

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
1. คุณภาพอากาศในบรรยากาศ		
Total Suspended Particulate	High Volume Air Sampler No. B11, B25, B37, B38, B44	Digital Balance
PM ₁₀	High Volume PM ₁₀ Air Sampler No. B12, B15, B18, B26, B29	Digital Balance
PM _{2.5}	High Volume PM _{2.5} Air Sampler No. B04, B05, B07, B11, B12	Digital Balance
Hydrogen Chloride	Gas Sampler Box No. B01, B05, B06, B07, B11	-
Sulfur Dioxide	SO ₂ Analyzer No. B01, B02, B04, B06, B07	SO ₂ Analyzer No. B01, B02, B04, B06, B07
Nitrogen Dioxide	NO _x Analyzer No. B05, B07, B10, B11, B22	NO _x Analyzer No. B05, B07, B10, B11, B22
2. คุณภาพอากาศจากปล่อง		
Total Suspended Particulate	Console No. B01 Pitot Tube No. B35	Digital Balance
Oxides of Nitrogen	Vacuum Gauge	Spectrophotometer
Sulfur Dioxide	Personal Pump SKC No. B62 Rotameter No. H-B08	-
Sodium Hydroxide as Sodium	Console No. B04 Pitot Tube No. B49	Inductively Couple Plasma (ICP)
Oil Mist	Console No. B04 Pitot Tube No. B49	Infrared Spectrophotometer (IR)
Hydrogen Chloride	Personal Pump SKC No. B49 Rotameter No. H-B02	Ion Chromatography (IC)
3. ระดับเสียงในบรรยากาศ		
3.1 ระดับเสียงริมรั้วโรงงาน L _{eq} 24 hr และ L ₉₀	Acoustic Calibrator Sound Level Meter No. ACO-B02, B12, B18, B32, B39, B41, R52, R56	- -
3.2 ระดับเสียงในชุมชน L _{eq} 24 hr และ L ₉₀	Acoustic Calibrator Sound Level Meter No. ACO-B09, B30, B37, B45, R54, R56	-
4. คุณภาพน้ำ		
pH	-	pH Meter
Temperature	-	Thermometer
Total Suspended Solids	-	Digital Balance
Total Dissolved Solids	-	Digital Balance
BOD ₅	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
Manganese	-	Inductively Couple Plasma (ICP)

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
4. คุณภาพน้ำ (ต่อ)		
Lead	-	Inductively Couple Plasma (ICP)
Zinc	-	Inductively Couple Plasma (ICP)
Total Chromium	-	Inductively Couple Plasma (ICP)
Conductivity	-	Conductivity Meter
Total Aluminum	-	Inductively Couple Plasma (ICP)
Total Iron	-	Inductively Couple Plasma (ICP)
Total Coliform Bacteria	-	Incubator/Water Bath
Sulfate		Spectrophotometer
Mercury	-	AAS
Hexavalent Chromium	-	Spectrophotometer
Cadmium	-	AAS
Arsenic	-	AAS
Nickel	-	Inductively Couple Plasma (ICP)
Copper	-	Inductively Couple Plasma (ICP)
5. คุณภาพกากตะกอน		
Arsenic	-	AAS
Cadmium	-	Inductively Couple Plasma (ICP)
Chromium	-	Inductively Couple Plasma (ICP)
Lead	-	Inductively Couple Plasma (ICP)
Mercury	-	AAS
Selenium	-	AAS
Zinc	-	Inductively Couple Plasma (ICP)
Iron	-	Inductively Couple Plasma (ICP)
Manganese	-	Inductively Couple Plasma (ICP)
6. คุณภาพดิน		
Total Iron	-	Inductively Couple Plasma (ICP)
Total Manganese	-	Inductively Couple Plasma (ICP)
Total Chromium	-	Inductively Couple Plasma (ICP)
Total Lead	-	Inductively Couple Plasma (ICP)
7. ระดับความร้อนในสถานประกอบการ		
WBGT	Digital Thermometer Heat Stress WBGT Meter No. B07, B17, B21 B31, B33,	-
8. คุณภาพอากาศในสถานประกอบการ		
Total Dust	Personal Pump No. B05, B56 Rotameter No. H-B03, B10	Digital Balance
Respirable Dust	Personal Pump No. B33, B88 Rotameter No. H-B03, B10	Digital Balance
Hydrogen Chloride	Personal Pump No. B03, B73 Rotameter No. H-B03, B10	Ion Chromatography (IC)

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
9. ระดับเสียงในสถานประกอบการ L _{eq} 8 hr	Acoustic Calibrator Sound Level Meter No. ACO-B05, B18, B41, R40, R41, R51	-
10. ปริมาณเสียงสะสมแบบติดตัวบุคคล Noise Dose (TWA)	Acoustic Calibrator Sound Level Meter No.NMD-B06, B07, B10, B18, B19, B20	-

คุณภาพอากาศในบรรยากาศ



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

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	01/08/2024	$y = 1.171x - 2.911$	0.998
B02	B02	02/08/2024	$y = 1.163x + 0.020$	0.999
B03	B03	05/08/2024	$y = 1.195x - 3.992$	0.998
B04	B04	02/08/2024	$y = 1.212x - 3.522$	0.999
B05	B05	02/08/2024	$y = 1.222x - 5.699$	0.997
B06	B06	05/08/2024	$y = 1.192x - 3.521$	0.999
B07	B07	08/08/2024	$y = 1.173x - 2.945$	0.998
B08	B08	02/08/2024	$y = 1.181x - 2.549$	0.999
B09	B09	02/08/2024	$y = 1.202x - 4.007$	0.999
B10	B10	05/08/2024	$y = 1.187x - 0.531$	0.998
B11	B11	05/08/2024	$y = 1.092x + 1.351$	1.000
B12	B12	07/08/2024	$y = 1.186x - 4.168$	0.998
B13	B13	05/08/2024	$y = 1.182x - 3.641$	0.996
B14	B14	05/08/2024	$y = 1.226x - 5.106$	0.999
B15	B15	05/08/2024	$y = 1.218x - 3.602$	1.000
B16	B16	02/08/2024	$y = 1.174x - 1.318$	0.997
B17	B17	05/08/2024	$y = 1.188x - 1.593$	1.000
B18	B18	02/08/2024	$y = 1.218x - 5.796$	0.999
B19	B19	02/08/2024	$y = 1.225x - 6.976$	0.998
B20	B20	02/08/2024	$y = 1.197x - 2.746$	0.999
B21	B21	05/08/2024	$y = 1.214x - 5.212$	0.997
B22	B22	05/08/2024	$y = 1.205x - 5.711$	0.999
B23	B23	02/08/2024	$y = 1.221x - 4.197$	0.998
B24	B24	02/08/2024	$y = 1.164x - 1.349$	0.999
B25	B25	07/08/2024	$y = 1.125x - 0.794$	1.000
B26	B26	07/08/2024	$y = 1.181x - 2.418$	0.998
B27	B27	07/08/2024	$y = 1.109x - 1.204$	0.998
B28	B28	07/08/2024	$y = 1.183x - 5.519$	1.000
B29	B29	02/08/2024	$y = 1.227x - 3.979$	0.996
B30	B30	05/08/2024	$y = 1.174x - 2.401$	0.999
B31	B31	05/08/2024	$y = 1.190x - 4.450$	1.000
B32	B32	05/08/2024	$y = 1.203x - 1.091$	0.999
B33	B33	05/08/2024	$y = 1.218x - 3.935$	1.000
B34	B34	05/08/2024	$y = 1.224x - 5.708$	0.996

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	05/08/2024	$y = 1.186x - 3.084$	0.999
B36	B36	05/08/2024	$y = 1.210x - 3.778$	0.997
B37	B37	06/08/2024	$y = 1.196x - 3.291$	0.998
B38	B38	06/08/2024	$y = 1.176x - 3.769$	1.000
B39	B39	05/08/2024	$y = 1.200x - 1.884$	0.999
B40	B40	05/08/2024	$y = 1.192x - 3.238$	0.999
B41	B41	05/08/2024	$y = 1.170x - 2.205$	0.996
B42	B42	05/08/2024	$y = 1.141x - 0.385$	1.000
B43	B43	02/08/2024	$y = 1.175x - 1.695$	0.996
B44	B44	02/08/2024	$y = 1.167x - 1.577$	0.998
R01	R01	02/08/2024	$y = 1.177x - 4.285$	0.999
R02	R02	02/08/2024	$y = 1.216x - 5.757$	0.997
R03	R03	02/08/2024	$y = 1.198x - 6.621$	0.999
R04	R04	08/08/2024	$y = 1.170x - 2.838$	0.997
R05	R05	08/08/2024	$y = 1.184x - 4.669$	1.000
R06	R06	01/08/2024	$y = 1.205x - 5.684$	0.998
R07	R07	01/08/2024	$y = 1.114x + 0.237$	1.000
R08	R08	01/08/2024	$y = 1.073x + 1.881$	0.997
R09	R09	01/08/2024	$y = 1.186x - 1.865$	0.999
R10	R10	02/08/2024	$y = 1.171x - 3.610$	0.996
R11	R11	02/08/2024	$y = 1.201x - 4.470$	1.000
R12	R12	02/08/2024	$y = 1.167x - 3.984$	0.998
R13	R13	06/08/2024	$y = 1.171x - 3.661$	0.997
R14	R14	06/08/2024	$y = 1.194x - 2.635$	0.998
R15	R15	02/08/2024	$y = 1.207x - 6.878$	0.999
R16	R16	02/08/2024	$y = 1.212x - 6.360$	1.000
R17	R17	05/08/2024	$y = 1.194x - 4.223$	0.999
R18	R18	05/08/2024	$y = 1.151x - 2.849$	0.999
R19	R19	05/08/2024	$y = 1.172x - 3.442$	0.998
R20	R20	05/08/2024	$y = 1.184x - 3.473$	0.999

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	02/08/2024	y = 1.192x-3.010	0.997
B02	B02	05/08/2024	y = 1.166x-1.422	0.998
B03	B03	07/08/2024	y = 1.198x-2.675	0.997
B04	B04	02/08/2024	y = 1.195x-4.855	0.999
B05	B05	05/08/2024	y = 1.215x-6.792	0.999
B06	B06	02/08/2024	y = 1.184x-3.554	0.997
B07	B07	01/05/2024	y = 1.132x-0.786	1.000
B08	B08	02/08/2024	y = 1.203x-1.746	0.997
B09	B09	05/08/2024	y = 1.198x-3.274	0.999
B10	B10	02/08/2024	y = 1.175x-1.634	0.996
B11	B11	02/08/2024	y = 1.188x-1.290	0.999
B12	B12	07/08/2024	y = 1.200x-4.619	0.997
B13	B13	05/08/2024	y = 1.140x-2.044	0.997
B14	B14	06/08/2024	y = 1.137x+0.196	0.996
B15	B15	05/08/2024	y = 1.156x-0.963	1.000
B16	B16	06/08/2024	y = 1.178x+0.511	0.999
B17	B17	02/08/2024	y = 1.167x-2.529	0.998
B18	B18	01/08/2024	y = 1.193x-2.801	0.997
B19	B19	05/08/2024	y = 1.174x-2.984	0.998
B20	B20	01/08/2024	y = 1.197x-4.582	0.999
B21	B21	05/08/2024	y = 1.195x-3.263	0.998
B22	B22	02/08/2024	y = 1.137x-0.996	0.998
B23	B23	05/08/2024	y = 1.191x-2.392	0.998
B24	B24	01/08/2024	y = 1.185x-3.393	0.997
B25	B25	02/08/2024	y = 1.202x-3.881	0.997
B26	B26	02/08/2024	y = 1.193x-3.733	0.997
B27	B27	02/08/2024	y = 1.165x-4.778	0.999
B28	B28	02/08/2024	y = 1.182x-4.730	0.999
B29	B29	05/08/2024	y = 1.177x-4.217	0.999
B30	B30	05/08/2024	y = 1.188x-3.046	0.998
B31	B31	01/08/2024	y = 1.173x-1.247	1.000
B32	B32	01/08/2024	y = 1.157x-3.072	1.000
B33	B33	05/08/2024	y = 1.153x-0.882	0.997
B34	B34	05/08/2024	y = 1.193x-1.943	0.996

