005	0.0045
	0.9334	0.935	-0.0016	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.2461	0.244	0.0021	0.0045
	0.4652	0.465	0.0002	0.0045
	0.9468	0.947	-0.0002	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.2594	0.257	0.0024	0.0045
	0.5040	0.503	0.0010	0.0045
	1.0032	1.001	0.0022	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.2579	0.256	0.0019	0.0045
	0.4971	0.496	0.0011	0.0045
	0.9720	0.971	0.0010	0.0045

Calibration Results:

Without Adjustment

Stray light *

Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
391.44 +/- 0.11 nm	391	3.8	1.420

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate



ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR3900

หมายเลขเครื่อง: 2021761

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
18 Mar 2025			18 Mar 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	1. ความสมบูรณ์เครื่อง	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swich)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	4. ปุ่มกด (Keypad)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. หน้าจอ (Display, Screen Contrast)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		Spectrophotometer			
<input type="checkbox"/>	<input type="checkbox"/>	6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8. ความยาวคลื่น (Wavelength Check)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	807nm=807.3nm
<input type="checkbox"/>	<input type="checkbox"/>	9. แหล่งกำเนิดแสง (UV < 3,000 hour)	<input type="checkbox"/>	<input type="checkbox"/>	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	10. แหล่งกำเนิดแสง (Visible < 5,000 hour)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	11. ช่องวัดหลายตัวอย่าง (Carousel Module)	<input type="checkbox"/>	<input type="checkbox"/>	
		pH Meter and Conductivity Meter			
<input type="checkbox"/>	<input type="checkbox"/>	12. อิเล็กโทรด (Electrode and Connection Cable)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	13. ระดับสารละลายใน Electrode (Level KCl)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	14. ฝาปิดกันปลาย Electrode (Dust Protection Hood)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	15. ขาจับอิเล็กโทรด (Stand)	<input type="checkbox"/>	<input type="checkbox"/>	
		Turbidimeter			
<input type="checkbox"/>	<input type="checkbox"/>	16. ค่าความขุ่นที่ต่ำสุด (No Sample)	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0)	<input type="checkbox"/>	<input type="checkbox"/>	
		Automatic titrator			
<input type="checkbox"/>	<input type="checkbox"/>	18. สภาพ Piston Burettes	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	19. Function Rinsing and Dosing	<input type="checkbox"/>	<input type="checkbox"/>	
<input type="checkbox"/>	<input type="checkbox"/>	20. ระบบท่อสายยางและอุปกรณ์ประกอบ	<input type="checkbox"/>	<input type="checkbox"/>	

เพิ่มเติม/ข้อแนะนำ :

Mr.Preecha Phooarsai
Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตห้วยขวาง กรุงเทพมหานคร 10260
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-R31-03: 20 Jul 2022



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

Certificate of Calibration

Cert. No.: 24TM762
Page.: 1 of 3

Equipment : COD Reactor Block
Manufacturer : Environment Express a Cole-Parmer Company
Model : B3000-240
Serial No. : 2022CODW149
ID No. : RYG_EN0207
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,
Rayong 21140 Thailand
Wet Chemistry Lab
Location :
Received Order : 25 April 2024
Calibration Date : 25 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :
Approved Signatory

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

Issue Date : 2 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : COD Reactor Block
Condition As-Received : Used Item
Reference : 2404-0440OC-2
Procedure Used :-

Cert. No.: 24TM762
Page.: 2 of 3

As agreed with customer the calibration was perform using in-house calibration method according to directed 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	MY44073381	23LM95	TPA	19 Jun 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

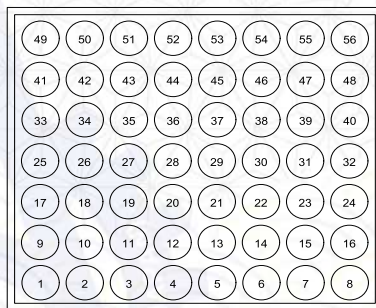
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Alumina (Aluminium Hydroxide)

Environment during calibration		
	Beginning	Finished
Temp.(°C)	23	23
REL.Humi.(%)	50	57
AC Supply (Volt)	222	222



