

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. R06	Digital Balance
Particulate Matter less than 10 microns (PM-10)	High Volume PM-10 Air Sampler Rec No. Blow No. R03	Digital Balance
Nitrogen Dioxide (NO _x)	NO/NO ₂ /NO _x Analyzer No. B02, B13	NO/NO ₂ /NO _x Analyzer No. B02, B13
2. คุณภาพอากาศจากแหล่งกำเนิด Total Suspended Particulate (TSP)	Console No. B04 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-R13, R23, R24, R25	-
L _{eq} 1 hr, L _{eq} 8 hr และ Noise Dose	Acoustic Calibrator Sound Level Meter ACO No. R02, R03, R06, R41, R50, R51	-
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. R15, R19 Rotameter No. H-R02	Digital Balance
Respirable Dust	Personal Pump SKC No. R38 Rotameter No. H-R02	Digital Balance
Aluminum	Personal Pump SKC No. R34, B77 Rotameter No. H-R02	ICP

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ระยะดำเนินการ) (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
5. คุณภาพอากาศในสถานที่ทำงาน (ต่อ) Hydrogen Fluoride	Personal Pump SKC No. B54 Rotameter No. H-R02	Ion Chromatography
Oil Mist	Personal Pump SKC No. R30 Rotameter No. H-R02	Ion Chromatography
6. ระดับความร้อนในการทำงาน WBGT	Heat Stress WBGT Meter No. R04, B32, B33	-

คุณภาพอากาศในบรรยากาศ



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High Volume Air Sampler Calibration Report

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

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	04/11/2025	$y = 1.088x - 1.183$	0.997
B36	B36	04/11/2025	$y = 1.131x - 2.774$	0.996
B37	B37	04/11/2025	$y = 1.068x + 0.301$	0.999
B38	B38	03/11/2025	$y = 1.109x - 3.757$	0.998
B39	B39	03/11/2025	$y = 1.027x + 0.098$	0.999
B40	B40	04/11/2025	$y = 1.117x - 1.067$	0.997
B41	B41	04/11/2025	$y = 1.097x - 1.570$	0.997
B42	B42	04/11/2025	$y = 1.142x - 3.608$	0.997
B43	B43	05/11/2025	$y = 1.100x - 0.506$	0.998
B44	B44	05/11/2025	$y = 1.149x - 3.077$	0.999
R01	R01	05/11/2025	$y = 1.114x - 0.751$	0.998
R02	R02	03/11/2025	$y = 1.144x - 3.923$	0.999
R03	R03	03/11/2025	$y = 1.161x - 4.126$	0.999
R04	R04	03/11/2025	$y = 1.113x - 2.188$	0.997
R05	R05	03/11/2025	$y = 1.139x - 0.779$	0.999
R06	R06	03/11/2025	$y = 1.106x - 1.148$	0.996
R07	R07	03/11/2025	$y = 1.128x - 3.641$	0.999
R08	R08	03/11/2025	$y = 1.135x - 4.572$	0.996
R09	R09	03/11/2025	$y = 1.121x - 4.112$	0.998
R10	R10	03/11/2025	$y = 1.117x - 2.052$	0.999
R11	R11	03/11/2025	$y = 1.110x - 2.812$	0.996
R12	R12	03/11/2025	$y = 1.120x - 1.259$	0.996
R13	R13	04/11/2025	$y = 1.146x - 5.407$	0.998
R14	R14	04/11/2025	$y = 1.150x - 3.484$	0.999
R15	R15	04/11/2025	$y = 1.143x - 5.066$	0.998
R16	R16	04/11/2025	$y = 1.153x - 6.481$	0.996
R17	R17	03/11/2025	$y = 1.126x - 3.877$	0.998
R18	R18	03/11/2025	$y = 1.147x - 5.065$	0.997
R19	R19	03/11/2025	$y = 1.119x - 4.625$	0.999
R20	R20	03/11/2025	$y = 1.148x - 4.605$	0.997



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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
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Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
R01	R01	03/11/2025	$y = 1.055x + 0.899$	0.998
R02	R02	03/11/2025	$y = 1.132x - 3.919$	0.998
R03	R03	03/11/2025	$y = 1.113x - 2.991$	0.996
R04	R04	03/11/2025	$y = 1.126x - 3.936$	0.996
R05	R05	04/11/2025	$y = 1.103x - 2.678$	0.996
R06	R06	04/11/2025	$y = 1.107x - 1.644$	0.996
R07	R07	04/11/2025	$y = 1.085x - 0.497$	0.998
R08	R08	03/11/2025	$y = 1.071x + 0.571$	0.998
R09	R09	03/11/2025	$y = 1.116x - 2.909$	0.999
R10	R10	03/11/2025	$y = 1.089x - 1.636$	0.996
R11	R11	03/11/2025	$y = 1.045x + 1.442$	0.999
R12	R12	03/11/2025	$y = 1.058x - 0.370$	0.998
R13	R13	03/11/2025	$y = 1.100x - 2.187$	0.998
R14	R14	03/11/2025	$y = 1.099x - 1.650$	0.999
R15	R15	03/11/2025	$y = 1.128x - 4.768$	0.997
R16	R16	05/11/2025	$y = 1.093x - 2.124$	0.997
R17	R17	05/11/2025	$y = 1.101x - 2.286$	0.997
R18	R18	05/11/2025	$y = 1.118x - 5.339$	0.999
R19	R19	03/11/2025	$y = 1.054x + 1.212$	0.996
R20	R20	03/11/2025	$y = 1.068x - 1.764$	0.997



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	30 November 2025	BRAND :	API	MODEL :	200A
NO.	NOX-B02	SERIAL NO.	2409		
Calibrator (Dilution System)					
Brand :	Teledyne	Model :	700E		
Last Cal. Date :	29 October 2025	Serial No. :	201-S		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A006745V		
Certified Date :	12 March 2025	Expired Date :	12 March 2028	Cylinder Conc. :	48.7 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	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.004
NO _x Span	400	400.2	0.050	400.0	1.007
API Model 200A 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	507	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.9	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	670	V	420 - 900 constant		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	28.9	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCCELL PRESS	8.4	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 _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO _x Slope	1.007	-	1.0 ± 0.3		
NO Offset	0.9	mV	-20 to +150		
NO _x Offset	0.5	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	30 November 2025	BRAND :	API	MODEL :	200A
NO.	NOX-B13	SERIAL NO.	1983		
Calibrator (Dilution System)					
Brand :	Teledyne	Model :	700E		
Last Cal. Date :	29 October 2025	Serial No. :	201-S		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A006745V		
Certified Date :	12 March 2025	Expired Date :	12 March 2028	Cylinder Conc. :	48.7 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	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.002
NO _x Span	400	400.3	0.075	400.0	1.004
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	103.3	mV	-20 - 150		
AZERO	93.6	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	28.9	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	314.9	°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 _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.002	-	1.0 ± 0.3		
NO _x Slope	1.004	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO _x Offset	0.5	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

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 :

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

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

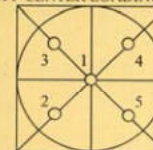
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

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	100.00001	-0.00001	0.00019
120.00	120.00002	-0.00002	0.00022

5. OFF-CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



คุณภาพอากาศจากแหล่งกำเนิด



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Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	ΔH_g (mmH ₂ O)
B01	1563	05/09/2025	1.004	49.67
B02	8002514	01/09/2025	1.002	49.85
B03	1503016	01/09/2025	1.005	49.77
B04	00006659	04/09/2025	0.997	49.93
B05	00007428	02/09/2025	1.003	49.51
R01	1561	01/09/2025	0.999	49.82
R02	8002513	01/09/2025	0.996	49.94
R03	1570	04/09/2025	0.998	50.02
R04	8002519	04/09/2025	1.002	49.89
R05	1503015	02/09/2025	0.996	50.10

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

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



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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	03/11/2025	0.85	0.84
B37	S	0.99	03/11/2025	0.84	0.84
B38	S	0.99	03/11/2025	0.84	0.84
B39	S	0.99	06/11/2025	0.84	0.85
B40	S	0.99	06/11/2025	0.84	0.84
B41	S	0.99	04/11/2025	0.85	0.84
B44	S	0.99	03/11/2025	0.84	0.84
B45	S	0.99	03/11/2025	0.84	0.84
B46	S	0.99	03/11/2025	0.85	0.84
B47	S	0.99	04/11/2025	0.84	0.83
B48	S	0.99	04/11/2025	0.85	0.84
B49	S	0.99	04/11/2025	0.84	0.84
B54	S	0.99	05/11/2025	0.85	0.84
B56	S	0.99	05/11/2025	0.84	0.85
B57	S	0.99	05/11/2025	0.84	0.84
B58	S	0.99	04/11/2025	0.84	0.85

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



CALIBRATION LABORATORY Co.,LTD.

