

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ TSP	High Volume Air Sampler No. B02, B12, B23, B43	Digital Balance
PM ₁₀	High Volume PM ₁₀ Air Sampler No. B08, B14, B20, B34	Digital Balance
Nitrogen Dioxide	NO ₂ Analyzer No. B10, B11, B17, B21	NO ₂ Analyzer No. B10, B11, B17, B21
Sulfur Dioxide	SO ₂ Analyzer No. B01, B08, B12, B13	SO ₂ Analyzer No. B01, B08, B12, B13
คุณภาพน้ำ		
Temperature	–	Thermometer
pH	–	pH Meter
Conductivity	–	Conductivity Meter
Total Dissolved Solids	–	Digital Balance
Total Suspended Solids	–	Digital Balance
BOD ₅	–	BOD Analyzer
COD	–	COD Reactor
Grease & Oil	–	Digital Balance
Phosphate-Phosphorus	–	Spectrophotometer
Nitrate-Nitrogen	–	Spectrophotometer
Nitrate	–	Spectrophotometer
Arsenic	–	ASS
Sodium	–	ICP
Sulfate	–	Spectrophotometer
Lead	–	ICP
Mercury	–	AAS
Nickel	–	ICP
Copper	–	ICP
Total Coliform Bacteria	–	Incubator Water Bath

คุณภาพอากาศในบรรยากาศ



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 (l ³ /min)	R ²	
B01	B01	01/11/2022	y = 1.277x-6.403	0.999	
B02	B02	03/11/2022	y = 1.083x-3.505	0.995	
B03	B03	03/11/2022	y = 1.143x-1.010	0.996	
B04	B04	04/11/2022	y = 1.206x-3.858	0.995	
B05	B05	01/11/2022	y = 1.317x-8.733	0.997	
B06	B06	01/11/2022	y = 1.268x-5.920	0.998	
B07	B07	01/11/2022	y = 1.228x-6.265	0.998	
B08	B08	08/11/2022	y = 1.160x-3.496	0.995	
B09	B09	03/11/2022	y = 1.245x-5.341	0.997	
B10	B10	01/11/2022	y = 1.097x-1.837	0.997	
B11	B11	07/11/2022	y = 1.155x-2.164	0.998	
B12	B12	04/11/2022	y = 1.201x-3.884	0.998	
B13	B13	01/11/2022	y = 1.266x-6.916	0.995	
B14	B14	03/11/2022	y = 1.269x-6.120	0.999	
B15	B15	02/11/2022	y = 1.149x-1.529	0.997	
B16	B16	03/11/2022	y = 1.212x-4.259	0.999	
B17	B17	04/11/2022	y = 1.172x-2.143	0.997	
B18	B18	04/11/2022	y = 1.321x-9.413	0.996	
B19	B19	02/11/2022	y = 1.356x-11.184	0.997	
B20	B20	04/11/2022	y = 1.310x-8.882	0.997	
B21	B21	03/11/2022	y = 1.156x-2.174	0.999	
B22	B22	02/11/2022	y = 1.288x-8.740	0.998	
B23	B23	04/11/2022	y = 1.247x-5.764	0.996	
B24	B24	01/11/2022	y = 1.161x-2.123	0.999	
B25	B25	02/11/2022	y = 1.025x+3.341	0.997	
B26	B26	02/11/2022	y = 1.234x-6.128	0.995	
B27	B27	03/11/2022	y = 1.220x-5.822	0.997	
B28	B28	02/11/2022	y = 1.253x-6.605	0.999	
B29	B29	08/11/2022	y = 1.311x-8.876	0.997	
B30	B30	07/11/2022	y = 1.264x-7.352	0.998	
B31	B31	07/11/2022	y = 1.215x-4.628	0.995	
B32	B32	03/11/2022	y = 1.258x-6.433	0.997	
B33	B33	03/11/2022	y = 1.329x-7.779	0.995	
B34	B34	03/11/2022	y = 1.287x-7.491	0.998	

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



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 (l ³ /min)	R ²	
B35	B35	03/11/2022	y = 1.306x-9.466	0.997	
B36	B36	02/11/2022	y = 1.213x-5.932	0.996	
B37	B37	01/11/2022	y = 1.253x-5.209	0.999	
B38	B38	01/11/2022	y = 1.228x-5.530	0.995	
B39	B39	01/11/2022	y = 1.318x-9.149	0.998	
B40	B40	01/11/2022	y = 1.196x-4.045	0.999	
B41	B41	07/11/2022	y = 1.179x-2.611	0.999	
B42	B42	01/11/2022	y = 1.209x-3.713	0.995	
B43	B43	02/11/2022	y = 1.187x-3.331	0.998	
B44	B44	07/11/2022	y = 1.298x-8.171	0.996	
R01	R01	02/11/2022	y = 1.289x-8.287	0.998	
R02	R02	07/11/2022	y = 1.307x-10.165	0.999	
R03	R03	03/11/2022	y = 1.259x-7.634	0.995	
R04	R04	04/11/2022	y = 1.157x-2.287	0.995	
R05	R05	03/11/2022	y = 1.273x-8.311	0.999	
R06	R06	01/11/2022	y = 1.297x-8.271	0.999	
R07	R07	02/11/2022	y = 1.071x+1.468	0.995	
R08	R08	01/11/2022	y = 1.206x-5.068	0.997	
R09	R09	01/11/2022	y = 1.252x-7.084	0.995	
R10	R10	03/11/2022	y = 1.246x-5.817	0.999	
R11	R11	03/11/2022	y = 1.117x-1.156	0.998	
R12	R12	02/11/2022	y = 1.351x-12.068	0.996	
R13	R13	03/11/2022	y = 1.118x-0.601	0.999	
R14	R14	03/11/2022	y = 1.164x-2.415	0.996	
R15	R15	03/11/2022	y = 1.134x-1.793	0.996	
R16	R16	04/11/2022	y = 1.182x-4.717	0.996	
R17	R17	07/11/2022	y = 1.218x-5.356	0.998	
R18	R18	04/11/2022	y = 1.233x-5.977	0.996	
R19	R19	07/11/2022	y = 1.277x-7.752	0.997	
R20	R20	04/11/2022	y = 1.327x-10.628	0.997	