Environmental
Express

Top View

Position	49	50	51	52	53	54	55	56
Ref. Std./ID No.:	23-01TC-09	23-01TC-10	23-01TC-01	23-01TC-02	23-01TC-03	23-01TC-04	23-01TC-05	23-01TC-06
Position	41	42	43	44	45	46	47	48
Ref. Std./ID No.:	23-01TC-01	23-01TC-02	23-01TC-03	23-01TC-04	23-01TC-05	23-01TC-06	23-01TC-07	23-01TC-08
Position	33	34	35	36	37	38	39	40
Ref. Std./ID No.:	23-01TC-03	23-01TC-04	23-01TC-05	23-01TC-06	23-01TC-07	23-01TC-08	23-01TC-09	23-01TC-10
Position	25	26	27	28	29	30	31	32
Ref. Std./ID No.:	23-01TC-05	23-01TC-06	23-01TC-07	23-01TC-08	23-01TC-09	23-01TC-10	23-01TC-01	23-01TC-02
Position	17	18	19	20	21	22	23	24
Ref. Std./ID No.:	23-01TC-07	23-01TC-08	23-01TC-09	23-01TC-10	23-01TC-01	23-01TC-02	23-01TC-03	23-01TC-04
Position	9	10	11	12	13	14	15	16
Ref. Std./ID No.:	23-01TC-09	23-01TC-10	23-01TC-01	23-01TC-02	23-01TC-03	23-01TC-04	23-01TC-05	23-01TC-06
Position	1	2	3	4	5	6	7	8
Ref. Std./ID No.:	23-01TC-01	23-01TC-02	23-01TC-03	23-01TC-04	23-01TC-05	23-01TC-06	23-01TC-07	23-01TC-08



Equipment : COD Reactor Block
Condition As-Received : Used Item
Reference : 2404-0440OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM762
Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
150.0	148.5	148.5	0.14	1.6	1.9	1.0	2.00

Calibration Point (°C)	Average Standard Reading (°C)							
	Position							
150.0	49	50	51	52	53	54	55	56
	149.383	149.591	149.399	150.287	150.086	150.023	150.186	149.840
	41	42	43	44	45	46	47	48
	149.277	149.916	150.729	149.538	150.326	150.037	150.056	149.388
	33	34	35	36	37	38	39	40
	149.312	149.239	149.802	149.928	149.886	149.301	149.359	149.444
	25	26	27	28	29	30	31	32
	150.327	150.033	149.788	149.553	150.069	150.268	149.765	149.628
	17	18	19	20	21	22	23	24
	149.788	149.553	150.069	150.268	149.787	150.138	150.267	150.001
	9	10	11	12	13	14	15	16
	149.431	150.268	149.787	150.138	150.267	150.001	150.327	150.033
	1	2	3	4	5	6	7	8
	149.068	149.587	149.759	149.442	150.454	150.555	149.525	149.741

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

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

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

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

UUC* : Unit Under Calibration

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

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

-o0o-

**QUALITY CALIBRATION CO., LTD.**235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584CERTIFICATE No : 24E6416
REFERENCE No : 73694-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER

MANUFACTURER : HANNA

MODEL : HI 3512

SERIAL No : TH118035

ID No : pH 04/56

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 : 27-Jun-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24

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, Bangkae, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24E6416

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER

MANUFACTURER : HANNA

ID No : pH 04/56

RECEIVED DATE : 24-Jun-24

AMBIENT TEMPERATURE : 23 ° C ± 3 ° C

MODEL : HI 3512

SERIAL NUMBER : TH118035

CALIBRATION DATE : 27-Jun-24

RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD BASED ON WI-TQ-062 AND WI-TQ-063. THE DISPLAY UNIT WAS TESTED BY GENERATING STANDARD VOLTAGE TO THE UNIT AND READING THE VALUE COMPARED WITH THE CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC784945	4880-14413915	24-Aug-25
2) pH STANDARD SOLUTION	00651-08	CC785578	4881-14430633	31-Aug-25
3) pH STANDARD SOLUTION	00651-10	CC787086	4882-14483317	21-Sep-25
4) PROCESS CALIBRATOR	CA150	91S6079	24E1251	09-Apr-25
5) BATH	260014	1247 48074	23T9014	13-Sep-24
6) THERMOMETER WITH PROBE	421504	55000379	23T9623	13-Sep-24

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 SI UNIT MAINTAINED AT :-
 - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : ADJUSTMENT**1. DISPLAY UNIT ONLY**SLOPE FACTOR $k = 2.303 \text{ RT/F} = 59 \text{ mV/pH}$

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.8	-0.69	-0.115	0.15	2.00
354.95	355.5	-0.55	0.884	0.15	2.00
295.80	296.4	-0.60	1.885	0.15	2.00
236.64	237.1	-0.46	2.886	0.15	2.00
177.48	178.0	-0.52	3.887	0.15	2.00
118.32	118.8	-0.48	4.887	0.15	2.00
59.16	59.6	-0.44	5.887	0.15	2.00
0.00	0.4	-0.40	6.888	0.15	2.00
-59.16	-58.7	-0.46	8.101	0.15	2.00
-118.32	-117.9	-0.42	9.345	0.15	2.00
-177.48	-177.4	-0.08	10.589	0.15	2.00
-236.64	-236.4	-0.24	11.834	0.15	2.00
-295.80	-294.5	-1.30	13.077	0.15	2.00
-354.95	-354.7	-0.25	14.322	0.15	2.00
-414.11	-413.9	-0.21	15.565	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3