2/10-11,14,55 Sol 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.	212301422
JOB CONTROL NO.	240720076546

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

DATE OF RECEIVED : 19 July 2025

DATE OF ISSUED: 24 July 2025

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

Calibrated By : Sittipong Pimdee
Calibration Engineer

Approved By :

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. Q24076546

F3-011-05/12-23

page 1 of 3



CALIBRATION LABORATORY Co.,LTD.

2110-11,14,55 Sol Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE	VACUUM GAUGE
MANUFACTURER	HI-LIGHT
MODEL/TYPE	N/A
SERIAL NO.	N/A [64-220088-1]
DATE OF CALIBRATION	23 July 2025
DUE DATE OF CALIBRATION	23 July 2026

ENVIRONMENT CONDITIONS

Temperature : (23 \pm 2) °C

Relative Humidity (55 \pm 10) %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 700PDS 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.

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. Q24076546

F3-011-05/12-23

page 2 of 3



QUALIFICATION LABORATORY Co., LTD.

2/1Q-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.qcalibration.com Email:sale@qcal-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	-15.07	-15.10	-4.5	-4.5	+0.5	+0.5
-10	-32.50	-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	-100.39	-100.39	-29.6	-29.6	+0.4	+0.4

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. Q24076546

F3-011-05/ 12-23



QUALITY CALIBRATION CO.,LTD.

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

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

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 :

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.



**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
ID No : BA05/50
AIR PRESSURE : 1009mbar \pm 1mbar
AMBIENT TEMPERATURE : 24°C \pm 1°C

MODEL : XS105DU
S/N : 1126422905
RECEIVED DATE : 07-Mar-25
CALIBRATION DATE : 07-Mar-25
RELATIVE HUMIDITY : 54 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

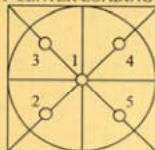
1. ZERO SETTING FUNCTION : NORMAL

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	100.00001	-0.00001	0.00019
120.00	120.00002	-0.00002	0.00022

5. OFF CENTER LOADING ERROR

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

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

END OF CALIBRATION REPORT

**SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY**

451-451/1 Sirinthon Road, Bangbunnu, Bangplud, Bangkok, 10700 Thailand

Tel. +66 2433 8331

Email : calibration@sithiporn.comSITHIPORN
associates

Cert. No. : SP25026

Pages : 1 of 4

Calibration Certificate

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

Condition As Found : GOOD

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

Location : ORGANIC LABORATORY IV

Ambient Temperature : (22.9 \pm 5) °C

Relative Humidity : (53.7 \pm 25) %

Received Date : 22 AUGUST 2025

Calibration Date : 22 AUGUST 2025

Date of Issue : 25 AUGUST 2025

Calibrated by :

Approved by :

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

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 2 of 4

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	126461	24/10/2026
Didymium liquid	RM-DL	28912	126462	24/10/2026
Neutral density filter	RM-1N2N3N	13877	126457	24/10/2026
Potassium dichromate solutions	RM-0204060810	14204	126497	25/10/2026
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)

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	278.21	0.08	0.16	2.00
	361.25	361.39	0.14	0.16	2.00
	467.82	467.71	-0.11	0.16	2.00
	536.56	536.50	-0.06	0.16	2.00
	640.50	640.36	-0.14	0.16	2.00
RM-DL	740.09	739.85	-0.24	0.16	2.00
	864.94	865.12	0.18	0.16	2.00

UUC* = Unit Under Calibration

Michon E.

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 3 of 4

Result of calibration : Photometric Accuracy

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	29381	0.5	0.5443	0.5413	-0.0030	0.0043	2.00
		29914	0.7	0.7484	0.7455	-0.0029	0.0054	2.00
		29360	1.0	1.0527	1.0535	0.0008	0.0032	2.00
	465.0	29381	0.5	0.4948	0.4922	-0.0026	0.0041	2.00
		29914	0.7	0.6906	0.6877	-0.0029	0.0050	2.00
		29360	1.0	0.9695	0.9709	0.0014	0.0031	2.00
	546.1	29381	0.5	0.5090	0.5068	-0.0022	0.0036	2.00
		29914	0.7	0.6985	0.6960	-0.0025	0.0041	2.00
		29360	1.0	0.9814	0.9825	0.0011	0.0031	2.00
	590.0	29381	0.5	0.5375	0.5353	-0.0022	0.0034	2.00
		29914	0.7	0.7256	0.7231	-0.0025	0.0037	2.00
		29360	1.0	1.0213	1.0219	0.0006	0.0032	2.00
	635.0	29381	0.5	0.5223	0.5202	-0.0021	0.0033	2.00
		29914	0.7	0.6927	0.6901	-0.0026	0.0036	2.00
		29360	1.0	0.9744	0.9750	0.0006	0.0032	2.00

UUC* = Unit Under Calibration

Michon B.

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 4 of 4

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Potassium dichromate solutions	235.0	20	0.2415	0.2443	0.0028	0.0101	2.00
		40	0.4866	0.4871	0.0005	0.0115	2.00
		60	0.7415	0.7295	-0.0120	0.0067	2.00
		80	0.9854	0.9844	-0.0010	0.0071	2.00
		100	1.2444	1.2425	-0.0019	0.0073	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 0.001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance
Wavelength Scan 190 nm - 1100 nm
Scanning Speed 7.5 nm/min
Band width(Wavelength) 1.0
Band width(Vis) 1.0
Band width(Uv) 1.0

Stray Light** UUC* Reading at 220.0 nm	
Transimission T(%)	Absorbance(A)
0.020	3.7032

**Specific Acceptance :

Transmission ≤ 1.0 T(%), Absorbance ≥ 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

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 :

Ambient Environment

Description : Sound Calibrator

Temperature : (23 ± 3) °C

Manufacturer : ACO

Relative Humidity : (50 ± 15) %

Model : 2127

Ambient Pressure : (101.325 ± 1.500) kPa

Serial No. : 130006

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 19 Feb. 2025

Date of Calibration : 21 Feb. 2025

1 / 2

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

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

FM.BLMTC.002 Rev.5

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Fax. (66) 0 2577 9009

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

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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 44/0268

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

Nominal Output of Unit Under Test = 94 dB re 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.

Appro

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

End of Certificate

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011268021900739001

2 / 2

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

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

FM.BLMTC.002 Rev.5

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



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
Tel : (662) 539-4370-72, Fax : (662) 513-4221, E-mail : sales@spscon.com, www.spscon.com

Noise R_706/25

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-R13	ACO	6236	00172041	30 November 2025	93.9	93.9
ACO-R22	ACO	6236	00182010	30 November 2025	93.9	93.9
ACO-R23	ACO	6236	00192035	30 November 2025	93.9	93.9
ACO-R24	ACO	6236	00192036	30 November 2025	93.9	93.9
ACO-R25	ACO	6236	00192037	30 November 2025	93.9	93.9

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research
(TISTR)

93.81 ± 0.10 dB

คุณภาพน้ำ



Agilent Technologies (Thailand) Limited
U CHU LIANG BLDG. 22/F UNIT A,D
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Bangkok 10500 Thailand

Tel: +662 637 6363
Fax: +662 632 4334
Email: ccc-smr@agilent.com
Website: www.agilent.com/chem

BKK_EL0043

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

TAX ID : 0105540004859

Chanattagarn.lmchom@alsglobal.com
27603068

Invoice To:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Delivery Site:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

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Service Request:	Service Request Date:
Service Order: 6007607368	Service Confirmation: 6906615981

Direct Inquiries to:

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Contact E-mail: ccc-smr@agilent.com
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Tax ID : 0105542068218

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399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007,
THB:Krun Thai Bank PCL
Siam Square Br.,416/1-2 Rama 1 Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6906615981

Service Confirmation Date: 03.10.2025

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	EOQ	Enterprise Operational Qualification	1.00	Agreement Entitlement - 100 % covered	03.10.2025	03.10.2025
1010	5185-5850	ICP-MS Checkout Solutions	1.00	Agreement Entitlement - 100 % covered		

Additional Information:

Service Confirmation Number: 6908615981

Service Confirmation Date: 03.10.2025

Service Information:

Problem Description:

*WU-EQ-IM-7900-5001413366

Service Provided:

Perform OQ hardware control. Test logon , tune , BG and stability.

Test OQ control of instrument ICPMS=BKK_EL0043

After done the instrument test all pass.

Service Overview Code:

Reason Code: Scheduled Service

Diagnosis Code: Scheduled Service

Resolution Code: Scheduled Service

Reported Hours:

5.0

Travel Hours:

1.5

Customer Field Service

Representative Name:

Panthep Kurasathain

Date:

03 Oct 2025

Customer Name:

Anchalee Khamjan

Date:

03 Oct 2025

Additional Comments:

SARTORIUS



Accredited by

NSC-TISI-TIS 17025

Calibration 0426

Calibration certificate

Calibration Certificate No. 25BKL0003

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	MSU224S-100-DU	This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08.
Serial QM Ident. no.	31709552 RYG_EN0003	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

APPROVE

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

Calibration object

Single range instrument

Model	MSU224S-100-DU
Serial Number	31709552
QM Ident. no Inventory no.	RYG_EN0003 ---
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

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}	24.7 °C 0.3 K
Measuring conditions	The installation site is suitable. The device was levelled. Balance was loaded up to Max before test.
Comments	Humidity 62.3 %RH.