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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CALIBRATION REPORT			
PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC)			
DATE :	17 September 2024	BRAND :	BGI
		MODEL :	PQ200
NO.	PM2.5-04	SERIAL NO.	160810-4 (VSCC)
CALIBRATING CONDITION			
Pressure	1011	mmbar	Temp. 24.5 °C
		% RH	49
Calibration Method : Dry Cal Primary		Model : Defender 510 H	S/N : 136164
CALIBRATION SETTING			
detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading, L/min	Initial Flowrate Reading (Before Adj.), L/min	% Dif.	Final Flowrate Reading (After Adj.), L/min
16.70	16.65	0.299	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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CALIBRATION REPORT			
PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC)			
DATE :	17 September 2024	BRAND :	BGI
		MODEL :	PQ200
NO.	PM2.5-05	SERIAL NO.	160810-14(VSCC)
CALIBRATING CONDITION			
Pressure	1011	mmbar	Temp. 24.5 °C
		% RH	49
Calibration Method : Dry Cal Primary		Model : Defender 510 H	S/N : 136164
CALIBRATION SETTING			
detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading, L/min	Initial Flowrate Reading (Before Adj.), L/min	% Dif.	Final Flowrate Reading (After Adj.), L/min
16.70	16.68	0.120	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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CALIBRATION REPORT			
PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC)			
DATE :	17 September 2024	BRAND :	BGI
NO.	PM2.5-07	MODEL :	PQ200
		SERIAL NO.	152099 (VSCC)
CALIBRATING CONDITION			
Pressure	1011	mmbar	Temp. 24.5 °C
		% RH	49
Calibration Method : Dry Cal Primary		Model : Defender 510 H	S/N : 136164
CALIBRATION SETTING			
detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading, L/min	Initial Flowrate Reading (Before Adj.), L/min	%Dif.	Final Flowrate Reading (After Adj.), L/min
16.70	16.65	0.299	16.70

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
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CALIBRATION REPORT			
PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC)			
DATE :	17 September 2024	BRAND :	BGI
		MODEL :	CCZ-30
NO.	PM2.5-11	SERIAL NO.	2024EN0242005
CALIBRATING CONDITION			
Pressure	1011	mmbar	Temp. 24.5 °C
		% RH	49
Calibration Method : Dry Cal Primary		Model : Defender 510 H	S/N : 136164
CALIBRATION SETTING			
detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading,L/min	Initial Flowrate Reading (Before Adj.),L/min	%Dif.	Final Flowrate Reading (After Adj.),L/min
16.70	16.65	0.299	16.70

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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Tel: (662) 939-4370 (Automatic 5 Lines) Fax: (662) 513-4221 E-mail: sale@spscon.com

CALIBRATION REPORT			
PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC)			
DATE :	17 September 2024	BRAND :	BGI
MODEL :	CCZ-30	SERIAL NO.	2024EN0242003
NO.	PM2.5-12		
CALIBRATING CONDITION			
Pressure	1011	mmbar	Temp. 24.5 °C
% RH	49		
Calibration Method : Dry Cal Primary	Model : Defender 510 H	S/N : 136164	
CALIBRATION SETTING			
detaCal	PM2.5 AIR SAMPLER		
Flowrate Reading, L/min	Initial Flowrate Reading (Before Adj.), L/min	% Dif.	Final Flowrate Reading (After Adj.), L/min
16.70	16.68	0.120	16.70

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

Calibration Data

Gas Sampler		Calibration Data					
No.	Rotameter	Date	Setting (Constant Flow) (ml/min)	Actual Flow Rate (ml/min)			
				Sampling Line A		Sampling Line B	
				Normal Condition	Standard Condition	Normal Condition	Standard Condition
B01	2 (A&B)	02/09/2024	200	200.3	199.8	200.5	200.0
B02	2 (A&B)	03/09/2024	200	200.4	199.9	200.7	200.2
B03	2 (A&B)	02/09/2024	200	200.6	200.1	200.4	199.9
B04	2 (A&B)	03/09/2024	200	200.8	200.3	200.2	199.7
B05	2 (A&B)	02/09/2024	200	200.6	200.0	200.3	199.8
B06	2 (A&B)	02/09/2024	200	200.4	199.9	200.5	200.0
B07	2 (A&B)	04/09/2024	200	200.5	200.0	200.8	200.3
B08	2 (A&B)	04/09/2024	200	200.3	199.8	200.4	199.9
B09	2 (A&B)	04/09/2024	200	200.7	200.2	200.6	200.1
B10	2 (A&B)	04/09/2024	200	200.6	200.1	200.3	199.8
B11	2 (A&B)	04/09/2024	200	200.5	199.9	200.4	199.9
B12	2 (A&B)	02/09/2024	200	200.3	199.8	200.6	200.1
B13	2 (A&B)	03/09/2024	200	200.6	200.1	200.3	199.8
B14	2 (A&B)	02/09/2024	200	200.5	200.0	200.7	200.1
B15	2 (A&B)	03/09/2024	200	200.3	199.8	200.5	199.9
B16	2 (A&B)	04/09/2024	200	200.7	200.2	200.6	200.1
B17	2 (A&B)	02/09/2024	200	200.4	199.9	200.3	199.8

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	17 September 2024	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B01			SERIAL NO.	1749
Calibrator (Dilution System)					
Brand	: Teledyne			Model	: 700E
Last Cal. Date	: 30 October 2023			Serial No.	: 201-S
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 49.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	399.7	-0.075	400.0	1.005
API Model 100A SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	659	cc/min	650 ± 10%		
PMT	103.0	mV	-20-150 with Zero Air		
UV LAMP	3016.4	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	672	V	550-900 constant		
DCPS	2525	mV	2500 ± 200		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.1	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.005	-	1.0 ± 0.3		
SO ₂ Offset	21.9	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	17 September 2024	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B02			SERIAL NO.	1847
Calibrator (Dilution System)					
Brand : Teledyne			Model : 700E		
Last Cal. Date : 30 October 2023			Serial No. : 201-S		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO ₂)			Cylinder No. : A00814SK		
Certified Date : 21 June 2021		Expired Date : 21 June 2029		Cylinder Conc. : 49.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	400.2	0.050	400.0	1.011
API Model 100A SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.7	in-Hg	25-35		
SAMPLE FLOW	655	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	3030.8	mV	1000-4900		
STR. LGT	61.8	PPB	<100		
DRK PMT	63.3	mV	-50 - 200		
DRK LMP	57.9	mV	-50 - 200		
HVPS	674	V	550-900 constant		
DCPS	2517	mV	2500 ± 200		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.011	-	1.0 ± 0.3		
SO ₂ Offset	22.2	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	17 September 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -B04	SERIAL NO.	3159		
Calibrator (Dilution System)					
Brand	: API		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 49.8 ppm				
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.9	-0.025	400.0	1.007
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.4	in-Hg	25-35		
SAMPLE FLOW	657	cc/min	650 ± 10%		
PMT	103.4	mV	-20-150 with Zero Air		
UV LAMP	3038.1	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.7	mV	-50 - 200		
HVPS	669	V	550-900 constant		
DCPS	2524	mV	2500 ± 200		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.0	°C	5-40		
PMT TEMP	7.4	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.007	-	1.0 ± 0.3		
SO ₂ Offset	21.7	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	17 September 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -B06			SERIAL NO.	3430
Calibrator (Dilution System)					
Brand	: Teledyne			Model	: 700E
Last Cal. Date	: 30 October 2023			Serial No.	: 201-S
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 49.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.8	-0.050	400.0	1.006
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	660	cc/min	650 ± 10%		
PMT	103.5	mV	-20-150 with Zero Air		
UV LAMP	3041.2	mV	1000-4900		
STR. LGT	61.7	PPB	<100		
DRK PMT	63.1	mV	-50 - 200		
DRK LMP	57.9	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2518	mV	2500 ± 200		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.006	-	1.0 ± 0.3		
SO ₂ Offset	21.8	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	17 September 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -B07			SERIAL NO.	1706
Calibrator (Dilution System)					
Brand : Teledyne			Model : 700E		
Last Cal. Date : 30 October 2023			Serial No. : 201-S		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO ₂)			Cylinder No. : A00814SK		
Certified Date : 21 June 2021		Expired Date : 21 June 2029		Cylinder Conc. : 49.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	399.6	-0.100	400.0	1.003
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.7	in-Hg	25-35		
SAMPLE FLOW	656	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3028.7	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.6	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2522	mV	2500 ± 200		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.003	-	1.0 ± 0.3		
SO ₂ Offset	21.6	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT						
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER						
DATE :	17 September 2024	BRAND :	API	MODEL :	200E	
NO.	NOX-B05	SERIAL NO.	2284			
Calibrator (Dilution System)						
Brand	: Teledyne			Model	: 700E	
Last Cal. Date	: 30 October 2023			Serial No.	: 201-S	
Reference Standard Gas						
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm	
CALIBRATING CONDITION						
Pressure	1011	mmbar	Temp.	24.6	°C	
% RH						50
CALIBRATION SETTING						
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB		
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope	
Zero	0	-0.10	-	0	-	
NO Span	400	399.8	-0.050	400.0	1.007	
NO _x Span	400	400.1	0.025	400.0	1.010	
API Model 200E NO _x Analyzer Check List						
Test Values	Observed Value	Units	Nominal Range			
RANGE	500	PPB	500 standard			
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air			
SAMPLE FLOW	509	cc/min	500 ± 50			
OZONE FLOW	79	cc/min	80 ± 15			
PMT	103.2	mV	-20 - 150			
AZERO	94.0	mV	-20 - 150			
HVPS	673	V	420 - 900 constant			
RCELL TEMP	50.1	°C	50 ± 1			
BOX TEMP	29.2	°C	8 - 48			
PMT TEMP	7.3	°C	7 ± 2			
MOLY TEMP	314.7	°C	315 ± 5			
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant			
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant			
NO Span Conc	400	PPB	20 - 20,000			
NO _x Span Conc	400	PPB	20 - 20,000			
NO Slope	1.007	-	1.0 ± 0.3			
NO _x Slope	1.010	-	1.0 ± 0.3			
NO Offset	1.4	mV	-20 to +150			
NO _x Offset	0.9	mV	-20 to 150			
Stability at Zero	0.1	PPB	< 0.2			
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas			

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : (Signature)
(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	17 September 2024	BRAND :	API	MODEL :	200E
NO.	NOX-B07	SERIAL NO.	4338		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.004
NO _x Span	400	399.9	-0.025	400.0	1.008
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	505	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.0	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.1	°C	8 - 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	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	1.008	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO _x Offset	0.7	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sale@spscon.com., www.spscon.com

CALIBRATION REPORT						
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER						
DATE :	17 September 2024	BRAND :	API	MODEL :	200E	
NO.	NOX-B10	SERIAL NO.	4465			
Calibrator (Dilution System)						
Brand	: Teledyne			Model	: 700E	
Last Cal. Date	: 30 October 2023			Serial No.	: 201-5	
Reference Standard Gas						
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm	
CALIBRATING CONDITION						
Pressure	1011	mmbar	Temp.	24.6	°C	
% RH						50
CALIBRATION SETTING						
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB		
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope	
Zero	0	-0.10	-	0	-	
NO Span	400	400.1	0.025	400.0	1.010	
NO _x Span	400	400.3	0.075	400.0	1.013	
API Model 200E NO _x Analyzer Check List						
Test Values	Observed Value	Units	Nominal Range			
RANGE	500	PPB	500 standard			
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air			
SAMPLE FLOW	511	cc/min	500 ± 50			
OZONE FLOW	79	cc/min	80 ± 15			
PMT	103.2	mV	-20 - 150			
AZERO	93.8	mV	-20 - 150			
HVPS	675	V	420 - 900 constant			
RCELL TEMP	50.4	°C	50 ± 1			
BOX TEMP	29.1	°C	8 - 48			
PMT TEMP	7.3	°C	7 ± 2			
MOLY TEMP	315.2	°C	315 ± 5			
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant			
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant			
NO Span Conc	400	PPB	20 - 20,000			
NO _x Span Conc	400	PPB	20 - 20,000			
NO Slope	1.010	-	1.0 ± 0.3			
NO _x Slope	1.013	-	1.0 ± 0.3			
NO Offset	1.8	mV	-20 to +150			
NO _x Offset	1.1	mV	-20 to 150			
Stability at Zero	0.1	PPB	< 0.2			
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas			