F-G010 REV 03



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CERTIFICATE No : 24E6416

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE):

2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm pH)	COVERAGE FACTOR k
4.015	4.011	0.004	3.905	0.012	2.00
7.003	7.003	0.000	6.972	0.012	2.00
10.009	10.014	-0.005	9.570	0.014	2.00

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ($^{\circ}$ C)	UUC READING ($^{\circ}$ C)	CORRECTION ($^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm $^{\circ}$ C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

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 APPROXIMATELY 95%.

END OF CALIBRATION REPORT



QUALITY CALIBRATION CO.,LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160
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www.qcalibration.com



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	OK-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

1. ZERO SETTING FUNCTION : NORMAL

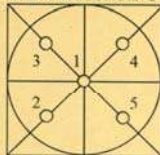
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g

4. 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	100.0001	-0.0001	0.00019
120.00	120.0002	-0.0002	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



F-G0



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, Bangkae, 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

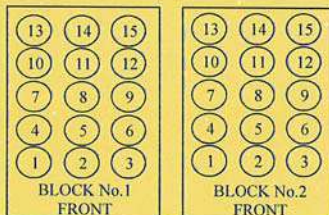
CONDITION OF THIS RESULTS OF CALIBRATION

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 MULTIPLYING COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



F-G0



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

Customer : S.P.S.Consulting Service Co.,Ltd Date Tested: January 6, 2025
Recommendation Recertification
Address : 7 Soi Phaholyothin 24 Period 6 Months
Paholyothin Road Recertification Due: July 6, 2025
Jompol Chatuchak, Bangkok 1090 Date Last Certified: July 4, 2024
User Name: K.Phenpha Vipasthawat Visit Number: 2 of 2
Phone: 083-9269252 PerkinElmer Phone: 02-719-6420 ext 206
Fax: 02-513-4221 PerkinElmer Fax: 02-318-5597

CONFIGURATION TESTED

MODEL SERIAL NUMBER
OPTIMA 5300DV 077C7042401

TESTED EQUIPMENT CALIBRATION NUMBER

IPV Methods

TEST STANDARD USED PART NUMBER
Multielement Standard N069-1579
Wavecal Solution N058-2152
VIS Wavecal solution N930-2946
Instrument Cal. STD4 N930-0221

CUSTOMER SUPPLIED COMMENTS
2 % HNO3
10 % HNO3

ACCESSORIES/COMPONENT NOT INCLUDED

EXPIRATION

EXPIRATION DATE
December 30, 2025
April 30, 2025
December 30, 2025
August 30, 2025

CUSTOMER INITIALS

Page 1 of 4

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkok, Huay Kwang, Bangkok 10310 Head Office



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401
DATE TESTED January 6, 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 : January 6, 2025

PARAMETER	SPECIFICATION			FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	0.00519	
	Ni	231.604 nm	≤ 0.008	0.00667	
	Ni	341.476 nm	≤ 0.012	0.00757	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	0.01621	
	Ba	455.403 nm	≤ 0.025	0.02183	
Precision	As	193.656 nm	% RSD < 1.0	0.51	%
	Zn	213.856 nm	% RSD < 1.0	0.48	%
	Mn	257.610 nm	% RSD < 1.0	0.03	%
	La	379.478 nm	% RSD < 1.0	0.05	%
	Ba	455.403 nm	% RSD < 1.0	0.07	%
	Ba	493.408 nm	% RSD < 1.0	0.04	%
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)	12.41	ppb
	Zn	213.856 nm	3(sd)	0.91	ppb
	Mn	257.610 nm	3(sd)	0.13	ppb
	La	379.478 nm	3(sd)	4.74	ppb
	Ba	455.403 nm	3(sd)	0.10	ppb
	Ba	493.408 nm	3(sd)	0.18	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	14.22	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	6.14	



MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED January 6, 2025**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)
Service Engineer

คุณภาพอากาศในการทำงาน



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sale@spscn.com, www.spscn.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature 25 ± 3 °C
Pressure 1010 ± 15 mmbar

