

## ภาคผนวก ง

### เอกสารการสอบเทียบเครื่องมือ

ภาคผนวก ง-1	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ
ภาคผนวก ง-2	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียง
ภาคผนวก ง-3	เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์ผลกระทบสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>1. คุณภาพอากาศในบรรยากาศโดยทั่วไป</b> Total Suspended Particulate	High Volume Air Sampler No. B02, B15, B25, B31	Digital Balance
Particulate Matter less than 10 microns	High Volume PM-10 Air Sampler No. R01, B17, B26, B31	Digital Balance
Sulfur Dioxide	SO <sub>2</sub> Analyzer No. B02, B12, R03, R07	SO <sub>2</sub> Analyzer
Nitrogen Dioxide	NO <sub>2</sub> Analyzer No. B02, B03, B18, B22	NO <sub>2</sub> Analyzer
<b>2. ระดับเสียง</b> Leq 24 hr, L <sub>max</sub> , L <sub>90</sub> , L <sub>dn</sub> และเสียงรบกวน	Acoustic Calibrator Sound Level Meter No. ACO-B18 Sound Level Meter No. CR-B07, CR-B08, CR-B09, CR-B10	-
เสียงพื้นฐาน	Acoustic Calibrator Sound Level Meter No. ACO-B29 Sound Level Meter No. CR-B01, CR-B02, CR-B04, CR-B05	-
<b>3. คุณภาพน้ำทิ้ง</b>		
pH	-	pH Meter
Temperature	-	Thermometer
Total Suspended Solids	-	Digital Balance
Total Dissolved Solids	-	Digital Balance
Dissolved Oxygen	-	DO Meter
BOD5	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
Cyanide	-	Spectrophotometer
Zinc	-	ICP
Arsenic	-	AAS
Mercury	-	AAS
Copper	-	ICP
Cadmium	-	ICP
Lead	-	ICP
Nickel	-	ICP
Manganese	-	ICP
Hexavalent Chromium	-	ICP

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์ผลกระทบสิ่งแวดล้อม

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>4. คุณภาพน้ำผิวดิน</b>		
pH	-	pH Meter
Temperature	-	Thermometer
Dissolved Oxygen	-	DO Meter
BOD <sub>5</sub>	-	BOD Analyzer
Cyanide	-	Spectrophotometer
Total Coliform Bacteria	-	Incubator Water bath
Zinc	-	ICP
Arsenic	-	AAS
Mercury	-	AAS
Copper	-	ICP
Cadmium	-	ICP
Lead	-	ICP
Nickel	-	ICP
Manganese	-	ICP
Hexavalent Chromium	-	ICP

**ภาคผนวก ง-1**

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ





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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 <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	10/05/2024	y = 1.153x-1.686	1.000
B02	B02	06/05/2024	y = 1.118x+2.367	0.999
B03	B03	06/05/2024	y = 1.188x-5.422	1.000
B04	B04	07/05/2024	y = 1.263x-5.863	0.999
B05	B05	07/05/2024	y = 1.265x-7.057	0.999
B06	B06	09/05/2024	y = 1.213x-4.898	0.997
B07	B07	07/05/2024	y = 1.193x-4.616	0.999
B08	B08	07/05/2024	y = 1.207x-4.482	0.998
B09	B09	06/05/2024	y = 1.216x-4.533	1.000
B10	B10	07/05/2024	y = 1.170x-0.607	1.000
B11	B11	07/05/2024	y = 1.135x-1.256	0.999
B12	B12	07/05/2024	y = 1.211x-4.879	0.997
B13	B13	07/05/2024	y = 1.237x-4.608	1.000
B14	B14	06/05/2024	y = 1.252x-5.906	0.998
B15	B15	09/05/2024	y = 1.192x-2.587	0.999
B16	B16	06/05/2024	y = 1.133x-0.425	0.996
B17	B17	06/05/2024	y = 1.250x-4.910	0.997
B18	B18	06/05/2024	y = 1.181x-4.244	0.998
B19	B19	09/05/2024	y = 1.246x-8.218	0.999
B20	B20	08/05/2024	y = 1.218x-4.223	0.999
B21	B21	08/05/2024	y = 1.189x-4.448	0.998
B22	B22	09/05/2024	y = 1.195x-6.295	0.999
B23	B23	06/05/2024	y = 1.247x-5.137	0.999
B24	B24	09/05/2024	y = 1.157x-1.861	0.998
B25	B25	07/05/2024	y = 1.079x+1.324	1.000
B26	B26	07/05/2024	y = 1.204x-3.730	0.997
B27	B27	07/05/2024	y = 1.140x-2.924	0.999
B28	B28	07/05/2024	y = 1.220x-7.484	0.999
B29	B29	07/05/2024	y = 1.215x-3.763	1.000
B30	B30	10/05/2024	y = 1.198x-3.745	0.998
B31	B31	10/05/2024	y = 1.209x-4.851	1.000
B32	B32	10/05/2024	y = 1.186x-0.772	0.998
B33	B33	10/05/2024	y = 1.237x-4.394	0.997
B34	B34	10/05/2024	y = 1.191x-4.725	0.999