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	17 September 2024	BRAND :	API	MODEL :	200E
NO.	NOX-B11	SERIAL NO.	4467		
Calibrator (Dilution System)					
Brand	: Teledyne			Model	: 700E
Last Cal. Date	: 30 October 2023			Serial No.	: 201-S
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00726SV
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.005
NO _x Span	400	399.9	-0.025	400.0	1.009
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	512	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	674	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.5	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCELL 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	1.005	-	1.0 ± 0.3		
NO _x Slope	1.009	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO _x Offset	0.8	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : (Signature)
(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	17 September 2024	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B22	SERIAL NO.	NO1618		
Calibrator (Dilution System)					
Brand	: Teledyne			Model	: 700E
Last Cal. Date	: 30 October 2023			Serial No.	: 201-S
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00726SV
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.11	-	0	-
NO Span	400	399.9	-0.025	400.0	1.007
NO _x Span	400	400.1	0.025	400.0	1.011
API Model TML-41M 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	503	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.2	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.007	-	1.0 ± 0.3		
NO _x Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.7	mV	-20 to +150		
NO _x Offset	1.0	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr.Peera Detudom)

**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 : 24M2227

REFERENCE No : 72448-1

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 : 08-Mar-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25°C \pm 1°C RELATIVE HUMIDITY : 53 %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	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

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

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

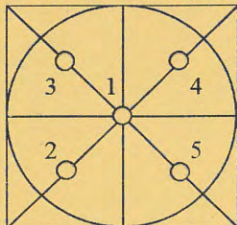
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 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	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	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

คุณภาพอากาศจากปล่อง



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S.P.S. CONSULTING SERVICE CO., LTD.

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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	02/09/2024	0.998	50.16
B02	8002514	04/09/2024	1.002	50.08
B03	1503016	02/09/2024	1.005	50.02
B04	00006659	03/09/2024	0.997	49.84
B05	00007428	02/09/2024	1.003	49.95
R01	1561	03/09/2024	0.998	50.11
R02	8002513	04/09/2024	0.997	49.97
R03	1570	03/09/2024	1.004	49.82
R04	8002519	02/09/2024	0.996	49.74
R05	1503015	04/09/2024	0.999	49.88

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

Accept Value of ΔH_{g} (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :

Peera Detudom

(Mr. Peera Detudom)



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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
B03	S	0.99	02/08/2024	0.84	0.83
B04	S	0.99	02/08/2024	0.85	0.84
B05	S	0.99	05/08/2024	0.84	0.84
B07	S	0.99	05/08/2024	0.84	0.83
B08	S	0.99	02/08/2024	0.84	0.84
B09	S	0.99	02/08/2024	0.84	0.85
B11	S	0.99	02/08/2024	0.84	0.84
B16	S	0.99	01/08/2024	0.83	0.84
B18	S	0.99	01/08/2024	0.84	0.84
B19	S	0.99	05/08/2024	0.84	0.84
B21	S	0.99	07/08/2024	0.84	0.85
B24	S	0.99	05/08/2024	0.83	0.84
B27	S	0.99	05/08/2024	0.84	0.83
B30	S	0.99	07/08/2024	0.85	0.84
B31	S	0.99	02/08/2024	0.84	0.85
B33	S	0.99	01/08/2024	0.84	0.84
B35	S	0.99	02/08/2024	0.84	0.85

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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	02/08/2024	0.83	0.84
B37	S	0.99	02/08/2024	0.84	0.84
B38	S	0.99	01/08/2024	0.84	0.83
B39	S	0.99	05/08/2024	0.84	0.85
B40	S	0.99	08/08/2024	0.84	0.84
B41	S	0.99	05/08/2024	0.84	0.85
B44	S	0.99	05/08/2024	0.84	0.85
B45	S	0.99	05/08/2024	0.85	0.84
B46	S	0.99	02/08/2024	0.84	0.85
B47	S	0.99	05/08/2024	0.84	0.85
B48	S	0.99	07/08/2024	0.83	0.84
B49	S	0.99	07/08/2024	0.84	0.85
B54	S	0.99	07/08/2024	0.83	0.84
B56	S	0.99	02/08/2024	0.84	0.84
B57	S	0.99	06/08/2024	0.85	0.84
B58	S	0.99	02/08/2024	0.84	0.84

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
CLID. NO. : 212301419
JOB CONTROL NO. : 240720076545
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 20 July 2024

DATE OF ISSUED : 23 July 2024

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

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
23 July 2024



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

Certificate No. Q24076545

F3-011-05/12-23

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

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

UNCERTAINTY :

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

Certificate No. **Q24076545**

F3-011-05/12-23

page 2 of 3



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

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

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

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

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

End of Certificate

Certificate No. Q24076545

F3-011-05/12-23

page 3 of 3





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@spscon.com. www.spscon.com

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	504.1	997.1	1991.2	0.995x + 6.628	1.000
H-B02	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	497.3	1003.5	2015.2	0.998 + 5.168	1.000
H-B03	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	498.4	994.8	2013.0	1.005x - 12.628	0.999
H-B04	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.1	997.9	1992.5	0.996x + 6.085	1.000
H-B05	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	497.9	1004.0	2014.2	0.998x + 4.472	1.000
H-B06	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	499.7	997.9	2015.7	1.004x - 9.662	0.999
H-B07	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	501.4	1002.3	1990.2	0.999x + 4.103	1.000
H-B08	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	501.5	999.6	1988.9	0.991x + 12.846	1.000
H-B09	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	502.7	1003.8	1984.8	0.997x + 6.523	0.999
H-B10	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	501.5	999.7	1988.7	0.994x + 9.648	1.000

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



CERTIFICATE No : 24M2227

REFERENCE No : 72448-1

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 : 08-Mar-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25°C \pm 1°C RELATIVE HUMIDITY : 53 %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	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

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

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

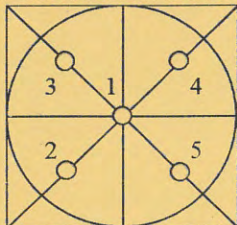
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 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	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT

Cert. No. : SP24020

Pages 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER

Manufacturer : PERKINELMER

Model : LAMBDA 25

Serial No.: 501S14123010

ID No.: SP03/58

Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY

Condition As Found : GOOD

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

Location : WET CHEMISTRY LABORATORY IV

Ambient Temperature : (28.1 ± 5) °C

Relative Humidity : (47.2 ± 25) %

Received Date : 27 AUGUST 2024

Calibration Date : 27 AUGUST 2024

Date of Issue : 27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :


(Thanakul Petchurai)

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01

The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution

The calibration procedure used was based on ASTM E275-01, ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

F. Petch

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

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

Resolution of Wavelength Mode	0.1 nm
Resolution of Photometric Mode	0.0001 A
Parameter Setting	
Measurement Mode	Wavelength, Absorbance
Wavelength Scan	1100 nm-190 nm
Scanning Speed	7.5 nm/min
Data Pitch	0.1 nm
Band width(Wavelength)	1.0 nm
Band width(Vis)	1.0 nm
Band width(Uv)	1.0 nm

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

T. Ketch



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 4, 2024</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 4, 2025</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 4, 2024</u>	
User Name: <u>K.Phenpha Vipasthawatt</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>September 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>January 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** July 4, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401
DATE TESTED : July 4, 2024

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	<u>0.00550</u>	
	Ni	231.604 nm	≤ 0.008	<u>0.00714</u>	
	Ni	341.476 nm	≤ 0.012	<u>0.00790</u>	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	<u>0.01655</u>	
	Ba	455.403 nm	≤ 0.025	<u>0.02391</u>	
Precision					
	As	193.656 nm	% RSD < 1.0	<u>0.72</u>	%
	Zn	213.856 nm	% RSD < 1.0	<u>0.66</u>	%
	Mn	257.610 nm	% RSD < 1.0	<u>0.30</u>	%
	La	379.478 nm	% RSD < 1.0	<u>0.98</u>	%
	Ba	455.403 nm	% RSD < 1.0	<u>0.95</u>	%
	Ba	493.408 nm	% RSD < 1.0	<u>0.78</u>	%
Detection Limits : Axial	Tl	190.080 nm	3(sd)	<u>6.22</u>	ppb
	As	193.696 nm	3(sd)	<u>6.44</u>	ppb
	Pb	220.353 nm	3(sd)	<u>2.06</u>	ppb
Detection Limits : Radial	As	193.696 nm	3(sd)	<u>78.26</u>	ppb
	Zn	213.856 nm	3(sd)	<u>2.07</u>	ppb
	Mn	257.610 nm	3(sd)	<u>0.52</u>	ppb
	La	379.478 nm	3(sd)	<u>2.63</u>	ppb
	Ba	455.403 nm	3(sd)	<u>0.08</u>	ppb
	Ba	493.408 nm	3(sd)	<u>0.75</u>	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	<u>64.72</u>	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	<u>15.04</u>	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED July 4, 2024**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:



(Wiphan Promlumda)

Service Engineer

Spectrum BX Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd.		
Address:	7 Soi Phaholyothin 24 ,Phaholyothin Rd.,Jompol, Chatuchak,Bangkok 10900		
User Name:	K.Waraphon Phoowat	WO Number :	WO-02860803
Telephone No.:	083-033-6758	Certificate Number:	IR1164-2024
Customer Support Engineer:	Tanongsak	PM Number :	1 of 1
Date PM Performed: (DD-MMM-YYYY)	14-Aug-2024	Next PM Due Date: (DD-MMM-YYYY)	14-Aug-2025

Scope

The purpose of this PM is to ensure the continued functionality of the Spectrum FTIR Spectrophotometer by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The document can be used for spectrum One, Spectrum One, NTS, Spectrum 100, Spectrum 100N, Spectrum Optica, Spectrum 4000F and the Frontier Series of FTIR Spectrophotometers.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files. The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Spectrum BX	70366	5.3.1 Std	KBr B/S

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot/SN #	Expiration Date (MM/YY)
N0171159	Desiccant	2	NA	NA

Procedure Checklist

Use (X) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Source and Source Mirror
- ☒ Beam splitter
- ☒ Optical Unit Windows
- ☒ Mirror

2. Mechanical:

- ☒ Motors including Electronics unit fan
- ☒ Purge seals
- ☒ Change Desiccant

3. Electronics Check:

- ☒ Laser Output

1000, Paragon, RX or BX Laser Output	Specification	Value	Laser Gain
	16 +/- 1	15.85	2.61

- ☒ EndStop

End Stop	Specification	Value
	+/- 50	3.00

- ☒ Zero Path

Zero Path	Specification	Value
	+/- 20	4.00

- ☒ Energy

Energy	Specification	Value
	NA	14454.00

☒ Gain

Gain	Specification	Value
	Less than +/- 9.5	6.85 / -8.26

☒ Match

Match	Specification	Value
	NA	3.22

3. Performance Test:

☒ Signal to Noise Ratio (SNR) – (Record typical SNR Value).

	Detector Type	Typical SNR
Signal to Noise Ratio	DTGS (MIR)	2858.78

4. Wavenumber Calibrate:

☒ Wavenumber Calibrate

Certified Value (cm-1)	Value	Specification	Difference (cm-1)
3082.22	3082.06	+/- 0.5	0.16
3060.14	3060.00	+/- 0.5	0.14
1601.38	1601.40	+/- 0.5	-0.02
1583.04	1583.27	+/- 0.5	-0.23
1028.42	1028.51	+/- 0.5	-0.09


6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Reset desiccant and service intervals on maintenance dialog.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand
- ☒ Attach PM sticker.
- ☐ Update Logbook.

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for FTIR have been completed.</i>	
Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> <i>the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: 	Date: 14-Aug-2024 <small>(DD-MMM-YYYY)</small>
Authorized Customer Representative:	Date: 14-Aug-2024 <small>(DD-MMM-YYYY)</small>



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.



บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO., LTD.

Operator Signature: _____

Date: June 24, 2024

(Mr. Ponwut Kornthongnimit)

Test Engineer

ระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : $(23 + 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

- 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 Keithley 2015-P S/N4106495.
 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 : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

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.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

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

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 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 Bruel&Kjaer 4180	93.85	-0.15	± 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 Bruel&Kjaer 4180	999.9	-0.1	± 1.5	$\pm 2.0\%$

3. Total Distortion


Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 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 :


(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

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.

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9000
Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



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@spscon.com, www.spscon.com

Noise B_305/24

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	04 March 2024
		Due Date	04 March 2025

Calibration Data

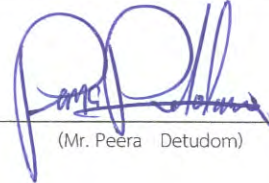
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	14 July 2024	93.9	93.9
ACO-B41	ACO	6236	00192032	14 July 2024	93.9	93.9
ACO-R52	ACO	6236	00192064	14 July 2024	94.1	93.9
ACO-R56	ACO	6236	00222310	14 July 2024	94.0	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :



(Mr. Peera Detudom)



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

Noise B_377/24

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	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B02	ACO	6236	00090370	17 September 2024	93.9	93.9
ACO-B09	ACO	6236	00152004	17 September 2024	94.1	93.9
ACO-B12	ACO	6236	00152081	17 September 2024	94.1	93.9
ACO-B30	ACO	6236	00182012	17 September 2024	93.9	93.9
ACO-B32	ACO	6236	00182014	17 September 2024	94.0	93.9
ACO-B37	ACO	6236	00192028	17 September 2024	93.9	93.9
ACO-B39	ACO	6236	00222301	17 September 2024	94.1	93.9
ACO-B45	ACO	6236	00222304	17 September 2024	93.9	93.9
ACO-R54	ACO	6236	00222307	17 September 2024	94.0	93.9
ACO-R56	ACO	6236	00222310	17 September 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

คุณภาพน้ำทิ้ง

**QUALITY CALIBRATION CO., LTD.**

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

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



CERTIFICATE No : 24E6416

REFERENCE No : 73694-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER

MANUFACTURER : HANNA

MODEL : HI 3512

SERIAL No : TH118035

ID No : pH 04/56

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 27-Jun-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24

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



QUALITY CALIBRATION CO., LTD.

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

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

CERTIFICATE No : 24E6416

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH 04/56
RECEIVED DATE : 24-Jun-24
AMBIENT TEMPERATURE : 23 ° C ± 3 ° C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 27-Jun-24
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR $k = 2.303 RT/F = 59 \text{ mV/pH}$

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

END OF CALIBRATION REPORT PAGE 2 OF 3

**QUALITY CALIBRATION CO., LTD.**

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

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

CERTIFICATE No : 24E6416

PAGE : 3 OF 3

Calibration Report**RESULT OF CALIBRATION (CONTINUE):****2. DISPLAY UNIT WITH pH ELECTRODE S/N: 09081C6M**

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

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

Certificate of Calibration

Certificate No. : 67-400037-2

Page : 1 of 2

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

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Equipment : Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

Environment : Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

Date of Received : 23 January 2024

Date of Calibration : 03 February 2024

Date of Issue : 03 February 2024

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

Reference Standard Instruments : This certification is traceable to the International System of Units

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by :

(Surachai Promthong)

Laboratory Manager

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 Calibratech Co.,Ltd.



Certificate of Calibration

Certificate No. : 67-400037-2

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.4336 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
20.5609	20	0.6	0.31

Remark

UUC : Unit Under Calibration

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

This 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%

- o O o -





CERTIFICATE No : 24M2229
REFERENCE No : 72448-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY :  PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2229

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE **MODEL** : BSA224S-CW
MANUFACTURER : SARTORIUS **S/N** : 36591843
ID No : BA 09/61 **RECEIVED DATE** : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar **CALIBRATION DATE** : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C **RELATIVE HUMIDITY** : 55 %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 :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) STANDARD WEIGHT SET	E2	QK-I-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

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

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

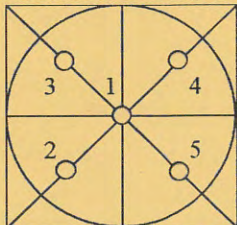
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000082
0.1	0.1000	0.0000	0.000083
0.2	0.2000	0.0000	0.000083
0.5	0.5000	0.0000	0.000083
1.0	1.0000	0.0000	0.000084
2.0	2.0000	0.0000	0.000084
5.0	5.0000	0.0000	0.000086
10.0	10.0000	0.0000	0.000089
20.0	20.0001	-0.0001	0.000094
50.0	50.0000	0.0000	0.00012
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT

CERT.No.: HS-V015C

Calibration Date : 20 Mar 24
 Submitted by : ASIA LAB @ CONSULTANT CO.,LTD
 184 Soi Phutthamonthon Sai 2 Soi 12,
 Bangphai, Bangkae, Bangkok 10160

Avg Room Temp : 20 °C
 Avg Water Temp : 20 °C
 Air Pressure : 760.00 mmHg
 Salinity : 0 ppt

Model : YSI 5000
 S/N : 15B100751
 Probe : YSI 5010
 S/N : 22D100097
 ID NO. : -
 Air Temp ref : S/N. F8065C26
 Barometric ref : S/N. F8065C26
 Water Temp ref : S/N. 11430
 Technician : Kittipong M.

Calibration Details

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

Mean Measurement	9.08	mg/l	-	-
Inaccuracy	0.01	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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



Technician Signature
 (Kittipong Maekwong)



Laboratory Manager
 (Supreecha Sumaritam)



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 24T0774

REFERENCE No : 71986-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200


SERIAL No : 15110C0235

ID No : CRB 05/59

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 5-Feb-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 5-Feb-24

RECEIVED DATE : 5-Feb-24



CERTIFICATE No : 24T0774

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : CRB 05/59
RECEIVED DATE : 5-Feb-24
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 5-Feb-24
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

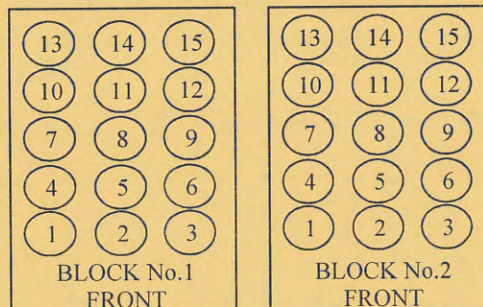
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	23T6640	14-Jul-24

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	150.2
	2	150.2
	3	150.2
	4	149.9
	5	149.9
	6	150.1
	7	150.7
	8	149.9
	9	149.9
	10	150.8
	11	150.4
	12	149.5
	13	150.1
	14	150.6
	15	150.1
Uncertainty of Measurement(± °C)	0.86	0.86

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

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 4, 2024</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 4, 2025</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 4, 2024</u>	
User Name: <u>K.Phenpha Vipasthawatt</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>September 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>January 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** July 4, 2024**1. MECHANICAL CHECKS**

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

2. OPTICAL CHECKS

- | | |
|---|-----------------------------|
| A. Inspect and clean all optical components. | <input type="checkbox"/> OK |
| B. As required, check and replace all purgefilters. | <input type="checkbox"/> OK |
| C. Recheck optical alignment. | <input type="checkbox"/> OK |

3. COOLING SYSTEM CHECKS

- | | |
|---|------------------------------|
| A. Perform preventive maintenance on chiller. | <input type="checkbox"/> OK |
| B. Flush out the chiller every year. | <input type="checkbox"/> N/A |

4. PERFORMANCE CHECKS

- | | |
|----------------------------|-----------------------------|
| A. Torch View Alignment. | <input type="checkbox"/> OK |
| B. Wavelength Calibration. | <input type="checkbox"/> OK |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401
DATE TESTED : July 4, 2024

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	<u>0.00550</u>	
	Ni	231.604 nm	≤ 0.008	<u>0.00714</u>	
	Ni	341.476 nm	≤ 0.012	<u>0.00790</u>	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	<u>0.01655</u>	
	Ba	455.403 nm	≤ 0.025	<u>0.02391</u>	
Precision					
	As	193.656 nm	% RSD < 1.0	<u>0.72</u>	%
	Zn	213.856 nm	% RSD < 1.0	<u>0.66</u>	%
	Mn	257.610 nm	% RSD < 1.0	<u>0.30</u>	%
	La	379.478 nm	% RSD < 1.0	<u>0.98</u>	%
	Ba	455.403 nm	% RSD < 1.0	<u>0.95</u>	%
	Ba	493.408 nm	% RSD < 1.0	<u>0.78</u>	%
Detection Limits : Axial	Tl	190.080 nm	3(sd)	<u>6.22</u>	ppb
	As	193.696 nm	3(sd)	<u>6.44</u>	ppb
	Pb	220.353 nm	3(sd)	<u>2.06</u>	ppb
Detection Limits : Radial	As	193.696 nm	3(sd)	<u>78.26</u>	ppb
	Zn	213.856 nm	3(sd)	<u>2.07</u>	ppb
	Mn	257.610 nm	3(sd)	<u>0.52</u>	ppb
	La	379.478 nm	3(sd)	<u>2.63</u>	ppb
	Ba	455.403 nm	3(sd)	<u>0.08</u>	ppb
	Ba	493.408 nm	3(sd)	<u>0.75</u>	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	<u>64.72</u>	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	<u>15.04</u>	



MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401

DATE TESTED July 4, 2024

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:



(Wiphan Promlumda)

Service Engineer

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : CONDUCTIVITY METER
MANUFACTURER : METTLER TOLEDO
MODEL / TYPE : SEVEN COMPACT S230
SERIAL NO. : C141708983/5821320179
CLID. NO. : 272300452
JOB CONTROL NO. : 240213016389
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

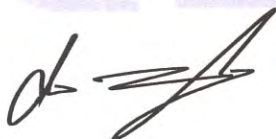
DATE OF RECEIVED : 13 February 2024

DATE OF ISSUED : 16 February 2024

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

Calibrated By :

Sukgasem Seehanart
Calibration Engineer



Approved By :

Mongkol Yotsoontorn
Authorized Signatory
16 February 2024



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

Certificate No. Q24016389

F3-011-05/12-23

page 1 of 4



@clccalibration

REPORT OF CALIBRATION FOR

NOMENCLATURE : CONDUCTIVITY METER
MANUFACTURER : METTLER TOLEDO
MODEL / TYPE : SEVEN COMPACT S230
SERIAL NO. : C141708983/5821320179
DATE OF CALIBRATION : 13 February 2024

ENVIRONMENT CONDITIONS :

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

PROCEDURE USED :

This instrument [Conductivity Meter] was calibrated under procedure No. **WI-305-130**. The calibration was performed by direct measurement with Certified Reference Material (CRM) and Reference Material (RM) .

This instrument [Temperature] was calibrated under procedure No. **WI-305-244**. The calibration was performed by Comparison with Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Conductivity Solution , Hanna Product Code HI 7033L Lot Number 7830.
2. Potassium Chloride Solution (nominal 1.41 mS/cm)
3. Potassium Chloride Solution (nominal 12.8 mS/cm)
4. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
5. Precision Thermometer, ASL Model F200-A-8 S/N. 014433/03.
6. IPRT, ASL Model T100-250-1D S/N. L0193A-1-1.



TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Hanna instruments.
Certificate No. 20F21 , Due Date June 2025 .
2. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.
Certificate No. HC30595403 , Due Date 31 January 2026 .
3. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.
Certificate No. HC20111554 , Due Date 30 September 2025.
4. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.
Certificate No. Q23136342, Due Date 20 December 2024.
5. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0203/67, Due Date 07 December 2024.
6. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Certificate No. TT-0136-23, Due Date 12 December 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of Conductivity Meter.