Measurement results | Measurement uncertainties

Repeatability			Eccentricity	
Test load (nominal): 10 g 200 g			Test load (nominal): 100 g	
	10 g	200 g	Center	100.0000 g
1	10.0000 g	200.0000 g	Front left	100.0000 g
2	10.0000 g	200.0001 g	Back left	100.0001 g
3	9.9999 g	200.0000 g	Back right	99.9999 g
4	10.0000 g	200.0000 g	Front right	99.9999 g
5	10.0000 g	200.0001 g	Maximum deviation from centric loading indication	
6	9.9999 g	200.0000 g	Δ <i>e</i> _{ecc} max = 0.0001 g	
7	10.0000 g	200.0000 g		
8	10.0000 g	200.0000 g		
9	10.0000 g	200.0000 g		
10	10.0000 g	200.0001 g		
<i>s</i> = 0.00004 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	0.00012 g	1.2 %
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	10.0000 g	0.0000 g	2.00	0.00013 g	0.0013 %
20.0000 g	20.0000 g	0.0000 g	2.00	0.00014 g	0.00068 %
50.0000 g	50.0000 g	0.0000 g	2.00	0.00015 g	0.00029 %
100.0000 g	100.0001 g	0.0001 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			

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

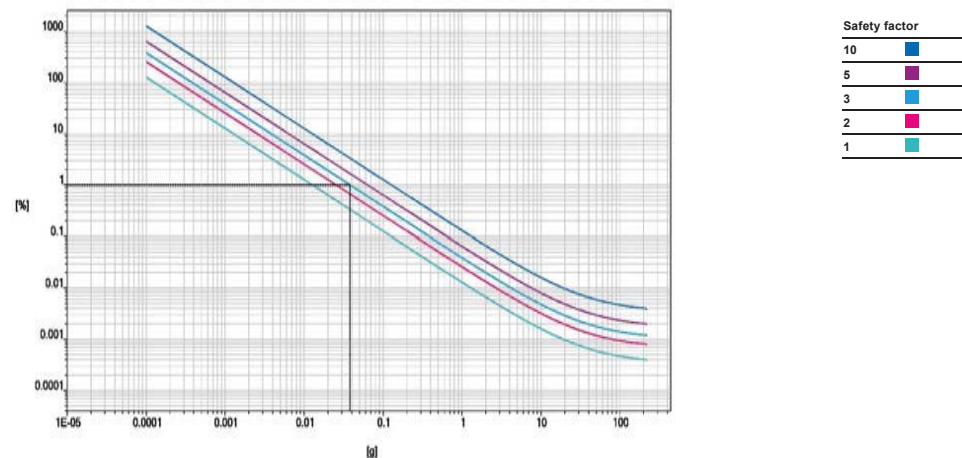
Device adjusted before measurement Yes
 Temperature deviation considered 1.5 K (isoCAL active)
 Temperature coefficient considered $1 \cdot 10^{-6}/K$

Uncertainty of the weighing result $U_{gl}(W)$ $U_{gl}(W) = 0.00013 \text{ g} + 3.42 \cdot 10^{-6} \cdot R$

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 $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
1 %	2.2000 g	0.00014 g	0.0063 %
25 %	55.0000 g	0.00032 g	0.00058 %
50 %	110.0000 g	0.00051 g	0.00046 %
75 %	165.0000 g	0.00069 g	0.00042 %
100 %	220.0000 g	0.00088 g	0.00040 %

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

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



Metrology Center SCI ECO Services Company Limited

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

Bangkok Tel : +668 9205 6851 , +669 81924 0059

Saraburi Tel : +669 8247 2360

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



Certificate No. T251530

Certificate of Calibration

Page 1 of 3

Equipment : Chamber (Oven)

Manufacturer : MEMMERT

Model : UF 110

Serial No. : B416.3420

Customer Code : RYG_EN0012

ID No. : T6444A5

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

616/10 Moo 5 T.Maenamkoo,

A.Pluakdaeng, Rayong 21140

Customer Location : ENVIRONMENT LABORATORY

Date of Receipt : 3 September 2025

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By : Boonchai Suriyawong (Site Calibration Manager)

Date of Issue



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

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



Certificate No. T251530

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 10 September 2025
Environment : Temperature : 35.7-36.6 °C
Line Voltage : 226.8-233.7 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

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

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	30-(CH1-10)	T242203	9 November 2025
DATA LOGGER	34970A	T47	T242203	9 November 2025
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.
- Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour 29 Minute At 104 °C
Fresh Air Damper ☒ Open ☒ Min ☐ Medium ☐ Max
☐ Close
☐ Not Available

5. Adjustment :

() without adjustment

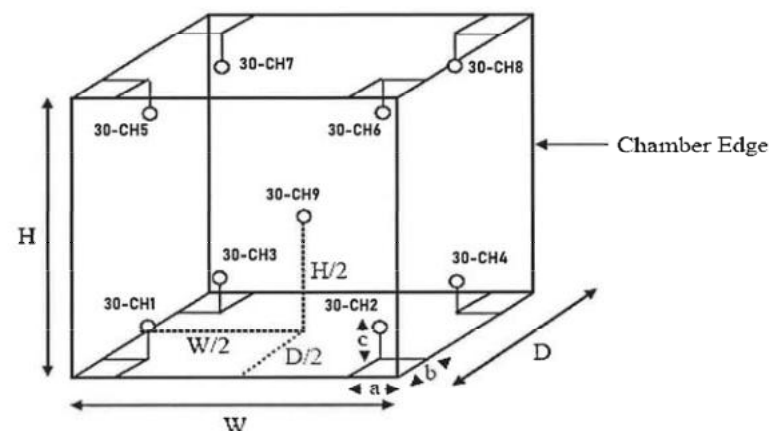
(X) after adjustment



Certificate No. T251530

Page 3 of 3

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm. , H (Height) = 48 cm. and D (Depth) = 40 cm.
Size of Installed Standard sensor number 30-CH1 to number 30-CH8 : a = 5 cm. , b = 5 cm. and c = 5 cm.
Size of Installed Standard sensor number 30-CH9 : W/2 = 56 cm./2 , H/2 = 48 cm./2 and D/2 = 40cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	30-CH1	30-CH2	30-CH3	30-CH4	30-CH5	30-CH6	30-CH7	30-CH8	30-CH9
104	104.02	103.70	104.01	104.16	104.11	104.08	104.01	104.33	103.61
180	180.67	178.78	180.38	179.85	179.16	180.27	180.98	181.04	179.49

Chamber (Oven)		Temperature Distribution					
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
104.0	103.9 , 104.1	104.0	104.00	0.08	0.61	0.42	2.00
180.0	179.9 , 180.1	180.0	180.07	0.21	1.51	0.52	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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

E_r





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.: 25LM10

Page.: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000-115V

Serial No. : 15E102796

ID No. : RYG_EN0032

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

Location : TPA On Site Calibration Laboratory

Received Order : 17 January 2025

Calibrated Date : 20 January 2025

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lernagtrakul

Approved by :

() Chakrit Waewwanj

(✓) Suwit Imjai

() Kunchit Promprat

Issue Date : 23 January 2025

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : DO Meter with Sensor

Condition As-Received : Used Item

Reference : 2501-0600DSC-2

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	2411022	TPA	17 Sep 2025

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

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

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 15E100464

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
20.00	60	20.002	19.81	-0.192	0.15	2.00

UUC* : Unit Under Calibration

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

-o0o-



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

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Certificate of Testing

Cert.No.: 25TW15

Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-115V
Serial No. : 15E102796
ID No. : RYG_EN0032
Received Date : 17 January 2025
Test Date : 20 January 2025
Reference : 2501-0600DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by :
() Pornthippa Tameyakul
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 21 January 2025



Cert.No.: 25TW15

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

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

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233821	110RC001	24MM131	04 July 2025

2. Standard Material :-

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

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

Titration Method (Azide Modification Method)	DO Meter Reading	Standard Deviation
(mg/L)	(mg/L)	(mg/L)
8.20	8.20	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

-o0o-



Certificate of Calibration

Equipment: SPECTROPHOTOMETER Certificate No.: C06250108
Model: DR6000 Issued Date: 18 March 2025
Serial No. (or ID.): 1627845 (RYG_EN0037) Job No.: WO-00064379
Manufacturer: HACH Page: 1 of 3
Condition: In Condition

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

Environment Condition: Temperature 24.4 °C ± 0.3
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 Starna 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