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

High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard			Model : TE 5025A	SN : 3611
Calibration Data				
High Volume PM-10 Data				
Recorder No.	Blower No.	Date	Actual Flowrate (l³/min)	R²
B01	B01	02/11/2022	y = 1.206x - 0.537	0.998
B02	B02	02/11/2022	y = 1.024x + 3.762	0.999
B03	B03	02/11/2022	y = 1.243x - 4.455	0.998
B04	B04	02/11/2022	y = 1.298x - 7.303	0.997
B05	B05	03/11/2022	y = 1.252x - 6.903	0.999
B06	B06	04/11/2022	y = 1.313x - 7.710	0.997
B07	B07	02/11/2022	y = 1.290x - 6.671	0.999
B08	B08	04/11/2022	y = 1.330x - 6.996	0.999
B09	B09	04/11/2022	y = 1.280x - 6.331	0.995
B10	B10	02/11/2022	y = 1.298x - 8.295	0.997
B11	B11	04/11/2022	y = 1.273x - 5.540	0.995
B12	B12	04/11/2022	y = 1.282x - 7.018	0.996
B13	B13	01/11/2022	y = 1.320x - 9.281	0.998
B14	B14	02/11/2022	y = 1.230x - 3.665	0.998
B15	B15	02/11/2022	y = 1.166x - 2.184	0.997
B16	B16	01/11/2022	y = 1.260x - 2.121	0.998
B17	B17	04/11/2022	y = 1.277x - 4.847	0.998
B18	B18	01/11/2022	y = 1.165x - 1.164	0.999
B19	B19	02/11/2022	y = 1.094x - 1.145	0.999
B20	B20	02/11/2022	y = 1.221x - 5.301	0.997
B21	B21	01/11/2022	y = 1.176x - 0.519	0.999
B22	B22	02/11/2022	y = 1.286x - 7.131	0.998
B23	B23	03/11/2022	y = 1.181x - 2.246	0.999
B24	B24	03/11/2022	y = 1.253x - 5.274	0.995
B25	B25	04/11/2022	y = 1.159x - 3.062	0.996
B26	B26	03/11/2022	y = 1.264x - 6.317	0.998
B27	B27	03/11/2022	y = 1.332x - 10.385	0.996
B28	B28	03/11/2022	y = 1.165x - 2.689	0.998
B29	B29	03/11/2022	y = 1.271x - 7.065	0.996
B30	B30	01/11/2022	y = 1.274x - 7.435	0.996
B31	B31	01/11/2022	y = 1.244x - 3.676	0.999
B32	B32	01/11/2022	y = 1.186x - 1.847	0.999
B33	B33	04/11/2022	y = 1.268x - 6.742	0.996
B34	B34	01/11/2022	y = 1.321x - 5.654	0.998

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

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 21 November 2022	BRAND : API	MODEL : 200E
NO. NOX-B10		SERIAL NO. 4465
Calibrator (Dilution System)		
Brand : API	Model : 700	
Last Cal. Date : 04 August 2022	Serial No. : 911	
Reference Standard Gas		
Standard Gas : Nitric Oxide (NO)	Cylinder No. : D636192	
Certified Date : 20 April 2022	Expired Date : 20 April 2024	Cylinder Conc. : 49.1 ppm
CALIBRATING CONDITION		
Pressure : 1011 mmbar	Temp. : 24.5 °C	% RH : 49
CALIBRATION SETTING		
Span	Initial Reading (Before Adj.) PPB	Final Reading (After Adj.) PPB
Set Point	Expected Concentration	Analyzer Response
Zero	0	-0.11
NO Span	400	399.9
NO _x Span	400	400.2
		% Dif
		-
		-0.025
		400.0
		400.0
		1.010
API Model 200E NO _x Analyzer Check List		
Test Values	Observed Value	Units
RANGE	500	PPB
STABILITY (Zero Gas)	0.1	PPB
SAMPLE FLOW	509	cc/min
OZONE FLOW	78	cc/min
PMT	103.2	mV
AZERO	93.9	mV
HVPS	669	V
RCCELL TEMP	50.1	°C
BOX TEMP	28.9	°C
PMT TEMP	7.0	°C
MOLY TEMP	314.9	°C
RCCELL PRESS	8.3	IN-Hg-A
SAMPLE PRESS	28.5	IN-Hg-A
NO Span Conc	400	PPB
NO _x Span Conc	400	PPB
NO Slope	1.006	-
NO _x Slope	1.010	-
NO Offset	1.2	mV
NO _x Offset	0.9	mV
Stability at Zero	0.1	PPB
Stability at Span	0.2	PPB
		< 2 ppb @ 400 ppb span gas