CALIBRATION DATA

1. Conductivity Solution Test @ 25°C

Standard Conductivity Solution	DUC Reading	Uncertainty of Measurement
*84.00 $\mu\text{S/cm}$	84.05 $\mu\text{S/cm}$ [Cell Constant 0.548589]	$\pm 1.00 \mu\text{S/cm}$
1414.0 $\mu\text{S/cm}$	1415 $\mu\text{S/cm}$ [Cell Constant 0.548589]	$\pm 21.0 \mu\text{S/cm}$
12.83 mS/cm	12.75 mS/cm [Cell Constant 0.548589]	$\pm 0.19 \text{mS/cm}$

Note. * means Calibrations marked "Not TISI Accredited" in this Certificate have been included for completeness.

The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 91 of 138

*2. Temperature Result [Probe Conductivity]

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty \pm (°C)
100	25.00	24.9	+0.10	0.07

Note. * means Calibrations marked " Not TISI Accredited " in this Certificate have been included for completeness.

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

End of Certificate

Certificate No. Q24016389

F3-011-05/12-23

page 4 of 4





MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkac Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 <http://www.mit.in.th>



CALIBRATION CERTIFICATE

Certificate No. : S2023090437-0003

Date Issued : 28-Sep-23

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

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

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

Date Received : 22-Sep-23

Date Calibrated : 22-Sep-23

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

Result of Calibration

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

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

Approved by:

Sarayuth T.
(Mr. Sarayuth Tochua)



Page 1 of 2

Certificate No. : S2023090437-0003

Environment : Ambient Temperature : Start record 24.3 °C, Stop record 24.5 °C

Relative Humidity : Start record 54.8 %RH, Stop record 54.6 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.08	0.17	0.31
41.5	41.5	41.5	0.04	0.18	0.25

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty ⁴ ±°C
35	34.83	34.85	34.97	34.82	34.84	34.95	34.90	34.80	34.93	0.23
41.5	41.36	41.38	41.46	41.32	41.28	41.48	41.40	41.33	41.44	0.23

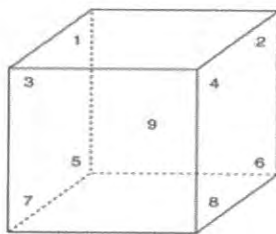
Calibration Temperature (°C)	MPE (±°C)	Pass / Fail with Guard Band								
		No. 1 (°C)	No. 2 (°C)	No. 3 (°C)	No. 4 (°C)	No. 5 (°C)	No. 6 (°C)	No. 7 (°C)	No. 8 (°C)	No. 9 (°C)
35.00	0.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
41.50	0.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass

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

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

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202306247-001 for Data Acquisition STD-286 Module 1 Serial No. MY44023139, Due 24-Dec-23

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.

2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.

3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.

4. The uncertainty of measurement is included temperature stability.

5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Certificate No. : S2024090374-0003

Date Issued : 23-Sep-24

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

Equipment : Incubator

Manufacturer : BINDER

Model : BD 115

Serial No. : 12-16967

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

Date Received : 16-Sep-24

Date Calibrated : 16-Sep-24

Calibrated by : Anusak Songliam

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

Result of Calibration

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

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

Approved by:

Saroyuth T.
(Saroyuth Tochua)



Certificate No. : S2024090374-0003

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

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

Without adjustment

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

Decision Rule with Guard Band

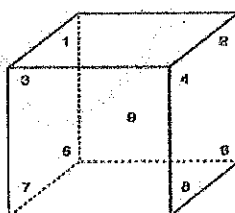
Calibration Temperature (°C)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	MPE (±°C)
35	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5
41.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5

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

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

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

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

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

End of Certificate

**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

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24T2234

REFERENCE No : 72448-8

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : WATER BATH

MANUFACTURER : MEMMERT

MODEL : WNB29

SERIAL No : L614.0123

ID No : WB-05/58

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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



CERTIFICATE No : 24T2234

PAGE : 2 OF 2

Calibration Report

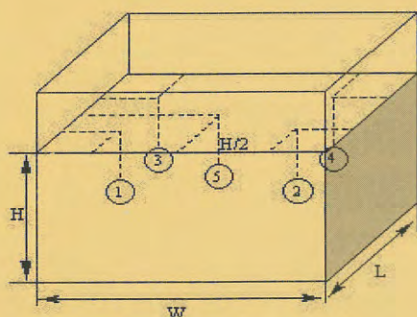
EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : WB-05/58
RECEIVED DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25 °C ± 1 °C
MODEL : WNB29
SERIAL NUMBER : L614.0123
CALIBRATION DATE : 08-Mar-24
RELATIVE HUMIDITY : 56 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
2. REFERENCE STANDARD INSTRUMENTS :-

- | INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|-------------------------|-------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH RTD | 2635A | 7286308 | 23T6641 | 14-Jul-24 |
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
 4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
 5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 2.1
Overall Variation of Line Voltage (V) : 14
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 60*40*6 cm

BATH PERFORMANCE

Controller Temperature (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
50.0	0.05	0.06	0.04	0.11
60.0	0.07	0.19	0.03	0.30

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± °C)
		#1	#2	#3	#4	Ref. 5	
50.0	50.0	49.61	49.62	49.63	49.67	49.65	0.15
60.0	60.0	59.48	59.67	59.52	59.60	59.59	0.16

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

NOTE 2 : 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 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY
Condition As Found : GOOD
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.
Location : ORGANIC LABORATORY IV
Ambient Temperature : (25.0 ± 5) °C
Relative Humidity : (48.4 ± 25) %
Received Date : 30 AUGUST 2023
Calibration Date : 30 AUGUST 2023
Date of Issue : 31 AUGUST 2023

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01

The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution

The calibration procedure used was based on ASTM E275-01,ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP23016
Job No. : VC66SP0014
Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422	0.2462	0.0040	0.0101	2.00	
		40	0.4866	0.4900	0.0034	0.0115	2.00	
		60	0.7414	0.7390	-0.0024	0.0068	2.00	
		80	0.9858	0.9871	0.0013	0.0093	2.00	
		100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC* = Unit Under Calibration

Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230

Resolution of Wavelength Mode 0.1 nm
Resolution of Photometric Mode 0.0001 A
Parameter Setting
Measurement Mode Wavelength, Absorbance
Wavelength Scan 1100 nm-190 nm
Scanning Speed 7.5 nm/min
Data Pitch 0.1 nm
Band width(Wavelength) 1.0 nm
Band width(Vis) 1.0 nm
Band width(Uv) 1.0 nm

Stray Light** UUC* Reading at 220 nm	
Transmission T(%)	Absorbance(A)
0.0111	3.9564

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

Cert. No. : SP24020

Pages 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER

Manufacturer : PERKINELMER

Model : LAMBDA 25

Serial No.: 501S14123010

ID No.: SP03/58

Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY

Condition As Found : GOOD

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

Location : WET CHEMISTRY LABORATORY IV

Ambient Temperature : (28.1 ± 5) °C

Relative Humidity : (47.2 ± 25) %

Received Date : 27 AUGUST 2024

Calibration Date : 27 AUGUST 2024

Date of Issue : 27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :


(Thanakul Petchurai)

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01

The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution

The calibration procedure used was based on ASTM E275-01, ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

F. Petch

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

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

Resolution of Wavelength Mode	0.1 nm
Resolution of Photometric Mode	0.0001 A
Parameter Setting	
Measurement Mode	Wavelength, Absorbance
Wavelength Scan	1100 nm-190 nm
Scanning Speed	7.5 nm/min
Data Pitch	0.1 nm
Band width(Wavelength)	1.0 nm
Band width(Vis)	1.0 nm
Band width(Uv)	1.0 nm

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

T. Ketch

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	Date Tested:	July 4, 2024
Address :	7 Soi Phaholyothin 24 Paholyothin Road Jompol Chatuchak, Bangkok 10900	Recommendation Recertification	
User Name:	K.Phenpha Vipasthawatt	Period	6 Months
Phone:	083-9269252	Recertification Due:	January 4, 2025
Email:		Date Last Certified:	January 4, 2024
		Visit Number:	2 OF 2
		PerkinElmer Phone:	02-719-6420 ext 204
		PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
1. INSTRUMENT CHECKS			
A. The Mirror and Lenses Condition			<input type="text" value="OK"/>
B. Grating Condition			<input type="text" value="OK"/>
C. Replace or Clean Dust Filter			<input type="text" value="OK"/>
D. Cleaning the Contact Cylinders			<input type="text" value="OK"/>
E. Cleaning the Furnace Windows			<input type="text" value="OK"/>
F. Cleaning the Burner Head			<input type="text" value="OK"/>
G. Cleaning the Nebulizer			<input type="text" value="OK"/>
H. Cleaning the Drain System			<input type="text" value="OK"/>
2. AUTOSAMPLE CHECK			
A. Sampling and Arm			<input type="text" value="OK"/>
B. Sampling & Rinse Pump			<input type="text" value="OK"/>
C. Sample Position & Clean			<input type="text" value="OK"/>
3. COOLING SYSTEM CHECKS			
A. Clean and Change Distill water			<input type="text" value="OK"/>
B. Themosensor			<input type="text" value="OK"/>
4. FIAS CHECKS			
A. Pump and 5 Port Valve			<input type="text" value="N/A"/>
B. Chemifold and Tubing			<input type="text" value="N/A"/>
C. Power Supply			<input type="text" value="N/A"/>
D. Flow meter and Gas system			<input type="text" value="N/A"/>

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
PARAMETER		SPECIFICATION	ACTUAL VAULE
A. Flame Mode Tests			
1. Detector-Linearity with Barium (553.55 nm)			
Neutral Density Filter 0.2 :	0.2042	Abs. \pm 5%	0.1815 Abs.
Neutral Density Filter 1.0 :	0.9798	Abs. \pm 5%	1.0220 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm)			
(at an integration time of 0.5 seconds			
and 99 replicates)			
	SD \leq 0.010 Abs.		0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm)			
(at an integration time of 0.5 seconds			
and 99 replicates)			
	SD \leq 0.001 Abs.		0.0001 Abs.
4. D ₂ Background Compensation (Copper 324.75 nm)			
with Neutral Density Filter 1.0	Absorbance \leq 0.010 Abs		0.0079 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm)			
(at an integration time of 2.0 seconds			
and 99 replicates)			
	SD \leq 0.005 Abs.		0.0007 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm)			
(at an integration time of 2.0 seconds			
and 99 replicates)			
	SD \leq 0.005 Abs.		0.0024 Abs.

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	<u>PTCS14111103</u>	DATE TESTED	<u>July 4, 2024</u>
PARAMETER	SPECIFICATION	ACTUAL VAULE	
7. Flame Interlock Shutdown	Shutdown correct?	<div>OK</div>	
8. Flame Sensitivity with Copper (324.75 nm)			
(5 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner and Stainless stell nebulizer)			
	Sensitivity ≥ 0.250 Abs.	<u>0.3118</u>	Abs.
(2 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner and High sensitivity nebulizer)			
	Sensitivity ≥ 0.250 Abs.	<u>N/A</u>	Abs.