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 สุขุมวิท ถนน, กรุงเทพฯ, ประเทศไทย 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-16: 11 Mar 2024



Certificate No.: C06250108

Page 2 of 3

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

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนน, กรุงเทพฯ, ประเทศไทย 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C06-16: 11 Mar 2024

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. สวิตช์ ปิด – เปิด เครื่อง (On-Off Swith)	<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"/>	

เพิ่มเต็ม/ข้อแนะเ้า : * 656.1nm = 656.1nm

* 486.0nm = 485.7nm

Mr.Preecha Phooarsai

Service Engineer



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110
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Certificate No. T250453

Page 1 of 5

Certificate of Calibration

Equipment : HEATING BLOCK
Manufacturer : Environmental Express
Model : B300 240
Serial No. : 2017 CODW115
Customer Code : RYG_EN0142
ID No. : T6770A4
Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140
Customer Location : ENVIRONMENT LABORATORY
Date of Receipt : 12 March 2025
Calibrated By : Suilar Naknakred (Site Calibration Manager)
Approved By : Chai Suriyawong (Site Calibration Manager)



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

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



Metrological Center

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Certificate No. T250453

Page 2 of 5

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 19 March 2025
Environment : Temperature : 24.9°C-26.°C
Line Voltage : 226.1-231.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert 29 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .
- Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T240712	19 April 2025
TC	TYPE T	TN231-TN240	T240712	19 April 2025
TC	TYPE T	TN261-TN270	T240715	19 April 2025
DATA LOGGER	34970A	T149	T240712	19 April 2025
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item : good
Equipment Description :
Time Constant 1 Hour 7 Minute At 150 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
- Adjustment :
() without adjustment



Metrological Center

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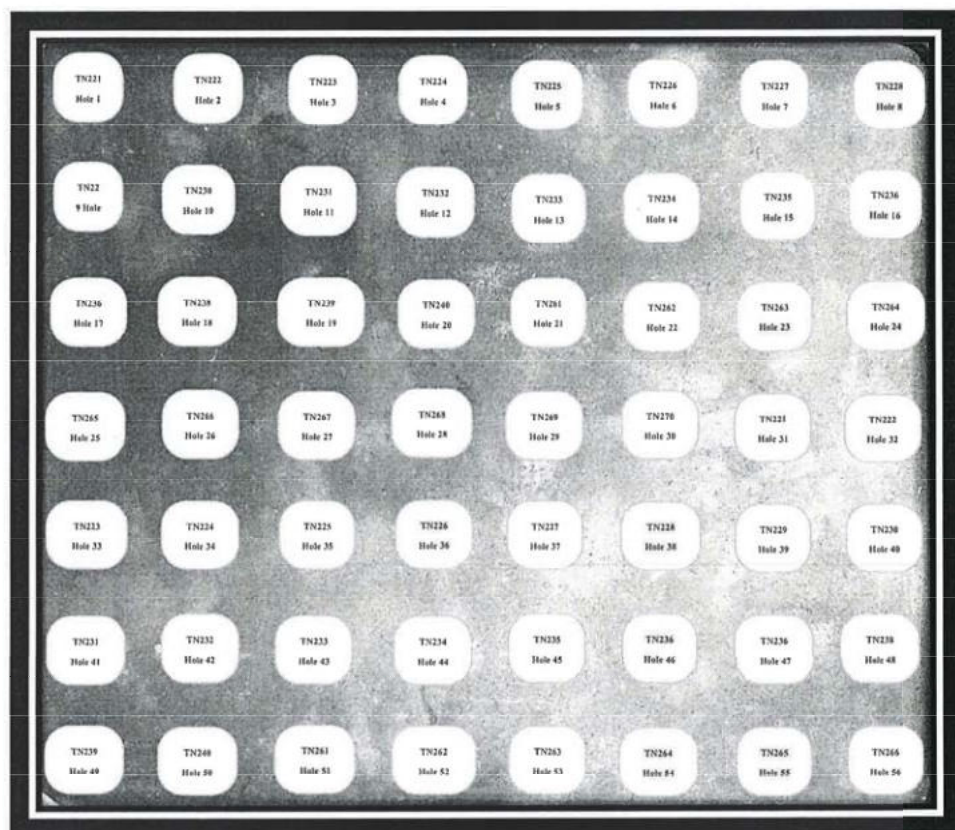
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T250453

Page 3 of 5

Calibration Report



FRONT CONTROL



Metrological Center

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Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T250453

Page 4 of 5

Calibration Report

Measurement Results

Calibration Point		Average Standard Reading at each position (°C)								
		TN221 Hole 1	TN222 Hole 2	TN223 Hole 3	TN224 Hole 4	TN225 Hole 5	TN226 Hole 6	TN227 Hole 7	TN228 Hole 8	TN229 Hole 9
CAL POINT	Max	150.44	150.76	150.03	150.90	150.21	149.09	149.11	150.14	149.79
	Min	150.15	150.55	149.87	150.73	150.09	148.94	148.96	149.99	149.50
	Average	150.29	150.66	149.95	150.82	150.15	149.02	149.04	150.06	149.64
		TN230 Hole 10	TN231 Hole 11	TN232 Hole 12	TN233 Hole 13	TN234 Hole 14	TN235 Hole 15	TN236 Hole 16	TN236 Hole 17	TN238 Hole 18
	Max	149.59	150.38	149.85	149.16	149.93	150.98	150.52	150.33	150.21
	Min	149.10	150.15	149.63	148.90	149.56	150.84	150.39	150.12	149.88
	Average	149.34	150.26	149.74	149.03	149.75	150.91	150.45	150.23	150.05
		TN239 Hole 19	TN240 Hole 20	TN261 Hole 21	TN262 Hole 22	TN263 Hole 23	TN264 Hole 24	TN265 Hole 25	TN266 Hole 26	TN267 Hole 27
	Max	149.77	150.38	149.84	149.82	150.74	150.38	150.58	149.87	150.58
	Min	149.54	150.19	149.58	149.70	150.42	150.17	150.28	149.65	150.40
	Average	149.65	150.29	149.71	149.76	150.58	150.27	150.43	149.76	150.49
		TN268 Hole 28	TN269 Hole 29	TN270 Hole 30	TN221 Hole 31	TN222 Hole 32	TN223 Hole 33	TN224 Hole 34	TN225 Hole 35	TN226 Hole 36
	Max	150.10	150.25	149.91	150.65	150.74	149.79	149.97	149.32	149.37
	Min	149.82	149.97	149.67	150.46	150.57	149.60	149.07	149.07	148.95
	Average	149.96	150.11	149.79	150.55	150.66	149.69	149.52	149.19	149.16
		TN227 Hole 37	TN228 Hole 38	TN229 Hole 39	TN230 Hole 40	TN231 Hole 41	TN232 Hole 42	TN233 Hole 43	TN234 Hole 44	TN235 Hole 45
	Max	149.37	149.63	150.58	150.27	150.02	149.74	150.08	149.98	151.06
	Min	149.05	149.45	150.37	149.89	149.68	149.45	149.73	149.62	150.81
	Average	149.21	149.54	150.47	150.08	149.85	149.60	149.91	149.80	150.94



Metrological Center

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Certificate No. T250453

Page 5 of 5

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN236 Hole 46	TN236 Hole 47	TN238 Hole 48	TN239 Hole 49	TN240 Hole 50	TN261 Hole 51	TN262 Hole 52	TN263 Hole 53	TN264 Hole 54	
Max	150.99	150.61	150.34	149.97	150.41	149.37	149.33	150.30	150.66	
Min	150.83	150.47	149.88	149.66	150.14	148.82	149.05	149.84	150.27	
Average	150.91	150.54	150.11	149.82	150.28	149.09	149.19	150.07	150.46	
	TN265 Hole 55	TN266 Hole 56								
Max	150.73	150.02								
Min	150.40	149.80								
Average	150.57	149.91								

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min , Max	Average		
150.0	149.9 , 150.1	150.0	0.28	0.87

The calibration result apply only the above calibrated item.

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

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

End of Certificate.



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



Certificate of Calibration

Cert.No.: 25CH709/1

Page.: 1 of 3

This Certificate was issued to replace to the Certificate No.25CH709

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenExcellence
Serial No. : B834291445
ID No. : RYG_EN0152
Condition As-Received: Used Item
Received Date : 12 June 2025
Calibration Date : 18 June 2025
Reference : 2506-0407DSC-2
Submitted by : **ALS Laboratory Group (Thailand) Co.,Ltd.
Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand**

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Walalak Sirithean

Approved by :

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

Issue Date : 1 July 2025

The Uncertainties are for a confidence probability of approximately 95%

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



Cert.No.: 25CH709/1
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
:The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 7.000	Hach Lenge GmbH	C03232	02 Dec 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: B834291445	4.000	177.48	177.3	4.000	0.058	2.00
	7.000	0.00	-0.1	7.000	0.058	2.00
	10.000	-177.48	-177.5	10.000	0.058	2.00



Cert.No.: 25CH709/1
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor <i>k</i>
pH Electrode S/N.: 5211504	4.007	4.006	181.1	0.0044	2.00
	7.000	7.000	4.9	0.0084	2.00
	10.010	10.007	-170.6	0.0066	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : InLabEXpert Pro-ISM

- Serial No. : 5211504

Dimension of probe

- Length : 120 mm.