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

CALIBRATION REPORT									
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER									
DATE :	21 November 2022	BRAND :	API	MODEL :	200E				
NO.	NOX-B11			SERIAL NO.	4467				
Calibrator (Dilution System)									
Brand	: API			Model	: 700				
Last Cal. Date	: 04 August 2022			Serial No.	: 911				
Reference Standard Gas									
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: D636192				
Certified Date	: 20 April 2022			Expired Date	: 20 April 2024				
Cylinder Conc. : 49.1 ppm									
CALIBRATING CONDITION									
Pressure	1011	mmbar	Temp.	24.5	°C	% RH	49		
CALIBRATION SETTING									
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB					
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope				
Zero	0	-0.10	-	0	-				
NO Span	400	399.7	-0.075	400.0	1.004				
NO _x Span	400	400.1	0.025	400.0	1.007				
API Model 200E NO _x Analyzer Check List									
Test Values	Observed Value	Units	Nominal Range						
RANGE	500	PPB	500 standard						
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air						
SAMPLE FLOW	505	cc/min	500 ± 50						
OZONE FLOW	78	cc/min	80 ± 15						
PMT	103.3	mV	-20 ~ 150						
AZERO	94.1	mV	-20 ~ 150						
HVPS	674	V	420 ~ 900 constant						
RCCELL TEMP	50.3	°C	50 ± 1						
BOX TEMP	29.0	°C	8 ~ 48						
PMT TEMP	7.2	°C	7 ± 2						
MOLY TEMP	315.2	°C	315 ± 5						
RCCELL PRESS	8.4	IN-Hg-A	2 ~ 10 constant						
SAMPLE PRESS	28.7	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	1.004	-	1.0 ± 0.3						
NO _x Slope	1.007	-	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 : (Mr. Peera Detudom)

Approved

CALIBRATION REPORT									
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER									
DATE :	21 November 2022	BRAND :	API	MODEL :	200A				
NO.	NOX-B17			SERIAL NO.	1977				
Calibrator (Dilution System)									
Brand	: API			Model	: 700				
Last Cal. Date	: 04 August 2022			Serial No.	: 911				
Reference Standard Gas									
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: D636192				
Certified Date	: 20 April 2022			Expired Date	: 20 April 2024				
Cylinder Conc. : 49.1 ppm									
CALIBRATING CONDITION									
Pressure	1011	mmbar	Temp.	24.5	°C	% RH	49		
CALIBRATION SETTING									
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB					
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope				
Zero	0	0.11	-	0	-				
NO Span	400	400.2	0.050	400.0	1.010				
NO _x Span	400	400.4	0.100	400.0	1.014				
API Model 200A NO _x Analyzer Check List									
Test Values	Observed Value	Units	Nominal Range						
RANGE	500	PPB	500 standard						
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air						
SAMPLE FLOW	513	cc/min	500 ± 50						
OZONE FLOW	79	cc/min	80 ± 15						
PMT	103.5	mV	-20 ~ 150						
AZERO	94.2	mV	-20 ~ 150						
HVPS	673	V	420 ~ 900 constant						
RCCELL TEMP	50.2	°C	50 ± 1						
BOX TEMP	29.2	°C	8 ~ 48						
PMT TEMP	7.1	°C	7 ± 2						
MOLY TEMP	315.4	°C	315 ± 5						
RCCELL PRESS	8.3	IN-Hg-A	2 ~ 10 constant						
SAMPLE PRESS	28.6	IN-Hg-A	25 ~ 30 constant						
NO Span Conc	400	PPB	20 ~ 20,000						
NO _x Span Conc	400	PPB	20 ~ 20,000						
NO Slope	1.010	-	1.0 ± 0.3						
NO _x Slope	1.014	-	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 :

Approved

CALIBRATION REPORT									
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER									
DATE :	21 November 2022	BRAND :	API	MODEL :	TML-41M	SERIAL NO.	N02374		
NO.	NOX-B21								
Calibrator (Dilution System)									
Brand	: API	Model	: 700						
Last Cal. Date	: 04 August 2022	Serial No.	: 911						
Reference Standard Gas									
Standard Gas	: Nitric Oxide (NO)	Cylinder No.	: D636192						
Certified Date	: 20 April 2022	Expired Date	: 20 April 2024	Cylinder Conc.	: 49.1 ppm				
CALIBRATING CONDITION									
Pressure	1011 mmbar	Temp.	24.5 °C	% RH	49				
CALIBRATION SETTING									
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB					
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope				
Zero	0	0.11	-	0	-				
NO Span	400	400.1	0.025	400.0	1.009				
NO _x Span	400	400.2	0.050	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	507	cc/min	500 ± 50						
OZONE FLOW	78	cc/min	80 ± 15						
PMT	103.1	mV	-20 - 150						
AZERO	93.7	mV	-20 - 150						
HVPS	671	V	420 - 900 constant						
RCCELL TEMP	50.4	°C	50 ± 1						
BOX TEMP	29.5	°C	8 - 48						
PMT TEMP	7.3	°C	7 ± 2						
MOLY TEMP	315.1	°C	315 ± 5						
RCCELL PRESS	8.4	IN-Hg-A	2 - 10 constant						
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant						
NO Span Conc	400	PPB	20 - 20,000						
NO _x Span Conc	400	PPB	20 - 20,000						
NO Slope	1.009	-	1.0 ± 0.3						
NO _x Slope	1.011	-	1.0 ± 0.3						
NO Offset	1.6	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 :  (Mr. Abdul Dangkum)

Approved  (Mr. Peera Detudom)