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
PARAMETER	SPECIFICATION	ACTUAL VAULE	
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm)			
(mesure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0021	
	SD ≤ 0.005 Int.Abs	0.0004	Int.Abs.
3. Chromium Characteristic Mass(m ₀) and Precition (357.87 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 10 ug/L Cr standard)			
	m0 Results ≤ 7.0 pg/0.0044A-s	7	pg/0.0044A-s
	Precision ≤ 2.0%	1.32	%
4. Copper Characteristic Mass(m ₀) and Zeeman Ratio (324.75 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 25 ug/L Cu standard)			
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
	Zeeman Ratio 0.52 + 0.04	0.559	

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** July 4, 2024

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio =
$$\frac{\text{Atomic Signal(peak area)}}{\text{Atomic Signal(peak area)+Background Signal(peak area)}}$$

= 0.1491/0.1491+0.1176
0.559

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



meets



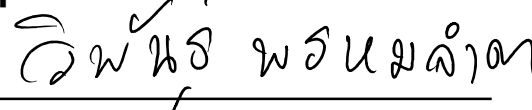
does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Customer Service Engineer:



(Wiphan Promlumda)

Service Engineer

คุณภาพกากตะกอน

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	Date Tested:	July 4, 2024
Address :	7 Soi Phaholyothin 24 Paholyothin Road Jompol Chatuchak, Bangkok 10900	Recommendation Recertification	
User Name:	K.Phenpha Vipasthawatt	Period	6 Months
Phone:	083-9269252	Recertification Due:	January 4, 2025
Email:		Date Last Certified:	January 4, 2024
		Visit Number:	2 OF 2
		PerkinElmer Phone:	02-719-6420 ext 204
		PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		
MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
1. INSTRUMENT CHECKS			
A. The Mirror and Lenses Condition			<input type="text" value="OK"/>
B. Grating Condition			<input type="text" value="OK"/>
C. Replace or Clean Dust Filter			<input type="text" value="OK"/>
D. Cleaning the Contact Cylinders			<input type="text" value="OK"/>
E. Cleaning the Furnace Windows			<input type="text" value="OK"/>
F. Cleaning the Burner Head			<input type="text" value="OK"/>
G. Cleaning the Nebulizer			<input type="text" value="OK"/>
H. Cleaning the Drain System			<input type="text" value="OK"/>
2. AUTOSAMPLE CHECK			
A. Sampling and Arm			<input type="text" value="OK"/>
B. Sampling & Rinse Pump			<input type="text" value="OK"/>
C. Sample Position & Clean			<input type="text" value="OK"/>
3. COOLING SYSTEM CHECKS			
A. Clean and Change Distill water			<input type="text" value="OK"/>
B. Themensor			<input type="text" value="OK"/>
4. FIAS CHECKS			
A. Pump and 5 Port Valve			<input type="text" value="N/A"/>
B. Chemifold and Tubing			<input type="text" value="N/A"/>
C. Power Supply			<input type="text" value="N/A"/>
D. Flow meter and Gas system			<input type="text" value="N/A"/>

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
PARAMETER		SPECIFICATION	ACTUAL VAULE
A. Flame Mode Tests			
1. Detector-Linearity with Barium (553.55 nm)			
Neutral Density Filter 0.2 :	0.2042	Abs. \pm 5%	0.1815 Abs.
Neutral Density Filter 1.0 :	0.9798	Abs. \pm 5%	1.0220 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm)			
(at an integration time of 0.5 seconds			
and 99 replicates)			
	SD \leq 0.010 Abs.		0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm)			
(at an integration time of 0.5 seconds			
and 99 replicates)			
	SD \leq 0.001 Abs.		0.0001 Abs.
4. D ₂ Background Compensation (Copper 324.75 nm)			
with Neutral Density Filter 1.0	Absorbance \leq 0.010 Abs		0.0079 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm)			
(at an integration time of 2.0 seconds			
and 99 replicates)			
	SD \leq 0.005 Abs.		0.0007 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm)			
(at an integration time of 2.0 seconds			
and 99 replicates)			
	SD \leq 0.005 Abs.		0.0024 Abs.

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
PARAMETER		SPECIFICATION	ACTUAL VAULE
7. Flame Interlock Shutdown		Shutdown correct?	<div>OK</div>
8. Flame Sensitivity with Copper (324.75 nm)			
(5 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner and Stainless stell nebulizer)			
		Sensitivity ≥ 0.250 Abs.	<u>0.3118</u> Abs.
(2 mg/L Cu Standard a read time of 10 seconds			
10 replicates, standard burner and High sensitivity nebulizer)			
		Sensitivity ≥ 0.250 Abs.	N/A Abs.

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
PARAMETER	SPECIFICATION	ACTUAL VAULE	
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm)			
(mesure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0021	
	SD ≤ 0.005 Int.Abs	0.0004	Int.Abs.
3. Chromium Characteristic Mass(m ₀) and Precition (357.87 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 10 ug/L Cr standard)			
	m0 Results ≤ 7.0 pg/0.0044A-s	7	pg/0.0044A-s
	Precision ≤ 2.0%	1.32	%
4. Copper Characteristic Mass(m ₀) and Zeeman Ratio (324.75 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 25 ug/L Cu standard)			
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
	Zeeman Ratio 0.52 + 0.04	0.559	

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 DATE TESTED July 4, 2024

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio = $\frac{\text{Atomic Signal(peak area)}}{\text{Atomic Signal(peak area)+Background Signal(peak area)}}$
 $= 0.1491/0.1491+0.1176$
0.559

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



meets



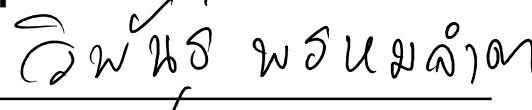
does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Customer Service Engineer:



(Wiphan Promlumda)

Service Engineer



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 4, 2024</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 4, 2025</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 4, 2024</u>	
User Name: <u>K.Phenpha Vipasthawatt</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>September 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>January 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** July 4, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401
DATE TESTED : July 4, 2024

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	As	193.696 nm	≤ 0.007	<u>0.00550</u>	
	Ni	231.604 nm	≤ 0.008	<u>0.00714</u>	
	Ni	341.476 nm	≤ 0.012	<u>0.00790</u>	
Spectral Resolution : VIS	La	408.672 nm	≤ 0.020	<u>0.01655</u>	
	Ba	455.403 nm	≤ 0.025	<u>0.02391</u>	
Precision					
	As	193.656 nm	% RSD < 1.0	<u>0.72</u>	%
	Zn	213.856 nm	% RSD < 1.0	<u>0.66</u>	%
	Mn	257.610 nm	% RSD < 1.0	<u>0.30</u>	%
	La	379.478 nm	% RSD < 1.0	<u>0.98</u>	%
	Ba	455.403 nm	% RSD < 1.0	<u>0.95</u>	%
	Ba	493.408 nm	% RSD < 1.0	<u>0.78</u>	%
Detection Limits : Axial	Tl	190.080 nm	3(sd)	<u>6.22</u>	ppb
	As	193.696 nm	3(sd)	<u>6.44</u>	ppb
	Pb	220.353 nm	3(sd)	<u>2.06</u>	ppb
Detection Limits : Radial	As	193.696 nm	3(sd)	<u>78.26</u>	ppb
	Zn	213.856 nm	3(sd)	<u>2.07</u>	ppb
	Mn	257.610 nm	3(sd)	<u>0.52</u>	ppb
	La	379.478 nm	3(sd)	<u>2.63</u>	ppb
	Ba	455.403 nm	3(sd)	<u>0.08</u>	ppb
	Ba	493.408 nm	3(sd)	<u>0.75</u>	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd	226.502 nm	≤ 150 ppb	<u>64.72</u>	
BEC : Radial (IB X 1000)/(IS-IB)	Mn	257.610 nm	≤ 45 ppb	<u>15.04</u>	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED July 4, 2024**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:



(Wiphan Promlumda)

Service Engineer

คุณภาพดิน



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 4, 2024</u>	
	Recommendation Recertification	
Address : <u>7 Soi Phaholyothin 24</u>	Period <u>6</u> Months	
<u>Paholyothin Road</u>	Recertification Due: <u>January 4, 2025</u>	
<u>Jompol Chatuchak, Bangkok 1090</u>	Date Last Certified: <u>January 4, 2024</u>	
User Name: <u>K.Phenpha Vipasthawatt</u>	Visit Number: <u>1 of 2</u>	
Phone: <u>083-9269252</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>	
Fax: <u>02-513-4221</u>	PerkinElmer Fax: <u>02-318-5597</u>	

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>September 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>January 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** July 4, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401
DATE TESTED : July 4, 2024

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007		<u>0.00550</u>	
	Ni 231.604 nm	≤ 0.008		<u>0.00714</u>	
	Ni 341.476 nm	≤ 0.012		<u>0.00790</u>	
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020		<u>0.01655</u>	
	Ba 455.403 nm	≤ 0.025		<u>0.02391</u>	
Precision					
	As 193.656 nm	% RSD	< 1.0	<u>0.72</u>	%
	Zn 213.856 nm	% RSD	< 1.0	<u>0.66</u>	%
	Mn 257.610 nm	% RSD	< 1.0	<u>0.30</u>	%
	La 379.478 nm	% RSD	< 1.0	<u>0.98</u>	%
	Ba 455.403 nm	% RSD	< 1.0	<u>0.95</u>	%
	Ba 493.408 nm	% RSD	< 1.0	<u>0.78</u>	%
Detection Limits : Axial	Tl 190.080 nm	3(sd)		<u>6.22</u>	ppb
	As 193.696 nm	3(sd)		<u>6.44</u>	ppb
	Pb 220.353 nm	3(sd)		<u>2.06</u>	ppb
Detection Limits : Radial	As 193.696 nm	3(sd)		<u>78.26</u>	ppb
	Zn 213.856 nm	3(sd)		<u>2.07</u>	ppb
	Mn 257.610 nm	3(sd)		<u>0.52</u>	ppb
	La 379.478 nm	3(sd)		<u>2.63</u>	ppb
	Ba 455.403 nm	3(sd)		<u>0.08</u>	ppb
	Ba 493.408 nm	3(sd)		<u>0.75</u>	ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb		<u>64.72</u>	
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb		<u>15.04</u>	



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED July 4, 2024**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.**Authorized Representative:**

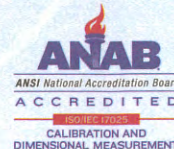
(Wiphan Promlumda)

Service Engineer

ระดับความร้อนในสถานประกอบการ



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24030285-5

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 : TEG040059

ID. Number : B07

Environmental Conditions

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

Relative Humidity : $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 19 Mar 2024

Calibration Date : 20 Mar 2024

Recommend Due Date : 20 Mar 2025

Date of Issue : 21 Mar 2024

Method of Calibration

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

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

Calibrated by : Mr.Navaporn Uengseng

Calibration Officer

Approved by :

(Ms.Bussakorn Chaikaew)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24030285-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	5020A	A47046	QR24-0167	26 Jan 2025

Traceability

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

Quality Reborn Co., Ltd



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24030285-5

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.8	-0.212	0.20
35.0	35.010	34.8	-0.210	0.20
40.0	40.015	39.9	-0.115	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.7	-0.312	0.20
35.0	35.010	34.7	-0.310	0.20
40.0	40.015	39.8	-0.215	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.8	-0.212	0.20
35.0	35.010	34.8	-0.210	0.20
40.0	40.015	39.9	-0.115	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 -



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@spscon.com., www.spscon.com

Heat B_370_1

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B07	Verification Date	: 17 September 2024
Brand	: Quest Technologies	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEG040059	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	47.2	-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			

Verified by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



Certificate of Calibration

Certificate Number : SPR23110050-2

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 34

Serial Number : TEF050029

ID. Number : B17

Environmental Conditions

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

Received Date : 03 Nov 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 03 Nov 2023

Location of Calibration : In-Lab

Recommend Due Date : 03 Nov 2024

Calibration Procedure : SP-CPT-04-13

Date of Issue : 04 Nov 2023

Method of Calibration

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

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

Calibrated by : Mr.Pitak Srisutam

Calibration Officer

Approved by :


(Mr.Prayoon Topart)

Authorized Signatory



Calibration Report

Certificate Number : SPR23110050-2

Page :2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QR23-0176	26 Jan 2024

Traceability

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

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

Quality Reborn Co., Ltd



Result of Calibration

Certificate No. : SPR23110050-2

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.3	0.286	0.20
35.0	35.012	35.3	0.288	0.20
40.0	40.017	40.3	0.283	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.2	0.186	0.20
35.0	35.012	35.2	0.188	0.20
40.0	40.017	40.2	0.183	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.2	0.186	0.20
35.0	35.012	35.2	0.188	0.20
40.0	40.017	40.2	0.183	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 -



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@spscon.com, www.spscon.com

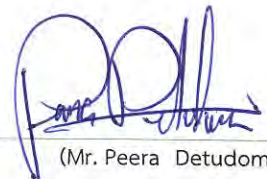
Heat B_303_1

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B17	Verification Date	: 14 July 2024
Brand	: Quest Technologies	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEF050029	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.3	-0.2	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.1	0.2	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

S.P.S. CONSULTING SERVICE CO., LTD.