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)			y		R ²	
					1	2	3	1	2	3				
B41	SKC	224-PCXR4	612669	03/04/2025	1,000	1,500	2,000	1,005	1,502	2,004	1.003x - 8.923		1.000	
B42	SKC	224-PCXR4	626041	03/04/2025	1,000	1,500	2,000	1,004	1,501	2,008	1.007x - 13.856		1.000	
B43	SKC	224-PCXR4	034636	01/04/2025	1,000	1,500	2,000	1,012	1,497	1,996	0.990x + 13.132		1.000	
B44	SKC	224-PCXR8	529341	01/04/2025	1,000	1,500	2,000	1,011	1,511	2,008	1.002x - 0.860		0.999	
B45	SKC	224-PCXR8	529594	04/04/2025	1,000	1,500	2,000	993	1,512	2,003	1.009x - 14.476		1.000	
B46	SKC	224-PCXR8	566743	04/04/2025	1,000	1,500	2,000	1,008	1,508	2,008	1.000x - 0.100		0.999	
B47	SKC	224-PCXR8	566747	04/04/2025	1,000	1,500	2,000	999	1,510	2,010	1.010x - 14.444		1.000	
B48	SKC	224-PCXR8	566753	01/04/2025	1,000	1,500	2,000	1,010	1,506	2,006	0.999x + 2.782		1.000	
B49	SKC	224-PCXR8	566780	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,004	1.003x - 2.183		1.000	
B50	SKC	224-PCXR8	500400	04/04/2025	1,000	1,500	2,000	1,002	1,493	1,995	0.994x + 5.841		1.000	
B51	SKC	224-PCXR8	500363	04/04/2025	1,000	1,500	2,000	998	1,511	2,011	1.013x - 19.465		0.999	
B52	SKC	224-PCXR8	093186	02/04/2025	1,000	1,500	2,000	997	1,505	2,006	1.008x - 12.641		1.000	
B53	SKC	224-PCXR8	707670	02/04/2025	1,000	1,500	2,000	1,004	1,503	2,007	1.007x - 7.992		1.000	
B54	SKC	224-PCXR3	509821	02/04/2025	1,000	1,500	2,000	1,005	1,504	2,008	1.010x - 15.060		0.999	
B55	SKC	224-PCXR3	510710	02/04/2025	1,000	1,500	2,000	1,001	1,495	1,997	0.996x + 5.073		1.000	
B56	SKC	224-PCXR3	511450	02/04/2025	1,000	1,500	2,000	1,005	1,494	1,996	0.991x - 13.385		1.000	
B57	SKC	224-PCXR3	510798	03/04/2025	1,000	1,500	2,000	997	1,511	2,009	1.014x - 21.540		0.999	
B58	SKC	224-PCXR3	509852	03/04/2025	1,000	1,500	2,000	1,006	1,493	2,002	1.001x - 4.094		1.000	
B59	SKC	224-PCXR3	509862	03/04/2025	1,000	1,500	2,000	995	1,502	2,003	1.012x - 21.564		1.000	
B60	SKC	224-PCXR3	512655	03/04/2025	1,000	1,500	2,000	998	1,507	2,004	1.010x - 18.510		0.999	
B61	SKC	224-PCXR3	503915	03/04/2025	1,000	1,500	2,000	997	1,499	2,001	1.002x - 4.374		1.000	
B62	SKC	224-PCXR3	505975	01/04/2025	1,000	1,500	2,000	1,002	1,503	2,005	1.008x - 11.138		1.000	
B63	SKC	224-PCXR3	511432	04/04/2025	1,000	1,500	2,000	998	1,502	1,996	0.996x + 3.970		1.000	
B64	SKC	224-PCXR3	508302	04/04/2025	1,000	1,500	2,000	1,005	1,509	2,008	1.009x - 10.402		1.000	
B65	SKC	224-PCXR3	508330	04/04/2025	1,000	1,500	2,000	1,004	1,503	2,007	1.010x - 14.088		1.000	
B66	SKC	224-PCXR3	509861	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,010	1.008x - 12.369		1.000	
B67	SKC	224-PCXR3	506295	04/04/2025	1,000	1,500	2,000	1,002	1,498	2,004	0.998x + 4.290		1.000	
B68	SKC	224-PCXR3	505872	04/04/2025	1,000	1,500	2,000	999	1,504	1,998	1.000x + 0.436		1.000	
B69	SKC	224-PCXR3	508375	02/04/2025	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501		1.000	
B70	SKC	224-PCXR3	510623	02/04/2025	1,000	1,500	2,000	996	1,497	2,005	1.005x - 8.735		1.000	
B71	SKC	224-PCXR3	508367	02/04/2025	1,000	1,500	2,000	1,013	1,505	2,009	1.000x + 3.294		0.999	
B72	SKC	224-PCXR3	505977	02/04/2025	1,000	1,500	2,000	997	1,494	2,003	1.006x - 11.350		1.000	
B73	SKC	224-PCXR3	512606	01/04/2025	1,000	1,500	2,000	1,010	1,507	2,004	0.998x + 5.129		1.000	
B74	SKC	224-PCXR3	505993	01/04/2025	1,000	1,500	2,000	998	1,499	2,010	1.009x - 11.942		1.000	
B75	SKC	224-PCXR3	509820	01/04/2025	1,000	1,500	2,000	995	1,511	2,004	1.011x - 18.966		0.999	
B76	SKC	224-PCXR3	509811	01/04/2025	1,000	1,500	2,000	998	1,504	2,010	1.012x - 20.993		0.999	
B77	SKC	224-PCXR3	508301	03/04/2025	1,000	1,500	2,000	1,007	1,509	2,008	1.001x + 3.750		1.000	
B78	SKC	224-PCXR3	510677	04/04/2025	1,000	1,500	2,000	998	1,508	2,001	1.003x - 3.278		1.000	
B79	SKC	224-PCXR3	510920	04/04/2025	1,000	1,500	2,000	1,001	1,501	1,994	0.999x - 1.819		1.000	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature 25 ± 3 °C
Pressure 1010 ± 15 mmbar