CALIBRATION REPORT									
SO ₂ FLUORESCENT ANALYZER									
DATE :	21 November 2022	BRAND :	API	MODEL :	100A	SERIAL NO.	1749		
NO.	SO ₂ -B01								
Calibrator (Dilution System)									
Brand	: API	Model	: 700						
Last Cal. Date	: 04 August 2022	Serial No.	: 911						
Reference Standard Gas									
Standard Gas	: Sulphur Dioxide (SO ₂)	Cylinder No.	: A00814SK						
Certified Date	: 21 June 2021	Expired Date	: 21 June 2028	Cylinder Conc.	: 50.0 ppm				
CALIBRATING CONDITION									
Pressure	1011 mmbar	Temp.	24.5 °C	% RH	49				
CALIBRATION SETTING									
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB					
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope				
Zero	0	0.10	-	0	-				
SO ₂ Span	400.0	400.3	0.075	400.0	1.014				
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	654	cc/min	650 ± 10%						
PMT	103.2	mV	-20-150 with Zero Air						
UV LAMP	3017.5	mV	1000-4900						
STR. LGT	61.3	PPB	<100						
DRK PMT	62.9	mV	-50 - 200						
DRK LMP	57.8	mV	-50 - 200						
HVPS	671	V	550-900 constant						
DCPS	2518	mV	2500 ± 200						
RCCELL TEMP	50.4	°C	50 ± 1						
BOX TEMP	29.2	°C	5-40						
PMT TEMP	7.0	°C	7 ± 2.0						
SO ₂ Span Conc	400	PPB	20-20,000						
SO ₂ Slope	1.014	-	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 :  (Mr. Abdul Dangkum)

Approved  (Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10900
Tel : (662) 939-470-72 Fax : (662) 513-4221 E-mail : sales@spsc.com, www.spsc.com

CALIBRATION REPORT									
SO ₂ FLUORESCENT ANALYZER									
DATE :	21 November 2022	BRAND :	TELEDYNE	MODEL :	TML-50				
NO.	SO ₂ -B12			SERIAL NO.	1886				
Calibrator (Dilution System)									
Brand	: API	Model	: 700						
Last Cal. Date	: 04 August 2022	Serial No.	: 911						
Standard Gas	: Sulphur Dioxide (SO ₂)	Cylinder No.	: A00814SK						
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029						
Reference Standard Gas									
Cylinder Conc. : 50.0 ppm									
CALIBRATING CONDITION									
Pressure	1011	mmbar	Temp.	24.5	°C	% RH	49		
CALIBRATION SETTING									
Span	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB					
Set Point	Expected Concentration	Analyzer Response	% Dif	Analyzer Response	Slope				
Zero	0	0.11	-	0	-				
SO ₂ Span	400.0	400.1	0.025	400.0	1.012				
API Model TML-50 SO ₂ Analyzer Check list									
Test Values	Observed Value	Units	Nominal Range						
RANGE	500	PPB	0-500						
SAMPLE PRESS	28.6	in-Hg	25-35						
SAMPLE FLOW	652	cc/min	650 ± 10%						
PMT	103.5	mV	-20-150 with Zero Air						
UV LAMP	3020.4	mV	1000-4900						
STR. LGT	61.8	PPB	<100						
DRK PMT	63.2	mV	-50 - 200						
DRK LMP	57.9	mV	-50 - 200						
HVPS	669	V	550-900 constant						
DCPS	2515	mV	2500 ± 200						
RCCELL TEMP	50.3	°C	50 ± 1						
BOX TEMP	29.0	°C	5-40						
PMT TEMP	7.2	°C	7 ± 2.0						
SO ₂ Span Conc	400	PPB	20-20,000						
SO ₂ Slope	1.012	-	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 :

Approved

(Mr. Peera Detudom)

บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10900
Tel : (662) 939-470-72 Fax : (662) 513-4221 E-mail : sales@spsc.com, www.spsc.com

CALIBRATION REPORT									
SO ₂ FLUORESCENT ANALYZER									
DATE :	21 November 2022	BRAND :	API	MODEL :	100A				
NO.	SO ₂ -B08			SERIAL NO.	1003				
Calibrator (Dilution System)									
Brand	: API	Model	: 700						
Last Cal. Date	: 04 August 2022	Serial No.	: 911						
Standard Gas	: Sulphur Dioxide (SO ₂)	Cylinder No.	: A00814SK						
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029						
Reference Standard Gas									
Cylinder Conc. : 50.0 ppm									
CALIBRATING CONDITION									
Pressure	1011	mmbar	Temp.	24.5	°C	% RH	49		
CALIBRATION SETTING									
Span	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB					
Set Point	Expected Concentration	Analyzer Response	% Dif	Analyzer Response	Slope				
Zero	0	0.11	-	0	-				
SO ₂ Span	400.0	399.8	-0.050	400.0	1.008				
API Model 100A 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	658	cc/min	650 ± 10%						
PMT	102.9	mV	-20-150 with Zero Air						
UV LAMP	3008.6	mV	1000-4900						
STR. LGT	61.5	PPB	<100						
DRK PMT	63.1	mV	-50 - 200						
DRK LMP	58.0	mV	-50 - 200						
HVPS	674	V	550-900 constant						
DCPS	2523	mV	2500 ± 200						
RCCELL TEMP	50.2	°C	50 ± 1						
BOX TEMP	29.1	°C	5-40						
PMT TEMP	7.5	°C	7 ± 2.0						
SO ₂ Span Conc	400	PPB	20-20,000						
SO ₂ Slope	1.008	-	1.0 ± 0.3						
SO ₂ Offset	22.1	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 :

Approved

(Mr. Peera Detudom)



QUALITY CALIBRATION CO., LTD.
235 Petchkasem 63/2 Road, Laksoeng, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

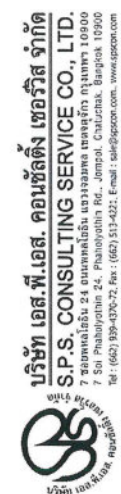


CERTIFICATE No : 22M2567
REFERENCE No : 64386-1

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS 105DU
SERIAL No : 1126422905
ID No : BA 05/50
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 : TETNITHI W.
CALIBRATION DATE : 11-Mar-22
APPROVED BY : PONGSAK J.
ISSUED DATE : 17-Mar-22
RECEIVED DATE : 11-Mar-22