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

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

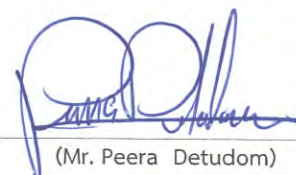
Heat B_370_2

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B17	Verification Date	: 17 September 2024
Brand	: Quest Technologies	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEF050029	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.5	-0.2	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24030285-8

Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Metrosonics

Model : hs-32

Serial Number : MCE030011

ID. Number : B21

Environmental Conditions

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

Relative Humidity : $50\% \pm 15\%$

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 19 Mar 2024

Calibration Date : 20 Mar 2024

Recommend Due Date : 20 Mar 2025

Date of Issue : 21 Mar 2024

Method of Calibration

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

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

Calibrated by : Mr. Navaporn Uengseng

Calibration Officer

Approved by :

(Ms. Bussakorn Chaikaew)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24030285-8

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	5020A	A47046	QR24-0167	26 Jan 2025

Traceability

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

Quality Reborn Co., Ltd



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24030285-8

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.8	-0.212	0.20
35.0	35.010	34.8	-0.210	0.20
40.0	40.015	39.9	-0.115	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.7	-0.312	0.20
35.0	35.010	34.7	-0.310	0.20
40.0	40.015	39.8	-0.215	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.7	-0.312	0.20
35.0	35.010	34.7	-0.310	0.20
40.0	40.015	39.7	-0.315	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 -



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@spscon.com., www.spscon.com

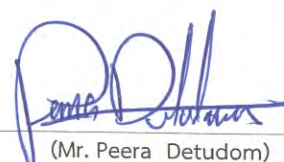
Heat B_370_3

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B21	Verification Date	: 17 September 2024
Brand	: METROSNICS	Ambient Temp.	: 24.5 °C
Model	: hs-32	Barometric Pressure	: 1011 mmbar
Serial No.	: MCE030011	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.3	-0.2	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



Certificate of Calibration

Certificate Number : SPR23110050-4

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 32

Serial Number : TPH050047

ID. Number : B31

Environmental Conditions

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

Received Date : 03 Nov 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 03 Nov 2023

Location of Calibration : In-Lab

Recommend Due Date : 03 Nov 2024

Calibration Procedure : SP-CPT-04-13

Date of Issue : 04 Nov 2023

Method of Calibration

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

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

Calibrated by : Mr.Pitak Srisutam

Calibration Officer

Approved by :


(Mr.Prayoon Topart)

Authorized Signatory



Calibration Report

Certificate Number : SPR23110050-4

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QR23-0176	26 Jan 2024

Traceability

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

Quality Reborn Co., Ltd



Result of Calibration

Certificate No. : SPR23110050-4

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.017	40.1	0.083	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.017	40.1	0.083	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.2	0.186	0.20
35.0	35.012	35.2	0.188	0.20
40.0	40.017	40.2	0.183	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 –



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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@spscon.com., www.spscon.com

Heat B_303_2

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B31	Verification Date	: 14 July 2024
Brand	: Quest Technologies	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPH050047	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	12.5	0.0	± 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			

Verified by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



Certificate of Calibration

Certificate Number : SPR23110050-5

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 : 03 Nov 2023

Relative Humidity : $50\% \pm 15\%$

Calibration Date : 03 Nov 2023

Location of Calibration : In-Lab

Recommend Due Date : 03 Nov 2024

Calibration Procedure : SP-CPT-04-13

Date of Issue : 04 Nov 2023

Method of Calibration

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

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

Calibrated by : Mr.Pitak Srisutam

Calibration Officer

Approved by :


(Mr.Prayoon Topart)

Authorized Signatory



Calibration Report

Certificate Number : SPR23110050-5

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QR23-0176	26 Jan 2024

Traceability

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

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

Quality Reborn Co., Ltd



Result of Calibration

Certificate No. : SPR23110050-5

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.2	0.186	0.20
35.0	35.012	35.2	0.188	0.20
40.0	40.017	40.2	0.183	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.0	-0.014	0.20
35.0	35.012	35.0	-0.012	0.20
40.0	40.017	40.0	-0.017	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.017	40.1	0.083	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 -



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@spscon.com., www.spscon.com

Heat B_303_3

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B33	Verification Date	: 14 July 2024
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	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)

คุณภาพอากาศในสถานประกอบการ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

S.P.S. CONSULTING SERVICE CO., LTD.

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature
Pressure

25

± 3

°C

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
B01	SKC	224-PCXR4	262101	05/07/2024	1,000	1,500	2,000	999	1,499	2,006	1.009x - 12.249	1.000
B02	SKC	224-PCXR4	626166	05/07/2024	1,000	1,500	2,000	1,000	1,494	1,997	0.995x + 3.958	1.000
B03	SKC	224-PCXR4	612968	05/07/2024	1,000	1,500	2,000	1,006	1,510	2,005	1.010x - 16.611	0.999
B04	SKC	224-PCXR4	602804	01/07/2024	1,000	1,500	2,000	1,006	1,506	2,008	1.009x - 11.881	1.000
B05	SKC	224-PCXR4	612693	05/07/2024	1,000	1,500	2,000	998	1,502	2,001	1.003x - 6.328	1.000
B06	SKC	224-PCXR4	262188	03/07/2024	1,000	1,500	2,000	1,007	1,513	2,006	1.012x - 16.439	0.999
B07	SKC	224-PCXR4	626262	05/07/2024	1,000	1,500	2,000	1,002	1,498	2,002	0.999x + 1.531	1.000
B08	SKC	224-PCXR4	626100	04/07/2024	1,000	1,500	2,000	1,005	1,506	2,005	1.008x - 13.624	0.999
B09	SKC	224-PCXR4	626479	05/07/2024	1,000	1,500	2,000	1,003	1,503	2,002	1.005x - 11.861	0.999
B10	SKC	224-PCXR4	091950	04/07/2024	1,000	1,500	2,000	994	1,495	2,003	1.007x - 13.804	1.000
B11	SKC	224-PCXR8	564315	05/07/2024	1,000	1,500	2,000	1,000	1,498	2,000	1.001x - 3.486	1.000
B12	SKC	224-PCXR4	034656	02/07/2024	1,000	1,500	2,000	1,005	1,513	2,009	1.007x - 8.707	0.999
B13	SKC	224-PCXR4	602073	05/07/2024	1,000	1,500	2,000	1,006	1,512	2,007	1.009x - 11.410	0.999
B14	SKC	224-PCXR4	626313	03/07/2024	1,000	1,500	2,000	1,006	1,494	1,995	0.992x + 9.519	1.000
B15	SKC	224-PCXR4	626474	03/07/2024	1,000	1,500	2,000	997	1,511	2,006	1.010x - 15.823	1.000
B16	SKC	224-PCXR4	626477	03/07/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.997x + 4.517	1.000
B17	SKC	224-PCXR4	626860	03/07/2024	1,000	1,500	2,000	996	1,495	2,000	1.001x - 4.046	1.000
B18	SKC	224-PCXR4	691484	05/07/2024	1,000	1,500	2,000	997	1,499	1,999	1.004x - 8.051	1.000
B19	SKC	224-PCXR4	691599	05/07/2024	1,000	1,500	2,000	1,007	1,514	2,007	1.008x - 12.253	0.999
B20	SKC	224-PCXR4	691587	05/07/2024	1,000	1,500	2,000	995	1,512	2,003	1.009x - 12.393	1.000
B21	SKC	224-PCXR4	691531	03/07/2024	1,000	1,500	2,000	1,007	1,509	2,008	1.012x - 16.990	0.999
B22	SKC	224-PCXR4	691654	04/07/2024	1,000	1,500	2,000	1,004	1,502	2,002	1.009x - 15.731	0.999
B23	SKC	224-PCXR4	798393	04/07/2024	1,000	1,500	2,000	999	1,503	2,005	1.007x - 11.817	1.000
B24	SKC	224-PCXR4	626363	04/07/2024	1,000	1,500	2,000	996	1,502	1,998	1.000x - 9.991	1.000
B25	SKC	224-PCXR4	798489	04/07/2024	1,000	1,500	2,000	1,012	1,504	2,004	1.006x - 8.339	0.999
B26	SKC	224-PCXR4	798479	03/07/2024	1,000	1,500	2,000	999	1,500	1,996	0.995x + 5.313	1.000
B27	SKC	224-PCXR4	691673	03/07/2024	1,000	1,500	2,000	1,000	1,498	2,004	1.003x - 2.207	1.000
B28	SKC	224-PCXR4	691570	01/07/2024	1,000	1,500	2,000	1,003	1,504	2,009	1.013x - 17.234	1.000
B29	SKC	224-PCXR4	626472	01/07/2024	1,000	1,500	2,000	1,007	1,509	2,006	1.009x - 12.657	0.999
B30	SKC	224-PCXR4	691489	01/07/2024	1,000	1,500	2,000	998	1,500	2,009	1.012x - 16.759	1.000
B31	SKC	224-PCXR4	691509	04/07/2024	1,000	1,500	2,000	1,003	1,503	2,007	1.005x - 11.138	0.999
B32	SKC	224-PCXR4	091567	04/07/2024	1,000	1,500	2,000	996	1,505	2,007	1.016x - 26.973	0.999
B33	SKC	224-PCXR4	091756	04/07/2024	1,000	1,500	2,000	1,000	1,500	2,000	1.004x - 7.636	1.000
B34	SKC	224-PCXR4	612962	04/07/2024	1,000	1,500	2,000	1,005	1,504	2,008	1.012x - 18.993	0.999
B35	SKC	224-PCXR4	602682	05/07/2024	1,000	1,500	2,000	998	1,500	2,005	1.006x - 8.339	1.000
B36	SKC	224-PCXR4	626164	04/07/2024	1,000	1,500	2,000	999	1,501	2,002	1.001x - 4.266	1.000
B37	SKC	224-PCXR4	626256	04/07/2024	1,000	1,500	2,000	1,007	1,502	2,005	1.006x - 12.029	0.999
B38	SKC	224-PCXR4	626167	04/07/2024	1,000	1,500	2,000	1,001	1,498	2,003	1.003x - 2.603	1.000
B39	SKC	224-PCXR4	034637	04/07/2024	1,000	1,500	2,000	1,006	1,506	2,006	1.008x - 11.270	0.999
B40	SKC	224-PCXR4	798349	03/07/2024	1,000	1,500	2,000	998	1,502	1,999	1.002x - 7.748	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

S.P.S. CONSULTING SERVICE CO., LTD.