- Diameter : 12 mm.

- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor <i>k</i>
25.0	25.001	25.1	0.099	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-3000-24 FAX. 0-2719-9484



Certificate of Calibration

Certificate No. : 25E1979/1

Page : 1 of 2

This Certificate was issued to replace to the Certificate No. 25E1979

Equipment : pH Meter
Manufacturer: Mettler Toledo
Model : SevenExcellence
Serial No.: B834291445
ID No.: RYG_EN0152
Condition As-Received: Used Item
Received Date: 12 June 2025
Calibration Date: 16 June 2025
Reference: 2506-0407DSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 10) %

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing
Services.

Submitted by: *ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch*

*616/10 Moo 5, T.Maenam Khu, A.Plukdaeng,
Rayong 21140, Thailand*

Procedure used: Calibration were conducted using calibration procedure No. CP-E17 According to EURAMET cg-15.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Multi-Product Calibrator	5500A	6315011	25E1627	19 May 2026

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

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

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

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

Calibrated by : Wutchareeporn Peethong
Issue Date : 01 July 2025

Appro



Cert. No.: 25E1979/1

Page.: 2 of 2

Result of calibration :- (*) Without adjustment () After adjustment

Function:	DC voltage measurement	Range:	2000	mV
	<u>Standard Value</u>	<u>UUC* Reading</u>	<u>Error</u>	<u>Uncertainty</u>
	(mV)	(mV)	(mV)	(± μV)
	-200.0000	-199.9	0.1	68
	-150.0000	-150.0	0.0	65
	-100.0000	-100.0	0.0	63
	-50.0000	-50.0	0.0	61
	0.0000	0.0	0.0	58
	50.0000	50.0	0.0	61
	100.0000	100.0	0.0	63
	150.0000	149.9	-0.1	65
	200.0000	199.9	-0.1	68

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

UUC* = Unit Under Calibration.

-o0o-



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24TM1663
Page : 1 of 3

Equipment : Low Temp. Incubator

Manufacturer : Memmert

Model : IPP750

Serial No. : V818.0084

ID No. : RYG_EN0154

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

Location : BOD Room

Received Order : 01 November 2024

Calibration Date : 01 November 2024

Ambient Temperature : $(26 \pm 10) ^\circ\text{C}$

Relative Humidity : $(50 \pm 30) \%$

AC Line Voltage : $(220 \pm 22) \text{ V}$

Calibrated by :

Approved by :

() Ponpan Paipim

() Suwit Imjai

(✓) Kunchit Promprat

Issue Date : 07 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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



Equipment : Low Temp. Incubator

Condition As-Received : Used Item

Reference : 2411-0002OC-1

Procedure Used :-

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY44073381	24LM73	TPA	18 May 2025

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

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

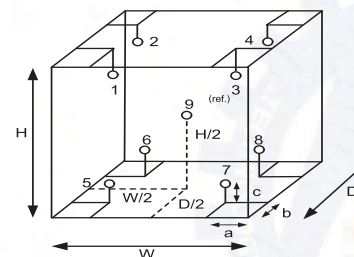
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	24	25
REL.Humid. (%)	55	53
AC Supply (Volt)	220	221



Probe Installation Details :

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

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.72 m³

Position :	Ref. Std. ID No.:
1	1RTD-2/1
2	1RTD-2/2
3	22-01RTD-03
4	1RTD-2/4
5	1RTD-2/5
6	1RTD-2/6
7	23-01RTD-07
8	1RTD-2/8
9 (ref.)	23-01RTD-09



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM1663
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
20.0	20.0	20.0	0.026	0.26	0.53	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	(± °C)
20.0	20.071	19.915	20.273	20.179	19.977	19.782	20.056	20.026	20.033	0.30

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

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

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

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

UUC* : Unit Under Calibration

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

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

-oOo-

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 DA ...

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

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

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				

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

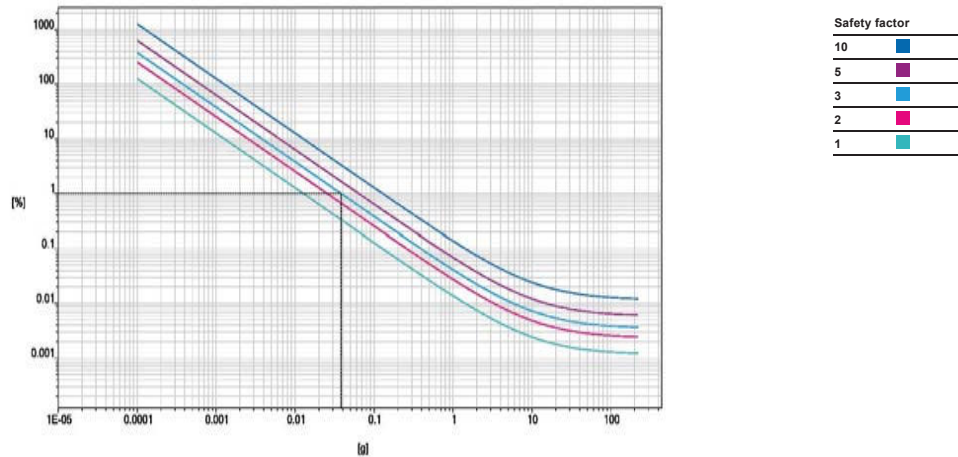
Device adjusted before measurement Yes
Temperature deviation considered 1.5 K (isoCAL active)
Temperature coefficient considered $1 \cdot 10^{-6}/K$

Uncertainty of the weighing result $U_{gl}(W)$ $U_{gl}(W) = 0.00013 \text{ g} + 1.16 \cdot 10^{-5} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-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 $U_{gl}(W)$	Uncertainty relative $U_{gl}(W)_{rel}$
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 Certificate No.: C06250109
Model: DR3900 Issued Date: 18 March 2025
Serial No. (or ID.): 2021761 (RYG_EN0179) Job No.: WO-00064379
Manufacturer: HACH Page: 1 of 3
Condition: In Condition

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 ± 0.5
Humidity 60.0 %RH ± 4.0

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 Phoosai
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.

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

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.

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, 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. สวิตช์ ปิด – เปิด เครื่อง (On-Off Switch)	<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 ดีเคเอส เอเซีย จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง 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-R31-03: 20 Jul 2022



Metrology

SCI ECO Services Company Limited

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

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851, +669 8247 2360

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



Certificate No. T250454

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Oven)

Manufacturer : MEMMERT

Model : UF 110

Serial No. : B423.0853

Customer Code : RYG_EN0213

ID No. : T5884A5

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

616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140

Customer Location : ENVIRONMENT LABORATORY

Date of Receipt : 12 March 2025

Calibrated By : Sujjar Nakkred (Site Calibration Manager)

Approved By : [Signature] Suriyawong (Site Calibration Manager)

Date of Issue

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

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

FM-L14 119/18-08-66

Certificate No. T250454

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 19 March 2025
Environment : Temperature : 26.5-26.9 °C
Line Voltage : 223.9-231.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

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

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
RTD	100 ohm	27-(CH1-10)	T240709	19 April 2025
DATA LOGGER	34970A	T149	T240709	19 April 2025

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 44 Minute At 104 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☒ Close
☐ Not Available

5. Adjustment :

() without adjustment

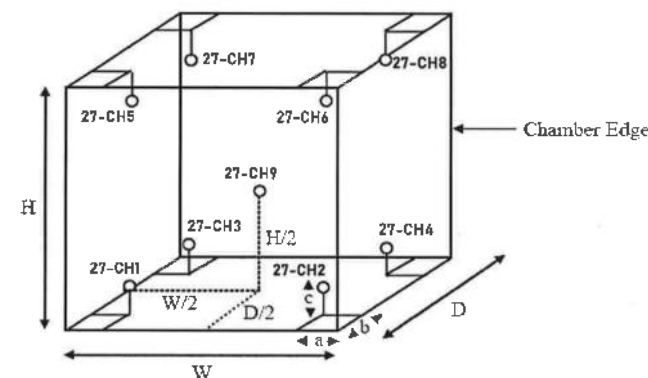
(X) after adjustment



Certificate No. T250454

Page 3 of 3

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm. , H (Height) = 48 cm. and D (Depth) = 40 cm.
Size of Installed Standard sensor number 27-CH1 to number 27-CH8 : a = 5 cm, b = 5 cm, and c = 5 cm.
Size of Installed Standard sensor number 27-CH9 : W/2 = 56 cm./2 , H/2 = 48 cm./2 and D/2 = 40 cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	27-CH1	27-CH2	27-CH3	27-CH4	27-CH5	27-CH6	27-CH7	27-CH8	27-CH9
104	103.84	104.10	104.10	104.48	103.73	104.14	103.95	103.57	104.22
180	179.41	179.92	180.80	181.37	179.54	179.52	179.82	179.41	180.31