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



CALIBRATION REPORT SO₂ FLUORESCENT ANALYZER

DATE : 21 November 2022	BRAND : TELEDYNE	MODEL : TML-50
NO. SO ₂ -B13	SERIAL NO. 1891	
Calibrator (Dilution System)		
Brand : API	Model : 700	
Last Cal. Date : 04 August 2022	Serial No. : 911	
Reference Standard Gas		
Standard Gas : Sulphur Dioxide (SO ₂)	Cylinder No. : A00814SK	
Certified Date : 21 June 2021	Expired Date : 21 June 2029	Cylinder Conc. : 50.0 ppm
CALIBRATING CONDITION		
Pressure : 1011 mmbar	Temp. : 24.5 °C	% RH : 49
CALIBRATION SETTING		
Span	Initial Reading (Before Adj.), PPB	Final Reading (After Adj.), PPB
Set Point	% Dif	Analyzer Response
Zero	-0.10	0
SO ₂ Span	400.0	399.7
API Model TML-50 SO ₂ Analyzer Check list		
Test Values	Observed Value	Units
RANGE	500	PPB
SAMPLE PRESS	28.3	in-Hg
SAMPLE FLOW	655	cc/min
PMT	103.0	mV
UV LAMP	3028.1	mV
STR. LGT	61.4	PPB
DRK PMT	63.0	mV
DRK LMP	57.7	mV
HVPS	673	V
DCPS	2528	mV
RCCELL TEMP	50.5	°C
BOX TEMP	29.3	°C
PMT TEMP	7.4	°C
SO ₂ Span Conc	400	PPB
SO ₂ Slope	1.005	
SO ₂ Offset	22.0	mV
Stability at Zero	0.1	PPB
Stability at Span	0.2	PPB

Calibrated by : (Mr. Adul Dangkom)
Approved : (Mr. Peera Deudom)



CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
ID No : BA 05/50
AIR PRESSURE : 1008mbar \pm 1mbar
AMBIENT TEMPERATURE : 22 $^{\circ}$ C \pm 1 $^{\circ}$ C
MODEL : XS 105DU
S/N : 1126422905
RECEIVED DATE : 11-Mar-22
CALIBRATION DATE : 11-Mar-22
RELATIVE HUMIDITY : 49 %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 :-

- 1) STANDARD WEIGHT SET
E2 QK-1-151
2) THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
3) THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

4. 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

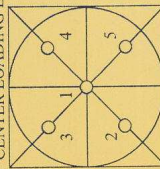
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.00000	0.00000	0.00011
100.00	100.00001	-0.00001	0.00019
120.00	120.00001	-0.00001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)
1	10.00001
2	10.00002
3	10.00001
4	10.00001
5	10.00002
OFF-CENTER LOADING	0.00001

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

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A

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

END OF CALIBRATION REPORT

คุณภาพน้ำ

Certificate of Calibration

Certificate No. : 65-400210-1

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 :

19 April 2022

Date of Calibration :

23 April 2022

Date of Issue :

23 April 2022

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

400001 TT-0016-22 07 Feb 2024

2. Standard Digital Thermometer

ID No. Cert. No. Due Date

400003 21E1850 14 Jun 2023

400004 21E1850 14 Jun 2023

Traceability
National Institute of Metrology Thailand (NIMT)

Traceability
National Institute of Metrology Thailand (NIMT)

National Institute of Metrology Thailand (NIMT)

National Institute of Metrology Thailand (NIMT)

Approved by :

(Bunjerd Masri)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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Certificate of Calibration

Certificate No. : 65-400210-1

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 0.6439 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (± °C)
20.6690	20	0.7	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 -





QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584



CERTIFICATE No : 22E9693
REFERENCE No : 66476-1

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 : 15-Sep-22

APPROVED BY : 
ISSUED DATE : 15-Sep-22
RECEIVED DATE : 14-Sep-22

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

F-G010 REV 02



QUALITY CALIBRATION CO.,LTD.
235 Petchkasem 63/2 Road, Laksong, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22E9693

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
MODEL : HI 3512
ID No : TH118035
RECEIVED DATE : 14-Sep-22
AMBIENT TEMPERATURE : 20 °C ± 1 °C
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

- 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 READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTROD WAS CALIBRATED BY USING STANDARD pH BUFFER
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No/	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	LOT No	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC719181	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC718727	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.

- NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : ADJUSTMENT

- DISPLAY UNIT ONLY

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

mV	APPLIED	UUC	CORRECTION	UUC	UNCERTAINTY OF	COVERAGE
		READING (mV)	(mV)	READING (pH)	MEASUREMENT	FACTOR
					(± mV)	k
414.11	414.8	-0.69	-0.171	0.14	2.0	
354.95	355.6	-0.65	0.860	0.14	2.0	
295.80	296.4	-0.60	1.892	0.14	2.0	
236.64	237.2	-0.56	2.922	0.14	2.0	
177.48	178.0	-0.52	3.954	0.14	2.0	
118.32	118.8	-0.48	4.985	0.14	2.0	
59.16	59.7	-0.54	6.016	0.14	2.0	
0.00	0.5	-0.50	7.049	0.14	2.0	
-59.16	-58.8	-0.36	8.136	0.14	2.0	
-118.32	-117.9	-0.42	9.223	0.14	2.0	
-177.48	-177.1	-0.38	10.311	0.14	2.0	
-236.64	-236.3	-0.34	11.399	0.14	2.0	
-295.80	-295.5	-0.30	12.487	0.14	2.0	
-354.95	-354.7	-0.25	13.575	0.14	2.0	
-414.11	-413.9	-0.21	14.662	0.14	2.0	