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)			y		R ²	
					1	2	3	1	2	3				
B80	SKC	224-PCXR3	504569	04/04/2025	1,000	1,500	2,000	1,010	1,515	1,999	0.989x + 14.683		0.999	
B81	SKC	224-PCXR3	503480	02/04/2025	1,000	1,500	2,000	1,007	1,499	1,998	0.997x + 2.890		1.000	
B82	SKC	224-PCXR3	505673	02/04/2025	1,000	1,500	2,000	999	1,511	2,004	1.007x - 11.710		1.000	
B83	SKC	224-PCXR3	510785	02/04/2025	1,000	1,500	2,000	1,005	1,504	2,008	1.005x - 5.353		1.000	
B84	SKC	224-PCXR3	508333	03/04/2025	1,000	1,500	2,000	998	1,508	2,002	1.003x - 4.482		1.000	
B85	SKC	224-PCXR3	505757	03/04/2025	1,000	1,500	2,000	1,010	1,499	2,006	0.999x + 0.820		0.999	
B86	SKC	224-PCXR3	512625	04/04/2025	1,000	1,500	2,000	1,003	1,494	1,998	0.993x + 6.616		1.000	
B87	SKC	224-PCXR3	504324	04/04/2025	1,000	1,500	2,000	1,004	1,506	2,000	1.000x - 1.787		1.000	
B88	SKC	224-PCXR3	508307	04/04/2025	1,000	1,500	2,000	1,002	1,511	2,009	1.009x - 12.753		0.999	
B89	SKC	224-PCXR3	509860	04/04/2025	1,000	1,500	2,000	999	1,504	1,997	0.998x + 1.835		1.000	
B90	SKC	224-PCXR3	508366	04/04/2025	1,000	1,500	2,000	1,004	1,498	2,004	0.997x + 4.382		1.000	
B91	SKC	224-PCXR3	510919	02/04/2025	1,000	1,500	2,000	997	1,495	2,002	1.005x - 9.911		1.000	
B92	SKC	224-PCXR3	510987	02/04/2025	1,000	1,500	2,000	1,012	1,507	2,004	0.997x + 7.928		1.000	
B93	SKC	224-PCXR3	509845	02/04/2025	1,000	1,500	2,000	998	1,499	2,010	1.009x - 11.942		1.000	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136833