Chamber (Oven)			Temperature Distribution				
Setting °C	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min , Max	Average					
104.0	103.9 , 104.1	104.0	104.01	0.08	0.65	0.42	2.00
180.0	-	180.0	180.01	0.17	1.26	0.49	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

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





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



Certificate of Calibration

Certificate No. : 25T1632

Page : 1 of 2

Equipment : Digital Thermometer With Sensor
Manufacturer: Testo
Model : 106
Serial No.: 31282167/504
ID No.: RYG_FS0468

Condition As-Received: Used Item

Received Date: 30 September 2025

Calibration Date: 09 October 2025
to 17 October 2025
2509-1019DSC

Reference: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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

Submitted by: ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch

616/10 Moo 5 T.Maenamkoo, A.Pluakdaeng, Rayong 21140,
Thailand

Procedure used: Calibration were conducted using in-house calibration procedure CP-T01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into liquid bath temperature controller.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1.Reference standards instruments :

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Black Stack Thermometer	1560	8C454	251625	06 Jun 2026
2) PRT Scanner Module	2562	A01303	251625	06 Jun 2026
3) Industrial Platinum Resistance Thermometer	5627-12	571971	251625	06 Jun 2026

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

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

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

Calibrated by : Theerapong Ameen
Issue Date : 20 October 2025

Approved



Cert. No.: 25T1632

Page.: 2 of 2

Result of Calibration:-

Without Adjustment

Function:

Temperature measurement

Dimension of probe : Diameter 3 mm Length 55 mm Sheath material : Stainless Steel

<u>Immersion</u>	<u>Standard</u>	<u>UUC*</u>		<u>Uncertainty</u>
<u>Depth</u>	<u>Temperature</u>	<u>Reading</u>	<u>Error</u>	<u>of Measurement</u>
(mm)	(°C)	(°C)	(°C)	(±°C)
50	25.0048	24.9	-0.1048	0.12
50	44.9954	44.9	-0.0954	0.12

UUC* : Unit Under Calibration

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

-o0o-

คุณภาพอากาศในการทำงาน



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., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72 : (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 : 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.)					
					1	2	3	1	2	3	y	R ²	
B41	SKC	224-PCXR4	612669	01/10/2025	1,000	1,500	2,000	1,010	1,508	2,009	1.000x + 2.612	0.999	
B42	SKC	224-PCXR4	626041	02/10/2025	1,000	1,500	2,000	1,006	1,494	1,994	0.997x + 1.348	1.000	
B43	SKC	224-PCXR4	034636	01/10/2025	1,000	1,500	2,000	998	1,505	2,002	1.001x - 3.177	1.000	
B44	SKC	224-PCXR8	529341	01/10/2025	1,000	1,500	2,000	999	1,496	1,998	0.996x + 0.909	1.000	
B45	SKC	224-PCXR8	529594	01/10/2025	1,000	1,500	2,000	996	1,510	1,992	1.005x - 11.343	1.000	
B46	SKC	224-PCXR8	566743	01/10/2025	1,000	1,500	2,000	1,003	1,488	1,997	0.994x + 3.717	1.000	
B47	SKC	224-PCXR8	566747	01/10/2025	1,000	1,500	2,000	1,004	1,500	1,993	0.996x + 2.220	1.000	
B48	SKC	224-PCXR8	566753	01/10/2025	1,000	1,500	2,000	1,002	1,501	1,991	1.000x - 4.116	0.999	
B49	SKC	224-PCXR8	566780	01/10/2025	1,000	1,500	2,000	995	1,502	1,990	0.997x - 1.978	1.000	
B50	SKC	224-PCXR8	500400	02/10/2025	1,000	1,500	2,000	997	1,503	2,001	1.004x - 10.178	1.000	
B51	SKC	224-PCXR8	500563	01/10/2025	1,000	1,500	2,000	1,001	1,502	1,993	0.995x + 2.848	1.000	
B52	SKC	224-PCXR8	093186	03/10/2025	1,000	1,500	2,000	994	1,510	1,999	1.005x - 12.252	0.999	
B53	SKC	224-PCXR8	707670	03/10/2025	1,000	1,500	2,000	1,002	1,496	2,004	1.003x - 8.791	1.000	
B54	SKC	224-PCXR3	509621	03/10/2025	1,000	1,500	2,000	999	1,501	1,995	0.999x - 2.090	1.000	
B55	SKC	224-PCXR3	510710	02/10/2025	1,000	1,500	2,000	1,002	1,503	2,006	1.007x - 13.250	0.999	
B56	SKC	224-PCXR3	511450	01/10/2025	1,000	1,500	2,000	995	1,505	1,997	1.002x - 7.594	1.000	
B57	SKC	224-PCXR3	510798	02/10/2025	1,000	1,500	2,000	998	1,500	1,994	0.999x - 7.153	0.999	
B58	SKC	224-PCXR3	509852	03/10/2025	1,000	1,500	2,000	1,002	1,494	1,996	0.993x + 6.485	1.000	
B59	SKC	224-PCXR3	509862	01/10/2025	1,000	1,500	2,000	1,006	1,505	1,998	0.996x + 5.117	1.000	
B60	SKC	224-PCXR3	512655	02/10/2025	1,000	1,500	2,000	1,004	1,501	2,003	1.010x - 14.223	0.999	
B61	SKC	224-PCXR3	503915	03/10/2025	1,000	1,500	2,000	993	1,495	1,994	0.999x - 4.942	1.000	
B62	SKC	224-PCXR3	505975	03/10/2025	1,000	1,500	2,000	995	1,500	2,005	1.009x - 16.396	1.000	
B63	SKC	224-PCXR3	511432	03/10/2025	1,000	1,500	2,000	996	1,497	1,991	0.998x - 5.171	1.000	
B64	SKC	224-PCXR3	508302	03/10/2025	1,000	1,500	2,000	1,008	1,506	1,998	0.992x + 8.667	0.999	
B65	SKC	224-PCXR3	508310	03/10/2025	1,000	1,500	2,000	1,006	1,492	2,003	1.000x - 4.355	1.000	
B66	SKC	224-PCXR3	509861	03/10/2025	1,000	1,500	2,000	994	1,496	1,994	0.997x - 0.275	1.000	
B67	SKC	224-PCXR3	506295	01/10/2025	1,000	1,500	2,000	997	1,505	2,001	1.004x - 10.258	1.000	
B68	SKC	224-PCXR3	505872	03/10/2025	1,000	1,500	2,000	998	1,512	1,992	0.999x - 3.554	0.999	
B69	SKC	224-PCXR3	508375	01/10/2025	1,000	1,500	2,000	997	1,489	1,996	0.997x - 2.309	1.000	
B70	SKC	224-PCXR3	510623	03/10/2025	1,000	1,500	2,000	1,001	1,496	1,991	0.992x + 7.131	1.000	
B71	SKC	224-PCXR3	508367	03/10/2025	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.433	1.000	
B72	SKC	224-PCXR3	505977	03/10/2025	1,000	1,500	2,000	996	1,507	1,999	1.003x - 7.490	1.000	
B73	SKC	224-PCXR3	512656	03/10/2025	1,000	1,500	2,000	1,004	1,503	2,003	1.001x - 5.285	0.999	
B74	SKC	224-PCXR3	505993	01/10/2025	1,000	1,500	2,000	1,006	1,501	1,997	0.993x + 8.232	1.000	
B75	SKC	224-PCXR3	509820	02/10/2025	1,000	1,500	2,000	1,005	1,494	1,995	0.997x - 2.979	0.999	
B76	SKC	224-PCXR3	509811	02/10/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x - 10.613	1.000	
B77	SKC	224-PCXR3	508301	01/10/2025	1,000	1,500	2,000	1,003	1,490	1,998	0.994x + 4.694	1.000	
B78	SKC	224-PCXR3	510877	01/10/2025	1,000	1,500	2,000	1,004	1,492	1,997	0.995x + 4.036	1.000	
B79	SKC	224-PCXR3	510920	01/10/2025	1,000	1,500	2,000	1,008	1,504	2,006	1.006x - 9.588	0.999	