END OF CALIBRATION REPORT PAGE 2 OF 3



CERTIFICATE No : 22E9693

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE):

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

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm pH)	COVERAGE FACTOR k
4.007	4.007	0.000	3.996	0.012	2.0
7.004	7.006	-0.002	6.944	0.012	2.0
10.016	10.012	0.004	10.194	0.014	2.0

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (\pm °C)	COVERAGE FACTOR k
25.003	25.0	0.003	---	0.0085	2.0

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9484

NSC-TS-17025
CALIBRATION 0008Cert.No.: 22CH140
Page.: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : SevenCompact
Serial No. : C141708983
ID No. : -

Condition As-Received:

Used Item
Received Date : 31 January 2022
Calibration Date : 02 February 2022
Reference : 2201-0954WSC-1

Submitted by :

S.P.S. Consulting Service Co.,Ltd.
7 Soi Phahonyothin 24, Phahonyothin Rd.,
Chom Phon, Chatuchak, Bangkok 10900

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

Calibration Procedure : In-house method :

- CP-CH6 : based on direct measurement by
using certified reference material (CRM)

Calibrated by :

Warakorn Lemgagrakul

Approved by :

Approved Signatory

(✓) Malee Butkruea
() Saitip Meangmai
() Warakorn Lemgagrakul

Issue Date :

10 February 2022

The Uncertainties are for a confidence probability of approximately 95 %

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



CERTIFICATE No : 22M2569
REFERENCE No : 64386-3

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 : TETNITHI W.
CALIBRATION DATE : 11-Mar-22
APPROVED BY : [Redacted]
ISSUED DATE : 17-Mar-22
RECEIVED DATE : 11-Mar-22

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

Cert.No.: 22CH140

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instrument :-

1) Thermometer
Serial No. 1963878 ID No. 130RC095 Certificate No. 211977 Due date 17 Sep 2022

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

- Traceable to National Institute of Metrology (Thailand), NIMT

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Conductivity Solution	Manufacturer	Lot No.	Exp. date
147.0 µS/cm	CPA Chem	761020	02 Aug 2022
1413.0 µS/cm	CPA Chem	761021	02 Aug 2022
12.880 mS/cm	CPA Chem	761022	02 Aug 2022
111.3 mS/cm	CPA Chem	768164	12 Sep 2022

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 0.147, 1.413, 12.880, 111.3 mS/cm

Conductivity Electrode Serial No.: 5821320179

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
147.0 µS/cm	148.1 µS/cm	147.0 µS/cm	0.99 µS/cm	2.00
1413.0 µS/cm	1413 µS/cm	1413 µS/cm	9.2 µS/cm	2.00
12.880 mS/cm	12.61 mS/cm	12.88 mS/cm	0.086 mS/cm	2.00
111.3 mS/cm	105.7 mS/cm	111.4 mS/cm	0.76 mS/cm	2.00

Remark

- UUC* = Unit Under Calibration
- 147.0 µS/cm Adjustment Cell constant = 0.550585 cm⁻¹
- 1413.0 µS/cm Adjustment Cell constant = 0.554585 cm⁻¹
- 12.880 mS/cm Adjustment Cell constant = 0.562585 cm⁻¹
- 111.3 mS/cm Adjustment Cell constant = 0.578585 cm⁻¹

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

-000-



CERTIFICATE No.: 22M2569

PAGE: 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
ID No : BA 09/61
AIR PRESSURE : 1008mmbar \pm 1mmbar
AMBIENT TEMPERATURE : 22 $^{\circ}$ C \pm 1 $^{\circ}$ C
MODEL : BSA224S-CW
S/N : 36591843
RECEIVED DATE : 11-Mar-22
CALIBRATION DATE : 11-Mar-22
RELATIVE HUMIDITY : 51 %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 ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST 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 :-

1. STANDARD WEIGHT SET
E2
QK-H-151
C02210415
09-Feb-23
2. ZERO SETTING FUNCTION : NORMAL
3. TARE FUNCTION : NORMAL
4. REPEATABILITY OF READING AT 200 g WAS 0.000048 g
5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

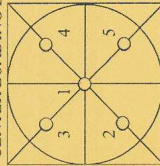
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.0000	0.0000	0.000078
0.10	0.1000	0.0000	0.000078
0.20	0.2000	0.0000	0.000078
0.50	0.5000	0.0000	0.000079
1.00	1.0000	0.0000	0.000080
2.00	2.0000	0.0000	0.000081
5.00	5.0000	0.0000	0.000084
10.00	10.0000	0.0000	0.000089
20.00	20.0000	0.0000	0.00011
50.00	50.0000	0.0000	0.00019
100.00	100.0000	0.0000	0.00032
200.00	199.9999	0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9999
2	99.9999
3	100.0000
4	99.9999
5	99.9998

OFF-CENTER LOADING

0.0001

NOTE: THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT PRODUCTION 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%.

LAW OF CALIBRATION ACT 1991



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

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

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

Cert.No.: 22TW98

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter

Manufacturer : YSI

Model : 5000-230V

Serial No. : 15B100751

ID No. : -

Received Date : 20 April 2022

Test Date : 21 April 2022

Reference : 2204-0429WC-1

Submitted by :

S.P.S. Consulting Service Co.,Ltd.
7 Phaholyothin 24, Phaholyothin Road.,
Jompol, Chatuchak, Bangkok 10900Laboratory Condition : Temperature (25 \pm 5) $^{\circ}$ CHumidity (50 \pm 20) %

Test Procedure : In - house method : CP-CH9

by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithean

Approved by :

Approved Signatory

(☒) Malee Buikrua
(☐) Sathip Meangmai
(☐) Warakorn Lengagtrakul

Issue Date : 25 April 2022



CERTIFICATE No : 22T0570
REFERENCE No : 63773-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB 200
SERIAL No : 15110C0498
ID No : DRB 06/59
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 : 21-Jan-22

APPROVED BY :
PONGSAK J.
ISSUED DATE : 21-Jan-22
RECEIVED DATE : 19-Jan-22

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

F-G010 REV : 02



Cert.No.: 22TW98
Page.: 2 of 2

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

Titration Method (Azide Modification Method)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.14	0.0084

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory.