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)			y		
					1	2	3	1	2	3			R ²
R01	SKC	224-PCXR4	602467	02/04/2025	1,000	1,500	2,000	1,003	1,506	2,001	1.003x - 1.855	1.000	
R02	SKC	224-PCXR4	626450	02/04/2025	1,000	2,000	3,000	994	1,501	2,002	1.006x - 11.866	1.000	
R03	SKC	224-PCXR4	691592	01/04/2025	1,000	1,500	2,000	995	1,509	2,007	1.013x - 22.400	0.999	
R04	SKC	224-PCXR4	691672	02/04/2025	1,000	1,500	2,000	996	1,502	1,996	0.999x + 0.668	1.000	
R05	SKC	224-PCXR4	798470	04/04/2025	1,000	1,500	2,000	995	1,511	2,005	1.010x - 16.711	0.999	
R06	SKC	224-PCXR4	798456	04/04/2025	1,000	1,500	2,000	1,002	1,499	2,003	1.004x - 5.745	1.000	
R07	SKC	224-PCXR4	798480	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,007	1.011x - 16.099	0.999	
R08	SKC	224-PCXR4	883215	04/04/2025	1,000	1,500	2,000	1,002	1,503	2,004	1.014x - 23.623	0.999	
R09	SKC	224-PCXR4	034630	02/04/2025	1,000	1,500	2,000	999	1,497	2,011	1.009x - 11.282	1.000	
R10	SKC	224-PCXR4	091765	01/04/2025	1,000	1,500	2,000	1,002	1,505	2,003	1.012x - 20.705	0.999	
R11	SKC	224-PCXR4	091763	02/04/2025	1,000	1,500	2,000	997	1,504	2,005	1.005x - 4.550	1.000	
R12	SKC	224-PCXR4	091568	02/04/2025	1,000	1,500	2,000	998	1,513	2,004	1.015x - 25.798	0.999	
R13	SKC	224-PCXR4	091638	03/04/2025	1,000	1,500	2,000	996	1,502	1,999	1.003x - 5.821	1.000	
R14	SKC	224-PCXR4	091764	03/04/2025	1,000	1,500	2,000	1,002	1,503	1,997	0.997x + 5.785	1.000	
R15	SKC	224-PCXR8	529457	01/04/2025	1,000	1,500	2,000	996	1,501	2,001	1.002x - 5.453	1.000	
R16	SKC	224-PCXR8	529643	02/04/2025	1,000	1,500	2,000	999	1,506	1,998	0.998x + 4.829	1.000	
R17	SKC	224-PCXR8	529645	02/04/2025	1,000	1,500	2,000	993	1,504	2,004	1.009x - 19.210	1.000	
R18	SKC	224-PCXR8	566756	04/04/2025	1,000	1,500	2,000	1,005	1,503	2,008	1.007x - 9.639	1.000	
R19	SKC	224-PCXR8	566802	04/04/2025	1,000	1,500	2,000	996	1,495	1,997	1.000x - 2.051	1.000	
R20	SKC	224-PCXR8	529089	02/04/2025	1,000	1,500	2,000	999	1,498	1,999	1.004x - 12.497	1.000	
R21	SKC	224-PCXR8	665728	02/04/2025	1,000	1,500	2,000	994	1,502	1,996	1.000x - 2.818	1.000	
R22	SKC	224-PCXR8	707444	03/04/2025	1,000	1,500	2,000	999	1,507	2,004	1.009x - 16.403	0.999	
R23	SKC	224-PCXR8	761067	03/04/2025	1,000	1,500	2,000	997	1,496	1,997	1.001x - 3.342	1.000	
R24	SKC	224-PCXR8	707893	02/04/2025	1,000	1,500	2,000	1,005	1,504	2,012	1.008x - 11.430	0.999	
R25	SKC	224-PCXR8	761052	01/04/2025	1,000	1,500	2,000	1,002	1,493	2,010	1.006x - 8.771	1.000	
R26	SKC	224-PCXR8	707956	02/04/2025	1,000	1,500	2,000	997	1,504	1,997	1.001x - 2.663	1.000	
R27	SKC	224-PCXR8	707398	02/04/2025	1,000	1,500	2,000	996	1,495	2,001	1.007x - 19.305	0.999	
R28	SKC	224-PCXR8	707481	03/04/2025	1,000	1,500	2,000	1,013	1,507	2,004	0.996x + 9.887	1.000	
R29	SKC	224-PCXR8	707402	04/04/2025	1,000	1,500	2,000	998	1,499	2,010	1.010x - 19.297	1.000	
R30	SKC	224-PCXR8	093811	02/04/2025	1,000	1,500	2,000	1,008	1,505	2,008	1.006x - 6.261	1.000	
R31	SKC	224-PCXR8	093183	02/04/2025	1,000	1,500	2,000	1,002	1,501	1,994	0.998x - 0.140	1.000	
R32	SKC	224-PCXR8	671930	01/04/2025	1,000	1,500	2,000	1,001	1,498	1,997	0.997x + 3.786	1.000	
R33	SKC	224-PCXR4	626254	01/04/2025	1,000	1,500	2,000	1,006	1,497	2,001	0.995x + 7.736	1.000	
R34	SKC	224-PCXR4	626131	01/04/2025	1,000	1,500	2,000	994	1,506	2,006	1.009x - 17.998	1.000	
R35	SKC	224-PCXR8	707460	01/04/2025	1,000	1,500	2,000	1,006	1,505	2,014	1.010x - 14.668	0.999	
R36	SKC	224-PCXR8	707446	04/04/2025	1,000	1,500	2,000	998	1,500	1,995	1.000x - 2.067	1.000	
R37	SKC	224-PCXR8	707432	02/04/2025	1,000	1,500	2,000	1,005	1,494	2,006	0.998x + 4.721	1.000	
R38	SKC	224-PCXR8	707349	03/04/2025	1,000	1,500	2,000	996	1,511	2,007	1.012x - 19.485	0.999	
R39	SKC	224-PCXR8	761095	02/04/2025	1,000	1,500	2,000	1,005	1,505	2,008	1.004x - 4.026	1.000	