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature
Pressure

25
1010

± 3
± 15

°C
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	02/07/2024	1,000	1,500	2,000	1,009	1,502	2,005	1.006x - 11.146	0.999
B42	SKC	224-PCXR4	626041	02/07/2024	1,000	1,500	2,000	1,005	1,499	2,005	0.997x + 6.432	1.000
B43	SKC	224-PCXR4	034636	02/07/2024	1,000	1,500	2,000	1,004	1,505	2,013	1.010x - 15.091	0.999
B44	SKC	224-PCXR8	529341	02/07/2024	1,000	1,500	2,000	1,004	1,506	2,005	1.005x - 9.731	0.999
B45	SKC	224-PCXR8	529594	03/07/2024	1,000	1,500	2,000	996	1,491	2,002	1.009x - 16.399	1.000
B46	SKC	224-PCXR8	566743	03/07/2024	1,000	1,500	2,000	996	1,495	2,001	1.001x - 5.621	1.000
B47	SKC	224-PCXR8	566747	03/07/2024	1,000	1,500	2,000	1,003	1,496	1,996	0.995x + 7.632	1.000
B48	SKC	224-PCXR8	566753	03/07/2024	1,000	1,500	2,000	1,007	1,503	2,005	1.007x - 9.047	0.999
B49	SKC	224-PCXR8	566780	05/07/2024	1,000	1,500	2,000	1,005	1,492	2,001	0.998x + 2.047	1.000
B50	SKC	224-PCXR8	500400	05/07/2024	1,000	1,500	2,000	997	1,513	2,006	1.008x - 10.870	1.000
B51	SKC	224-PCXR8	500363	05/07/2024	1,000	1,500	2,000	1,007	1,496	2,010	1.003x - 3.758	1.000
B52	SKC	224-PCXR8	093186	05/07/2024	1,000	1,500	2,000	1,003	1,496	2,002	0.999x + 1.439	1.000
B53	SKC	224-PCXR8	707670	05/07/2024	1,000	1,500	2,000	999	1,501	1,998	1.002x - 4.254	0.999
B54	SKC	224-PCXR3	509821	05/07/2024	1,000	1,500	2,000	1,000	1,503	1,998	1.003x - 5.249	1.000
B55	SKC	224-PCXR3	510710	03/07/2024	1,000	1,500	2,000	998	1,519	2,003	1.006x - 5.785	0.999
B56	SKC	224-PCXR3	511450	03/07/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.004x - 7.748	1.000
B57	SKC	224-PCXR3	510798	01/07/2024	1,000	1,500	2,000	1,008	1,505	2,008	1.010x - 16.191	0.999
B58	SKC	224-PCXR3	509852	01/07/2024	1,000	1,500	2,000	1,002	1,505	2,007	1.012x - 20.201	0.999
B59	SKC	224-PCXR3	509862	01/07/2024	1,000	1,500	2,000	997	1,501	1,999	1.000x + 0.760	1.000
B60	SKC	224-PCXR3	512655	05/07/2024	1,000	1,500	2,000	1,014	1,507	2,003	1.002x - 1.563	0.999
B61	SKC	224-PCXR3	503915	05/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.998x + 5.213	0.999
B62	SKC	224-PCXR3	505975	05/07/2024	1,000	1,500	2,000	1,000	1,501	2,010	1.008x - 7.876	1.000
B63	SKC	224-PCXR3	511432	05/07/2024	1,000	1,500	2,000	1,005	1,506	2,009	1.010x - 11.514	1.000
B64	SKC	224-PCXR3	508302	05/07/2024	1,000	1,500	2,000	999	1,512	2,009	1.009x - 11.825	1.000
B65	SKC	224-PCXR3	508310	05/07/2024	1,000	1,500	2,000	998	1,499	2,004	1.008x - 11.573	1.000
B66	SKC	224-PCXR3	509861	05/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.999x + 4.094	0.999
B67	SKC	224-PCXR3	506295	03/07/2024	1,000	1,500	2,000	997	1,505	2,006	1.011x - 17.514	1.000
B68	SKC	224-PCXR3	505872	01/07/2024	1,000	1,500	2,000	999	1,517	1,999	0.999x + 3.174	0.999
B69	SKC	224-PCXR3	508375	01/07/2024	1,000	1,500	2,000	1,008	1,505	2,009	1.013x - 17.610	0.999
B70	SKC	224-PCXR3	510623	01/07/2024	1,000	1,500	2,000	996	1,504	2,002	1.006x - 9.583	1.000
B71	SKC	224-PCXR3	508367	01/07/2024	1,000	1,500	2,000	997	1,499	1,996	1.001x - 8.495	1.000
B72	SKC	224-PCXR3	505977	01/07/2024	1,000	1,500	2,000	997	1,496	1,999	1.005x - 12.009	1.000
B73	SKC	224-PCXR3	512606	03/07/2024	1,000	1,500	2,000	1,007	1,504	2,007	1.006x - 15.183	0.999
B74	SKC	224-PCXR3	505993	03/07/2024	1,000	1,500	2,000	1,004	1,504	2,002	1.007x - 14.720	0.999
B75	SKC	224-PCXR3	509820	03/07/2024	1,000	1,500	2,000	1,005	1,493	2,002	1.000x - 3.606	1.000
B76	SKC	224-PCXR3	509811	03/07/2024	1,000	1,500	2,000	1,000	1,495	2,002	0.999x - 0.580	1.000
B77	SKC	224-PCXR3	508301	04/07/2024	1,000	1,500	2,000	1,005	1,505	2,010	1.008 - 12.453	0.999
B78	SKC	224-PCXR3	510677	04/07/2024	1,000	1,500	2,000	998	1,503	2,005	1.009x - 17.250	1.000
B79	SKC	224-PCXR3	510920	04/07/2024	1,000	1,500	2,000	998	1,509	1,996	1.002x - 3.822	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

S.P.S. CONSULTING SERVICE CO., LTD.

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 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
B80	SKC	224-PCXR3	504569	04/07/2024	1,000	1,500	2,000	1,006	1,505	2,003	1.009x – 14.904	0.999
B81	SKC	224-PCXR3	503480	02/07/2024	1,000	1,500	2,000	1,006	1,503	2,006	1.011x – 19.229	0.999
B82	SKC	224-PCXR3	505673	02/07/2024	1,000	1,500	2,000	1,004	1,504	2,007	1.010x – 14.060	1.000
B83	SKC	224-PCXR3	510785	02/07/2024	1,000	1,500	2,000	998	1,504	2,002	1.000x – 0.396	1.000
B84	SKC	224-PCXR3	508333	04/07/2024	1,000	1,500	2,000	998	1,508	2,005	1.009x – 17.242	0.999
B85	SKC	224-PCXR3	505757	04/07/2024	1,000	1,500	2,000	1,009	1,493	2,004	0.999x + 1.151	1.000
B86	SKC	224-PCXR3	512625	05/07/2024	1,000	1,500	2,000	1,000	1,495	2,003	1.002x – 3.458	1.000
B87	SKC	224-PCXR3	504324	03/07/2024	1,000	1,500	2,000	1,003	1,505	2,006	1.005x – 5.057	1.000
B88	SKC	224-PCXR3	508307	03/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.999x + 2.575	0.999
B89	SKC	224-PCXR3	509860	03/07/2024	1,000	1,500	2,000	998	1,518	2,006	1.010x – 14.096	0.999
B90	SKC	224-PCXR3	508366	03/07/2024	1,000	1,500	2,000	1,000	1,501	2,000	1.005x – 8.991	1.000
B91	SKC	224-PCXR3	510919	03/07/2024	1,000	1,500	2,000	1,006	1,503	2,008	1.014x – 22.160	0.999
B92	SKC	224-PCXR3	510987	02/07/2024	1,000	1,500	2,000	1,006	1,503	2,006	1.012x – 20.401	0.999
B93	SKC	224-PCXR3	509845	02/07/2024	1,000	1,500	2,000	1,003	1,504	2,008	1.006x – 6.113	1.000
B94	SKC	224-PCXR8	A127871	02/07/2024	1,000	1,500	2,000	1,012	1,496	1,998	0.997x – 0.876	0.999
B95	SKC	224-PCXR8	A127921	01/07/2024	1,000	1,500	2,000	999	1,502	2,000	1.001x – 0.460	1.000
B96	SKC	224-PCXR8	A127942	01/07/2024	1,000	1,500	2,000	997	1,501	2,001	1.005x – 7.496	1.000
B97	SKC	224-PCXR8	A127955	02/07/2024	1,000	1,500	2,000	1,011	1,496	1,998	0.998x – 1.995	0.999
B98	SKC	224-PCXR8	A127956	02/07/2024	1,000	1,500	2,000	1,011	1,496	1,998	0.997x – 0.476	0.999

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :

Peera Detudom

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	504.1	997.1	1991.2	0.995x + 6.628	1.000
H-B02	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	497.3	1003.5	2015.2	0.998 + 5.168	1.000
H-B03	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	498.4	994.8	2013.0	1.005x - 12.628	0.999
H-B04	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.1	997.9	1992.5	0.996x + 6.085	1.000
H-B05	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	497.9	1004.0	2014.2	0.998x + 4.472	1.000
H-B06	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	499.7	997.9	2015.7	1.004x - 9.662	0.999
H-B07	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	501.4	1002.3	1990.2	0.999x + 4.103	1.000
H-B08	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	501.5	999.6	1988.9	0.991x + 12.846	1.000
H-B09	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	502.7	1003.8	1984.8	0.997x + 6.523	0.999
H-B10	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	501.5	999.7	1988.7	0.994x + 9.648	1.000

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



CERTIFICATE No : 24M2227

REFERENCE No : 72448-1

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 : 08-Mar-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25°C \pm 1°C RELATIVE HUMIDITY : 53 %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	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25

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

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

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

- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

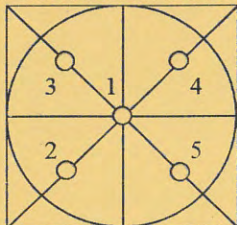
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 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	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	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



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.



บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO., LTD.

Operator Signature: _____

Date: June 24, 2024

(Mr. Ponwut Kornthongnimit)

Test Engineer

ระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : $(23 + 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

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 Keithley 2015-P S/N4106495.
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 : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

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.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

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

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 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 Bruel&Kjaer 4180	93.85	-0.15	± 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 Bruel&Kjaer 4180	999.9	-0.1	± 1.5	$\pm 2.0\%$

3. Total Distortion


Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 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 :


(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

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.

Head Office

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Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

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Noise B_302/24

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	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R40	ACO	6236	00192052	14 July 2024	93.9	93.9
ACO-R41	ACO	6236	00192053	14 July 2024	94.1	93.9
ACO-R51	ACO	6236	00192063	14 July 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Noise B_333/24

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	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B05	ACO	6236	00142002	14 August 2024	94.1	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Noise B_369/24

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	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	17 September 2024	94.1	93.9
ACO-B29	ACO	6236	00182011	17 September 2024	94.1	93.9
ACO-B33	ACO	6236	00182015	17 September 2024	94.1	93.9
ACO-B36	ACO	6236	00192027	17 September 2024	94.0	93.9
ACO-B41	ACO	6236	00192032	17 September 2024	93.9	93.9
ACO-B43	ACO	6236	00192034	17 September 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

ปริมาณเสียงสะสมติดตัวบุคคล



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0639

MTC No. EEL. BP. 40/0866

CALIBRATION CERTIFICATE

Submitted by : S.P.S Consulting Services 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 : $(23 \pm 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

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 Bruel&Kjaer 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was 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 : 11 Aug. 2023

Date of Calibration : 22 Aug. 2023

1 / 2

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

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FM.BL.MTC.002 Rev.4

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Request No. 21-66/0639

MTC No. EEL. BP. 40/0866

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 Bruel&Kjaer 4180	114.01	0.01	± 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 Bruel&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 Bruel&Kjaer 4180	0.19	± 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 :


.....
(Mr. Weerachai Deechaiyae)

Approved by :



.....
(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Aug. 2023

Date of Issue : 24 Aug. 2023

Ref : 2011266081103146003

End of Certificate

2 / 2

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

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Noise Dose B_302_1/24

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	22 August 2023
		Due Date	22 August 2024

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B18	SVANTEK	SV-104IS	106123	14 July 2024	114.1	114.0
NMD-B19	SVANTEK	SV-104IS	106124	14 July 2024	114.0	114.0
NMD-B20	SVANTEK	SV-104IS	106131	14 July 2024	114.0	114.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					114.01± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Noise Dose B_333_1/24

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	22 August 2023		
			Due Date	22 August 2024		
Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B10	SVANTEK	SV-104IS	80830	14 August 2024	114.0	114.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					114.01± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0562

MTC No. EEL. BP. 72/0767

CALIBRATION CERTIFICATE

Submitted by : S.P.S Consulting Services 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 : $(23 \pm 3) ^\circ\text{C}$

Relative Humidity : $(50 \pm 15) \%$

Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

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 : 31 Jul. 2024

Date of Calibration : 6 Aug. 2024

1/2

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E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0562

MTC No. EEL. BP. 72/0767

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 Bruel&Kjaer 4180	114.03	0.03	± 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 Bruel&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 Bruel&Kjaer 4180	0.27	± 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 :


.....
(Mr. Weerachai Deechaiyae)

Approved by :


.....
(Mr. Prawate Khuaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 6 Aug. 2024

Date of Issue : 7 Aug. 2024

Ref : 2011267073102836003

End of Certificate

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

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Noise Dose B_369_1/24

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	06 August 2024
		Due Date	06 August 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B06	SVANTEK	SV-104IS	80816	17 September 2024	114.1	114.0
NMD-B07	SVANTEK	SV-104IS	80817	17 September 2024	114.0	114.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					114.03± 0.10 dB	

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :

Peera Detudom

(Mr. Peera Detudom)