-o0o-

a 1105753



QUALITY CALIBRATION CO., LTD.

235 Petchkasem 63/2 Road, Laksong, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 22T0570

PAGE : 2 OF 2

Calibration Report

EQUIPMENT	:	COD REACTOR
MANUFACTURER	:	HACH
ID NUMBER	:	DRB 06/59
RECEIVED DATE	:	19-Jan-22
AMBIENT TEMPERATURE	:	23°C ± 1°C
MODEL	:	DRB 200
SERIAL NUMBER	:	15110C0498
CALIBRATION DATE	:	21-Jan-22
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	21T6767	10-Jul-22
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

BLOCK No.1 FRONT					BLOCK No.2 FRONT						
13	14	15	13	14	15	13	14	15	13	14	15
10	11	12	10	11	12	10	11	12	10	11	12
7	8	9	7	8	9	7	8	9	7	8	9
4	5	6	4	5	6	4	5	6	4	5	6
1	2	3	1	2	3	1	2	3	1	2	3

TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	150.5
Locations	150.6	150.1
	149.7	149.7
	150.2	150.7
	149.9	149.9
	150.1	150.4
	150.1	150.4
	149.7	150.7
	150.6	150.7
	149.6	150.6
	149.9	150.6
	149.6	150.0
	149.7	150.1
	149.8	150.2
	149.6	150.2
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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunmru, Bangplud Bangkok 10700 THAILAND.

Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

NSC-TSI-TIS 17025
CALIBRATION 0394

Cert. No. : SP22018

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, CHOMPON, CHATUCHAK, BANGKOK 10900, THAILAND.
Location :	ORGANIC LABORATORY IV
Ambient Temperature :	(24.4 ± 5) °C
Relative Humidity :	(60.1 ± 25) %
Received Date :	30 AUGUST 2022
Calibration Date :	30 AUGUST 2022
Date of Issue :	31 AUGUST 2022

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.

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : SP22018
Job No. : VC65SP0008
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	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-IN2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
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	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
RM-DL	640.50	640.5	0.00	0.16	2.00
	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP22018
Job No. : VC65SP0008
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	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
Neutral Density glass filter		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
Neutral Density glass filter		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	0.0032	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)
0.0107	3.9886

**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



PinAAcle 900Z Preventive Maintenance Report

Company Name: S.P.S.CONSULTING SERVICE CO.,LTD.


Instrument Location: PHAHOLYOTHIN RD, JOMPON, BANGKOK
51, TH, 10900

Instrument Serial No.: PZAS19090402

Date: 01-Jun-2022

PinAAcle 900Z Preventive Maintenance (PM)				
Company Name:	S.P.S.CONSULTING SERVICE CO.,LTD.			
Address (Instrument Location):	PHAHOLYOTHIN RD, JOMPON, BANGKOK, 51, TH, 10900			
Serial Number:	PZAS19090402	PM Number:	1/2	
Customer Name (if applicable):	K. PHENPHA	Telephone Number:	083-926-9252	
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-01473846	
Date PM Performed: (DD-MM-YYYY)	01-Jun-2022	Next PM Due Date: (DD-MM-YYYY)	01-Dec-2022	
Standard Labor Hours to Complete PM :			5 hours	

Part Number	Release	Publication Date
09370144 Rev.9	A	January 2018



Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900Z by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

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 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 #	Configuration Notes
A5900	A59419052359	Synglistix 3.1

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A

Additional Reagents and Standards Required for PM			
Part Number (if applicable)	Description	Quality	Batch/Lot # Expired Date (MM/YY)
N9300244	GFAAS Mixed Standard	AR	56-021CRY1 30-Jun-2023

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	
B3100652 Or N9307029	Electronic Flow Meter	1	NA	
B0505495	Test Jig	1	NA	
03030997	System 2 EDL Driver	1	03030997	
N3050605	As System 2 EDL	1	16148	
N3050121	Cu Lumina HCL	1	092216-010130	
N3050109	Ba Lumina HCL	1	102416-040160	
N3050139	K Lumina HCL	1	110716-010060	
N3050152	Ni Lumina HCL	1	100516-030190	
N3050119	Cr Lumina HCL	1	091911-020150	

Procedure Checklist

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

1. General:

- ✓ Review the instrument performance with the customer and document any recent problems.
- ✓ Inspect the customer log book and make any appropriate PM entries.
- ✓ Perform general inspection of system for cleanliness.

2. PC Instrument Software:

- ✓ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ✓ Inspect and clean all fans and filters. Replace filters if necessary
- ✓ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ✓ Clean exterior of the instrument.
- ✓ Check the drain system for signs of wear. Replace worn or damaged parts.
- ✓ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed. P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09903148
- ✓ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ✓ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ✓ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ✓ Check furnace open/close function.
- ✓ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ✓ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ✓ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ✓ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN
- ✓ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ✓ Check auto sampler operation.
- ✓ Perform an auto sampler check valve test as described in the Service Manual.
- ✓ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ✓ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.
- ✓ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ✓ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ✓ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ✓ Check furnace open/close function

4. Electrical:

- ✓ Inspect PC boards. Clean if necessary.
- ✓ Check instrument firmware revisions upgrade to current levels (if necessary)
- ✓ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ✓ Inspect and clean the sample compartment windows, if needed.
- ✓ Inspect and clean the furnace windows, if needed.
- ✓ Inspect and clean the GFTV camera lens, if needed.
- ✓ Inspect optics. Clean or replace if necessary,

6. Gasses:

- ✓ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900 Series Pre-installation Checklist SDB.
- ✓ Verify that the air filter element is dry. Replace if necessary.