Calibrated by :

(Mr. Adul Dangkom)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompet, Chulachak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136833

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)			y		
					1	2	3	1	2	3			R ²
R40	SKC	224-PCXR4	612753	03/04/2025	1,000	1,500	2,000	1,013	1,505	2,008	0.996x + 6.748	0.999	
R41	SKC	224-PCXR4	626140	01/04/2025	1,000	1,500	2,000	1,006	1,506	2,009	1.005x - 6.157	1.000	
R42	SKC	224-PCXR4	626463	02/04/2025	1,000	1,500	2,000	1,005	1,495	2,002	0.997x + 5.089	1.000	
R43	SKC	224-PCXR4	626129	04/04/2025	1,000	1,500	2,000	1,004	1,504	2,008	1.011x - 15.436	1.000	
R44	SKC	224-PCXR4	602753	02/04/2025	1,000	1,500	2,000	999	1,492	2,001	1.004x - 15.988	0.999	
R45	SKC	224-PCXR4	626137	03/04/2025	1,000	1,500	2,000	1,001	1,501	1,996	0.994x + 9.247	1.000	

Calibrated by :

(Mr. Peera Detudom)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spicon.com, www.spicon.com

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	02/04/2025	500	1,000	2,000	499.6	998.8	2004.8	1.001x - 3.678	1.000
H-R02	Dwyer	VFB-65	02/04/2025	500	1,000	2,000	501.7	997.1	1991.5	0.998x + 0.386	0.999
H-R03	Dwyer	VFB-65	01/04/2025	500	1,000	2,000	499.8	999.7	1992.8	1.000x + 1.316	1.000
H-R04	Dwyer	VFB-65	04/04/2025	500	1,000	2,000	500.2	999.4	1989.2	0.999x + 1.870	0.999
H-R05	Dwyer	VFB-65	04/04/2025	500	1,000	2,000	499.9	1000.8	1994.5	1.000x + 0.815	1.000
H-R06	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	500.5	1001.3	1990.7	0.997x + 4.894	0.999

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudorn)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spicon.com, www.spicon.com

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	02/04/2025	50	100	200	50.7	101.0	199.3	0.995x + 1.197	1.000
L-R02	Dwyer	VFA-21	02/04/2025	50	100	200	49.8	100.7	199.1	1.001x - 0.303	1.000
L-R03	Dwyer	VFA-21	01/04/2025	50	100	200	50.1	101.2	200.9	1.005x - 0.447	0.999
L-R04	Dwyer	VFA-21	04/04/2025	50	100	200	50.2	100.9	201.5	0.994x + 1.311	1.000
L-R05	Dwyer	VFA-21	04/04/2025	50	100	200	50.4	100.7	201.6	0.999x + 0.781	1.000
L-R06	Dwyer	VFA-21	03/04/2025	50	100	200	49.8	101.2	201.8	1.003x - 0.149	0.999

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudorn)



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 :

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.



F-G010 REV 03



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.

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

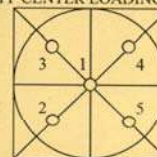
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000071 g
4. 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





MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	<u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested:	<u>January 6, 2025</u>
Address :	<u>7 Soi Phaholyothin 24</u>	Recommendation Recertification	
	<u>Paholyothin Road</u>	Period	<u>6</u> Months
	<u>Jompol Chatuchak, Bangkok 1090</u>	Recertification Due:	<u>July 6, 2025</u>
User Name:	<u>K.Phenpha Vipasthawatt</u>	Date Last Certified:	<u>July 4, 2024</u>
Phone:	<u>083-9269252</u>	Visit Number:	<u>2 of 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	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2025</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>April 30, 2025</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>December 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>August 30, 2025</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER	<u>077C7042401</u>	DATE TESTED	<u>January 6, 2025</u>
1. MECHANICAL CHECKS			
A. Inspect and clean all fans and filters.			<input type="text" value="OK"/>
B. Inspect and replace as necessary, all torch components including the RF coil.			<input type="text" value="OK"/>
C. Inspect all tubing for sign of clacking or leaking.			<input type="text" value="OK"/>
D. Adjust water and gas pressure regulator settings.			<input type="text" value="OK"/>
E. Inspect and leak check pneumatics drawers.			<input type="text" value="OK"/>
F. Clean the exterior of the instrument.			<input type="text" value="OK"/>
2. OPTICAL CHECKS			
A. Inspect and clean all optical components.			<input type="text" value="OK"/>
B. As required, check and replace all purgefilters.			<input type="text" value="OK"/>
C. Recheck optical alignment.			<input type="text" value="OK"/>
3. COOLING SYSTEM CHECKS			
A. Perform preventive maintenance on chiller.			<input type="text" value="OK"/>
B. Flush out the chiller every year.			<input type="text" value="N/A"/>
4. PERFORMANCE CHECKS			
A. Torch View Alignment.			<input type="text" value="OK"/>
B. Wavelength Calibration.			<input type="text" value="OK"/>