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Tel : (662) 939-4370-72 : (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.)					
					1	2	3	1	2	3	y	R ²	
R01	SKC	224-PCXR4	602967	01/10/2025	1,000	1,500	2,000	1,001	1,504	2,006	1.001x + 1.123	1.000	
R02	SKC	224-PCXR4	626450	01/10/2025	1,000	2,000	3,000	997	1,511	1,997	1.000x - 2.215	1.000	
R03	SKC	224-PCXR4	691592	01/10/2025	1,000	1,500	2,000	1,004	1,504	2,008	1.005x - 5.705	1.000	
R04	SKC	224-PCXR4	691672	01/10/2025	1,000	1,500	2,000	1,013	1,505	2,007	0.996x + 7.748	0.999	
R05	SKC	224-PCXR4	798470	01/10/2025	1,000	1,500	2,000	1,005	1,506	2,010	1.007x - 4.757	1.000	
R06	SKC	224-PCXR4	798456	01/10/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x - 5.913	1.000	
R07	SKC	224-PCXR4	798480	03/10/2025	1,000	1,500	2,000	997	1,502	1,996	1.000x - 8.975	0.999	
R08	SKC	224-PCXR4	883215	03/10/2025	1,000	1,500	2,000	1,005	1,504	1,995	0.999x - 0.068	1.000	
R09	SKC	224-PCXR4	034650	03/10/2025	1,000	1,500	2,000	994	1,505	1,998	1.005x - 11.989	1.000	
R10	SKC	224-PCXR4	091765	01/10/2025	1,000	1,500	2,000	1,005	1,508	2,006	1.008x - 11.738	0.999	
R11	SKC	224-PCXR4	091763	01/10/2025	1,000	1,500	2,000	1,006	1,493	2,003	0.996x + 5.589	1.000	
R12	SKC	224-PCXR4	091568	02/10/2025	1,000	1,500	2,000	995	1,496	1,999	1.002x - 5.717	1.000	
R13	SKC	224-PCXR4	091638	01/10/2025	1,000	1,500	2,000	1,012	1,505	2,008	1.004x - 2.938	0.999	
R14	SKC	224-PCXR4	091764	01/10/2025	1,000	1,500	2,000	996	1,494	2,004	1.008x - 18.690	1.000	
R15	SKC	224-PCXR8	529437	01/10/2025	1,000	1,500	2,000	998	1,507	2,007	1.007x - 12.957	0.999	
R16	SKC	224-PCXR8	529643	01/10/2025	1,000	1,500	2,000	997	1,496	1,994	0.999x - 1.395	1.000	
R17	SKC	224-PCXR8	529643	01/10/2025	1,000	1,500	2,000	1,005	1,503	1,995	1.003x - 10.886	0.999	
R18	SKC	224-PCXR8	566756	01/10/2025	1,000	1,500	2,000	997	1,505	1,993	1.000x - 4.450	1.000	
R19	SKC	224-PCXR8	566802	01/10/2025	1,000	1,500	2,000	1,004	1,504	2,007	1.006x - 6.752	1.000	
R20	SKC	224-PCXR8	529689	03/10/2025	1,000	1,500	2,000	1,008	1,497	2,001	1.002x - 6.025	0.999	
R21	SKC	224-PCXR8	665728	03/10/2025	1,000	1,500	2,000	997	1,505	2,003	1.008x - 16.973	0.999	
R22	SKC	224-PCXR8	707444	01/10/2025	1,000	1,500	2,000	1,005	1,494	2,001	0.995x + 6.369	1.000	
R23	SKC	224-PCXR8	761067	01/10/2025	1,000	1,500	2,000	1,008	1,495	2,000	0.992x + 13.025	1.000	
R24	SKC	224-PCXR8	707893	01/10/2025	1,000	1,500	2,000	1,005	1,504	1,997	1.004x - 8.140	0.999	
R25	SKC	224-PCXR8	761052	01/10/2025	1,000	1,500	2,000	1,006	1,510	2,006	1.001x - 0.152	0.999	
R26	SKC	224-PCXR8	707956	01/10/2025	1,000	1,500	2,000	1,000	1,513	2,008	1.008x - 10.714	1.000	
R27	SKC	224-PCXR8	707398	02/10/2025	1,000	1,500	2,000	1,011	1,512	2,012	1.002x + 2.547	0.999	
R28	SKC	224-PCXR8	707481	02/10/2025	1,000	1,500	2,000	999	1,498	2,000	1.000x + 0.144	1.000	
R29	SKC	224-PCXR8	707402	02/10/2025	1,000	1,500	2,000	1,000	1,509	2,006	1.000x + 5.501	1.000	
R30	SKC	224-PCXR8	093811	02/10/2025	1,000	1,500	2,000	998	1,514	2,005	1.009x - 15.222	1.000	
R31	SKC	224-PCXR8	093183	01/10/2025	1,000	1,500	2,000	999	1,508	2,003	1.005x - 9.387	1.000	
R32	SKC	224-PCXR8	671950	01/10/2025	1,000	1,500	2,000	1,000	1,494	1,996	0.994x + 5.137	1.000	
R33	SKC	224-PCXR4	626254	01/10/2025	1,000	1,500	2,000	1,004	1,495	2,005	1.008x - 16.151	0.999	
R34	SKC	224-PCXR4	626131	01/10/2025	1,000	1,500	2,000	998	1,508	1,994	0.998x - 0.764	1.000	
R35	SKC	224-PCXR8	707460	01/10/2025	1,000	1,500	2,000	1,003	1,502	1,993	0.993x + 8.172	1.000	
R36	SKC	224-PCXR8	707946	01/10/2025	1,000	1,500	2,000	997	1,510	1,999	1.000x - 8.044	1.000	
R37	SKC	224-PCXR8	707432	01/10/2025	1,000	1,500	2,000	1,012	1,515	2,007	0.997x + 7.376	0.999	
R38	SKC	224-PCXR8	707349	03/10/2025	1,000	1,500	2,000	999	1,511	1,998	1.001x - 2.818	1.000	
R39	SKC	224-PCXR8	761095	03/10/2025	1,000	1,500	2,000	1,008	1,514	1,996	0.993x + 11.058	0.999	



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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.)				
					1	2	3	1	2	3	y	R ²
R40	SKC	224-PCXR4	612753	03/10/2025	1,000	1,500	2,000	1,005	1,504	2,007	1.003x - 2.699	1.000
R41	SKC	224-PCXR4	626140	03/10/2025	1,000	1,500	2,000	998	1,498	2,000	1.001x - 1.631	1.000
R42	SKC	224-PCXR4	626463	03/10/2025	1,000	1,500	2,000	1,004	1,496	1,999	0.993x + 9.615	1.000
R43	SKC	224-PCXR4	626129	03/10/2025	1,000	1,500	2,000	1,002	1,505	2,003	1.008x - 13.761	0.999
R44	SKC	224-PCXR4	602753	01/10/2025	1,000	1,500	2,000	1,004	1,503	1,999	1.006x - 9.411	0.999
R45	SKC	224-PCXR4	626137	01/10/2025	1,000	1,500	2,000	997	1,504	1,998	1.002x - 5.862	1.000



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136833

Rotameter Data				Calibration Data							
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
HR01	Dwyer	VFB-65	01/10/2025	500	1,000	2,000	501.1	997.7	1996.7	$1.000x - 2.348$	0.999
HR02	Dwyer	VFB-65	01/10/2025	500	1,000	2,000	500.3	999.2	1997.5	$1.001x - 2.181$	1.000
HR03	Dwyer	VFB-65	02/10/2025	500	1,000	2,000	500.9	1001.1	1999.3	$0.999x + 0.708$	0.999
HR04	Dwyer	VFB-65	02/10/2025	500	1,000	2,000	501.4	999.4	1998.9	$0.997x + 3.139$	1.000
HR05	Dwyer	VFB-65	01/10/2025	500	1,000	2,000	500.5	1000.7	1998.2	$0.998x + 2.480$	1.000
HR06	Dwyer	VFB-65	03/10/2025	500	1,000	2,000	502.0	998.5	1994.8	$1.000x - 1.968$	0.999



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 :

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

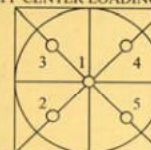
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

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	100.00001	-0.00001	0.00019
120.00	120.00002	-0.00002	0.00022

5. OFF-CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT





WO-11540201/2025

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : S.P.S.Consulting Service Co.,Ltd **Date Tested:** December 18, 2025
Address : 7 Soi Phaholyothin 24 **Period** 6 Months
Paholyothin Road **Recertification Due:** June 28, 2026
Jompol Chatuchak, Bangkok 1090 **Date Last Certified:** July 1, 2025
User Name: K.Phenpha Vipasthawat **Visit Number:** 2of 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** **EXPIRATION**
IPV Methods

TEST STANDARD USED **PART NUMBER** **EXPIRATION DATE**
Multielement Standard N069-1579 November 30, 2026
Wavecal Solution N058-2152 July 30, 2026
VIS Wavecal solution N930-2946 August 30, 2026
Instrument Cal. STD4 N930-0221 November 30, 2026