7. After PM Performance tests [THGA]:

7.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min ± 25 mL/min	255	Passed
External Flow Rate	100 mL/min ± 10 mL/min	105	Passed

7.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0001	Passed
Standard Deviation	≤ 0.005	0.0002	Passed

7.3 Chromium Characteristic Mass and Precision

Description: Calculate the characteristic mass using the characteristic mass tool and precision from the integrated absorbance values.

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	≤ 7.0 pg/0.0044 A-s	5.6	Passed
Precision	≤ 2.0 %	0.56	Passed

7.4 Copper Characteristic Mass and Zeeman Ratio

Description: Calculate the characteristic mass using the characteristic mass tool and check the Zeeman Ratio.

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	14.1	Passed
Zeeman Ratio	0.52 ± 0.04	0.53	Passed

8. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM	
$\text{Zeeman Ratio} = \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1609}{0.1609+0.1377}$ $= 0.53$	
REPLACE PM KIT FOR PinAAcle900Z	

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.</i>	
<i>This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	Date: 01-Jun-2022 (DD-MM-YYYY)
Authorized Customer Representative:	Date: 01-Jun-2022 (DD-MM-YYYY)



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

Customer :	S.P.S.Consulting Service Co.,Ltd	Date Tested:	July 11, 2022
Address :	7 Soi Phaholyothin 24 Phaholyothin Road Jompol Chatuchak, Bangkok 1090	Recommendation Recertification Period	6 Months
User Name:	K.Phenpha Viphasathawat	Recertification Due:	January 11, 2023
Phone:	083-9269252	Date Last Certified:	January 12, 2022
Fax:	02-513-4221	Visit Number:	1 of 2
		PerkinElmer Phone:	02-719-6420 ext 206
		PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED	
MODEL	SERIAL NUMBER		
OPTIMA 5300DV	077C7042401		
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION	
IPV Methods			
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE	
Multielement Standard	N069-1579	August 30, 2022	
Wavecal Solution	N058-2152	November 30, 2022	
VIS Wavecal solution	N930-2946	August 30, 2023	
Instrument Cal. STD4	N930-0221	August 30, 2022	
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS	
2 % HNO3			
10 % HNO3			



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

SERIAL NUMBER	077C7042401	DATE TESTED	July 11, 2022
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			



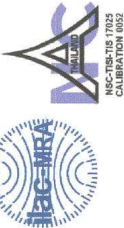
MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV



MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER : 077C7042401		DATE TESTED : July 11, 2022	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	0.00544	
	Ni 231.604 nm	0.00709	
	Ni 341.476 nm	0.00757	
Spectral Resolution : VIS	La 408.672 nm	0.01638	
	Ba 455.403 nm	0.02391	
Precision	As 193.656 nm	% RSD	< 1.0 %
	Zn 213.856 nm	% RSD	< 1.0 %
	Mn 257.610 nm	% RSD	< 1.0 %
	La 379.478 nm	% RSD	< 1.0 %
	Ba 455.403 nm	% RSD	< 1.0 %
	Ba 493.408 nm	% RSD	< 1.0 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	5.51 ppb
	As 193.696 nm	3(sd)	8.59 ppb
	Pb 220.353 nm	3(sd)	0.50 ppb
	As 193.696 nm	3(sd)	2.17 ppb
Detection Limits : Radial	Zn 213.856 nm	3(sd)	0.03 ppb
	Mn 257.610 nm	3(sd)	0.01 ppb
	La 379.478 nm	3(sd)	0.04 ppb
	Ba 455.403 nm	3(sd)	0.01 ppb
	Ba 493.408 nm	3(sd)	0.00 ppb
	Cd 226.502 nm	≤ 150 ppb	12.46
BEC : Axial (IB X 500)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	30.82

SERIAL NUMBER	077C7042401	DATE TESTED	July 11, 2022
Remarks :	Commissioning follow as commissioning performance sheets.		
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<hr/>			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/>		meets	
<input type="checkbox"/>		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:		(Mr. Wiphan Promlunda)	
		Service Engineer	



CALIBRATION CERTIFICATE

Certificate No. : S2022090647-0003

Date Issued : 03-Oct-22

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 : 30-Sep-22
Date Calibrated : 30-Sep-22
Calibrated by : Mr. Surat Aumarb

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:

(Mr. Sarayuth Tochua)



Certificate No. : S2022090647-0003

Environment : Ambient Temperature : Start record 26.5 °C, Stop record 26.6 °C
Relative Humidity : Start record 54.8 %RH, Stop record 54.6 %RH

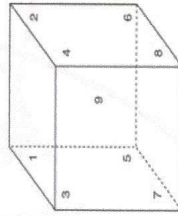
Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability ¹ (°C)	Measured Uniformity ² (°C)	Overall Variation ³ (°C)
35	35.0	35.0	0.03	0.07	0.14
41.5	41.5	41.5	0.03	0.08	0.15

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)	STD Uncertainty ⁴ (°C)
35	34.88	34.86	34.89	34.90	34.93	34.92	34.95	34.89	34.93	0.18
41.5	41.40	41.33	41.32	41.41	41.43	41.43	41.38	41.33	41.37	0.18

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. AD2207-125-0001 for Digital Thermometer with Probe (Agilent) Module 1 (73) NTC, Pt1000 Serial No. MY44024042, Due 01-Feb-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