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 DATE TESTED : January 6, 2025

PARAMETER	SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00519	
	Ni 231.604 nm	≤ 0.008	0.00667	
	Ni 341.476 nm	≤ 0.012	0.00757	
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01621	
	Ba 455.403 nm	≤ 0.025	0.02183	
Precision	As 193.656 nm	% RSD < 1.0	0.51	%
	Zn 213.856 nm	% RSD < 1.0	0.48	%
	Mn 257.610 nm	% RSD < 1.0	0.03	%
	La 379.478 nm	% RSD < 1.0	0.05	%
	Ba 455.403 nm	% RSD < 1.0	0.07	%
	Ba 493.408 nm	% RSD < 1.0	0.04	%
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)	12.41	ppb
	Zn 213.856 nm	3(sd)	0.91	ppb
	Mn 257.610 nm	3(sd)	0.13	ppb
	La 379.478 nm	3(sd)	4.74	ppb
	Ba 455.403 nm	3(sd)	0.10	ppb
	Ba 493.408 nm	3(sd)	0.18	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	14.22	
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	6.14	

Page 3 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 6, 2025

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)

Service Engineer

Page 4 of 4



Certificate of Calibration

Aquion: Anion (ID#894)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

S.P.S. Consulting Service Co., Ltd.

Operator Signature:  Date: June 24, 2024

(Mr. Ponwut Kornthongnimit)

Test Engineer

ระดับความร้อนในการทำงาน



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR25030358-6 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Metrosonics

Model : hs-32

Serial Number : MCE030011

ID. Number : B21

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C Received Date : 19 Mar 2025

Relative Humidity : 50 % ± 15 % Calibration Date : 27 Mar 2025

Location of Calibration : In-Lab Recommend Due Date : 27 Mar 2026

Calibration Procedure : SP-CPT-04-13 Date of Issue : 28 Mar 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Surasak Ritthikaew

Calibration Officer

Approved by :

(Mr.Prayoon Topart)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR25030358-6 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR25010173-14	30 Jan 2026
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2026

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.

NA - NA Caltechnologies Co., Ltd.



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR25030358-6

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	29.985	29.8	-0.185	0.20
35.0	34.988	34.8	-0.188	0.20
40.0	39.990	39.9	-0.090	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	29.985	29.7	-0.285	0.20
35.0	34.988	34.7	-0.288	0.20
40.0	39.990	39.8	-0.190	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	29.985	29.7	-0.285	0.20
35.0	34.988	34.7	-0.288	0.20
40.0	39.990	39.7	-0.290	0.20

Note :

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -



Heat R013

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B21	Verification Date :	08 April 2025
Brand :	METROSINCS	Ambient Temp. :	24.5 °C
Model :	hs-32	Barometric Pressure :	1011 mmbar
Serial No. :	MCE030011	Relative Humidity :	49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :

(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR25030358-2 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 32

Serial Number : TPH050015

ID. Number : B32

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C

Relative Humidity : 50 % ± 15 %

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 19 Mar 2025

Calibration Date : 22 Mar 2025

Recommend Due Date : 22 Mar 2026

Date of Issue : 23 Mar 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, with the approval of SP Metrology System (Thailand).

Calibrated by : Mr. Navaporn Uengseng

Calibration Officer

Approved

(Mr. Pootthipong A.)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR25030358-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR25010173-14	30 Jan 2026
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2026

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.
NA - NA Caltechnologies Co., Ltd.



Result of Calibration

Certificate Number : SPR25030358-2

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.015	29.9	-0.115	0.20
35.0	35.012	34.9	-0.112	0.20
40.0	40.016	39.9	-0.116	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.015	30.0	-0.015	0.20
35.0	35.012	35.0	-0.012	0.20
40.0	40.016	40.0	-0.016	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.015	30.2	0.185	0.20
35.0	35.012	35.2	0.188	0.20
40.0	40.016	40.2	0.184	0.20

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor $k = 2$, providing a level of confidence approximately 95%.

- End of Certificate -



Heat R013

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No. :	B32	Verification Date :	08 April 2025
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp ^o 32	Barometric Pressure :	1011 mmbar
Serial No. :	TPH050015	Relative Humidity :	49 %

Verification Module (Electronic Sensor Check) :

Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.3	-0.2	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.1	0.2	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by :

(Mr.Adul Dangklom)

Approved by :