CUSTOMER SUPPLIED **COMMENTS** **CUSTOMER INITIALS**
2 % HNO3
10 % HNO3

ACCESSORIES/COMPONENT
NOT INCLUDED

Page 1 of 4



WO-11540201/2025

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** December 18, 2025

1. MECHANICAL CHECKS

- A. Inspect and clean all fans and filters. ☐
- B. Inspect and replace as necessary, all torch components including the RF coil. ☐
- C. Inspect all tubing for sign of clacking or leaking. ☐
- D. Adjust water and gas pressure regulator settings. ☐
- E. Inspect and leak check pneumatics drawers. ☐
- F. Clean the exterior of the instrument. ☐

2. OPTICAL CHECKS

- A. Inspect and clean all optical components. ☐
- B. As required, check and replace all purgefilters. ☐
- C. Recheck optical alignment. ☐

3. COOLING SYSTEM CHECKS

- A. Perform preventive maintenance on chiller. ☐
- B. Flush out the chiller every year. ☐

4. PERFORMANCE CHECKS

- A. Torch View Alignment. ☐
- B. Wavelength Calibration. ☐

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : <u>077C7042401</u>		DATE TESTED : <u>December 18, 2025</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	<u>0.00530</u>
	Ni 231.604 nm	≤ 0.008	<u>0.00708</u>
	Ni 341.476 nm	≤ 0.012	<u>0.00776</u>
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	<u>0.01614</u>
	Ba 455.403 nm	≤ 0.025	<u>0.02377</u>
Precision			
	As 193.656 nm	% RSD < 1.0	<u>0.67</u> %
	Zn 213.856 nm	% RSD < 1.0	<u>0.62</u> %
	Mn 257.610 nm	% RSD < 1.0	<u>0.88</u> %
	La 379.478 nm	% RSD < 1.0	<u>0.63</u> %
	Ba 455.403 nm	% RSD < 1.0	<u>0.65</u> %
	Ba 493.408 nm	% RSD < 1.0	<u>0.45</u> %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	<u>3.21</u> ppb
	As 193.696 nm	3(sd)	<u>6.06</u> ppb
	Pb 220.353 nm	3(sd)	<u>0.92</u> ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	<u>17.35</u> ppb
	Zn 213.856 nm	3(sd)	<u>1.79</u> ppb
	Mn 257.610 nm	3(sd)	<u>0.18</u> ppb
	La 379.478 nm	3(sd)	<u>0.76</u> ppb
	Ba 455.403 nm	3(sd)	<u>0.11</u> ppb
	Ba 493.408 nm	3(sd)	<u>0.56</u> ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	<u>40.52</u>
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	<u>42.33</u>



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED December 18, 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.

Autho



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 Si

h 6, 2025

ระดับเสียงในการทำงาน



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 44/0268

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Ambient Environment

Description : Sound Calibrator

Temperature : (23 ± 3) °C

Manufacturer : ACO

Relative Humidity : (50 ± 15) %

Model : 2127

Ambient Pressure : (101.325 ± 1.500) kPa

Serial No. : 130006

Standards used : 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.

2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.

4. Digital Multimeter Agilent 34401A S/N MY44005560.

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 19 Feb. 2025

Date of Calibration : 21 Feb. 2025

1 / 2

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

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

FM.BL.MTC.002 Rev.5

Head Office
35 Mu. 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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Tel. (66) 0 2577 9036
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(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 :

Approved :

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

End of Certificate

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011268021900739001

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FM.BL.MTC.002 Rev.5

Head Office
35 Mu. 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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E-mail : mtc@tistr.or.th Website : www.tistr.or.th

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(66) 08 1889 6827

Noise R_702/25

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-R41	ACO	6236	00192053	02 December 2025	93.9	93.9
ACO-R50	ACO	6236	00192062	02 December 2025	93.9	93.9
ACO-R51	ACO	6236	00192063	02 December 2025	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB	

Approved by

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0514

MTC No. EEL. BP. 34/0868

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 : SVANTEK

Model : SV34

Serial No. : 83820

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

- 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 2633526.

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 : 14 Aug. 2025

Date of Calibration : 22 Aug. 2025

1/2

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

FM.BLMTC.002 Rev.5

Head Office

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(66) 08 3219 9440
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0514 MTC No. EEL. BP. 34/0868

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 = 114 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions: 101.325 kPa, 23.0 °C and 50 %RH.

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	114.02	0.02	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	1000.0	0.0	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	0.21	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by

Approved by

Date of Calibration : 22 Aug. 2025

Date of Issue : 25 Aug. 2025

Electron

Industrial Metrology and Testing Service Centre

Ref : 2011268081403169011

End of Certificate

2 / 2

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

FM.BLMTC.002 Rev.5

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(66) 08 1889 6827

Noise Dose R_703/25

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 03/60
Model	SV34	Serial No.	83820
Calibration Range	114 dB, 1000 Hz	Last Calibration	25 August 2025
		Due Date	25 August 2026

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R02	SVANTEK	SV-104IS	60152	02 December 2025	114.0	114.0
NMD-R03	SVANTEK	SV-104IS	60153	02 December 2025	114.0	114.0
NMD-R06	SVANTEK	SV-104IS	60146	02 December 2025	114.0	114.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					114.02 \pm 0.10 dB	

Calibrated

Approved by :

ระดับความร้อนในการทำงาน



Certificate of Calibration

Certificate Number : SPR25100063-4 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 34
Serial Number : TEN040005
ID. Number : R04
Environmental Conditions
Ambient Temperature : 23 °C ± 2 °C Received Date : 06 Oct 2025
Relative Humidity : 50 % ± 15 % Calibration Date : 08 Oct 2025
Location of Calibration : In-Lab Recommend Due Date : 08 Oct 2026
Calibration Procedure : SP-CPT-04-13 Date of Issue : 09 Oct 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).

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 Tel: (662) 193-2217-20

www.spmetrology.co.th www.spmetrology.co.th



Calibration Report

Certificate Number : SPR25100063-4 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2026
Temp & Humidity Test Chamber	TEMI1500-01/SD/N/N/	S7110ZL742 1014	SPR25040010-13	20 Apr 2026

Traceability

This certification is traceable to the International System of Unit maintained at :
NA - NA Caltechnologies Co., Ltd.

SP Metrology - SP Metrology system (Thailand) Co.Ltd.

69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 Tel: (662) 193-2217-20

www.spmetrology.co.th www.spmetrology.co.th

Result of Calibration

Certificate Number : SPR25100063-4

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.8	-0.214	0.20
35.0	35.012	34.8	-0.212	0.20
40.0	40.018	39.8	-0.218	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.7	-0.314	0.20
35.0	35.012	34.7	-0.312	0.20
40.0	40.018	39.7	-0.318	0.20

Temperature Accuracy in the Measurement. (GLOVE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.8	-0.214	0.20
35.0	35.012	34.8	-0.212	0.20
40.0	40.018	39.8	-0.218	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 -

SP-FM-04-15 REV.0



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@spcon.com, www.spcon.com

Heat R117

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	R04	Verification Date :	02 December 2025
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp ^o 34	Barometric Pressure :	1011 mmbar
Serial No. :	TEN040005	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	12.3	0.2	± 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	69.4	-0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			





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 Received Date : 19 Mar 2025
Relative Humidity : 50 % ± 15 % Calibration Date : 22 Mar 2025
Location of Calibration : In-Lab Recommend Due Date : 22 Mar 2026
Calibration Procedure : SP-CPT-04-13 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, without written approval of SP Metrology System (Thailand).



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 R117

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B32	Verification Date :	02 December 2025
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp ³ 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	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			



Certificate of Calibration

Certificate Number : SPR25100063-6 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 : Quest Technologies

Model : QUESTemp 32

Serial Number : TPK120034

ID. Number : B33

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 06 Oct 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 21 Oct 2025

Location of Calibration : In-Lab Recommend Due Date : 21 Oct 2026

Calibration Procedure : SP-CPT-04-13 Date of Issue : 22 Oct 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).



Calibration Report

Certificate Number : SPR25100063-6 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2026
Temp & Humidity Test Chamber	TEMI1500-01/SD/N/N/	S7110ZL742 1014	SPR25040010-13	20 Apr 2026

Traceability

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

NA - NA Caltechnologies Co., Ltd.

SP Metrology - SP Metrology system (Thailand) Co.Ltd.



Result of Calibration

Certificate Number : SPR25100063-6

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.007	30.0	-0.007	0.20
35.0	35.009	35.1	0.091	0.20
40.0	40.005	40.1	0.095	0.21

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.007	30.1	0.093	0.20
35.0	35.009	35.1	0.091	0.20
40.0	40.005	40.1	0.095	0.21

Temperature Accuracy in the Measurement. (GLOVE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.007	29.9	-0.107	0.20
35.0	35.009	34.9	-0.109	0.20
40.0	40.005	39.9	-0.105	0.21

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 R117

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B33	Verification Date :	02 December 2025
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp [®] 32	Barometric Pressure :	1011 mmbar
Serial No. :	TPK120034	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	12.7	-0.2	± 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	69.1	0.2	± 0.5
UUC* = UNIT UNDER CALIBRATION			