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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 <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	10/05/2024	y = 1.208x-2.196	0.999
B02	B02	06/05/2024	y = 1.126x+0.624	0.999
B03	B03	06/05/2024	y = 1.229x-3.954	0.999
B04	B04	06/05/2024	y = 1.179x-3.520	0.999
B05	B05	09/05/2024	y = 1.194x-4.966	0.998
B06	B06	09/05/2024	y = 1.211x-4.805	0.999
B07	B07	06/05/2024	y = 1.194x-4.491	0.998
B08	B08	06/05/2024	y = 1.199x-2.209	0.999
B09	B09	06/05/2024	y = 1.229x-6.309	0.999
B10	B10	07/05/2024	y = 1.205x-3.745	0.999
B11	B11	10/05/2024	y = 1.243x-4.611	0.998
B12	B12	07/05/2024	y = 1.235x-5.109	0.999
B13	B13	07/05/2024	y = 1.216x-4.616	0.999
B14	B14	06/05/2024	y = 1.206x-2.574	0.999
B15	B15	09/05/2024	y = 1.192x-1.864	0.999
B16	B16	07/05/2024	y = 1.198x-0.408	1.000
B17	B17	06/05/2024	y = 1.215x-4.321	0.996
B18	B18	10/05/2024	y = 1.221x-4.368	0.998
B19	B19	09/05/2024	y = 1.225x-4.263	0.999
B20	B20	07/05/2024	y = 1.236x-5.830	0.997
B21	B21	07/05/2024	y = 1.146x+0.383	0.998
B22	B22	09/05/2024	y = 1.204x-1.993	0.998
B23	B23	07/05/2024	y = 1.201x-3.338	0.999
B24	B24	09/05/2024	y = 1.155x-1.602	0.999
B25	B25	07/05/2024	y = 1.224x-5.057	0.998
B26	B26	06/05/2024	y = 1.188x-3.804	0.998
B27	B27	07/05/2024	y = 1.153x-4.016	0.998
B28	B28	07/05/2024	y = 1.197x-5.298	0.999
B29	B29	07/05/2024	y = 1.206x-4.662	0.999
B30	B30	07/05/2024	y = 1.181x-2.375	0.998
B31	B31	08/05/2024	y = 1.160x+0.847	0.999
B32	B32	08/05/2024	y = 1.223x-4.126	0.998
B33	B33	08/05/2024	y = 1.184x-1.773	0.999
B34	B34	07/05/2024	y = 1.229x-3.128	0.998



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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 (l <sup>3</sup> /min)	R <sup>2</sup>
R01	R01	06/05/2024	y = 1.174x-4.049	0.999
R02	R02	06/05/2024	y = 1.205x-3.581	0.998
R03	R03	07/05/2024	y = 1.235x-6.580	0.999
R04	R04	10/05/2024	y = 1.165x-5.072	0.998
R05	R05	10/05/2024	y = 1.211x-6.165	0.997
R06	R06	06/05/2024	y = 1.203x-3.045	0.998
R07	R07	06/05/2024	y = 1.195x-3.082	0.997
R08	R08	06/05/2024	y = 1.229x-5.593	0.999
R09	R09	06/05/2024	y = 1.223x-4.946	0.997
R10	R10	09/05/2024	y = 1.169x-3.241	0.999
R11	R11	07/05/2024	y = 1.228x-2.749	0.997
R12	R12	10/05/2024	y = 1.226x-6.607	0.996
R13	R13	09/05/2024	y = 1.154x-1.960	0.998
R14	R14	06/05/2024	y = 1.205x-4.415	0.998
R15	R15	06/05/2024	y = 1.199x-3.887	0.998
R16	R16	06/05/2024	y = 1.168x-3.045	0.998
R17	R17	06/05/2024	y = 1.140x-0.557	0.997
R18	R18	06/05/2024	y = 1.165x-3.692	0.998
R19	R19	06/05/2024	y = 1.157x-0.982	0.999
R20	R20	06/05/2024	y = 1.177x-5.526	1.000



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#### CALIBRATION REPORT

##### SO<sub>2</sub> FLUORESCENT ANALYZER

DATE : 23 May 2024 BRAND : API MODEL : 100A  
NO. SO<sub>2</sub>-B02 SERIAL NO. 1847

##### Calibrator (Dilution System)

Brand : API Model : 700  
Last Cal. Date : 08 August 2023 Serial No. : 911

##### Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO<sub>2</sub>) 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 : 48

##### CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.8	-0.050	400.0	1.010

##### API Model 100A SO<sub>2</sub> 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	657	cc/min	650 ± 10%
PMT	103.5	mV	-20-150 with Zero Air
UV LAMP	3042.1	mV	1000-4900
STR. LGT	61.6	PPB	<100
DRK PMT	63.1	mV	-50 - 200
DRK LMP	57.9	mV	-50 - 200
HVPS	669	V	550-900 constant
DCPS	2527	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 <sub>2</sub> Span Conc	400	PPB	20-20,000
SO <sub>2</sub> Slope	1.010	-	1.0 ± 0.3
SO <sub>2</sub> 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)



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	23 May 2024	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO <sub>2</sub> -B12	SERIAL NO.	1886		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 08 August 2023			Serial No. : 911		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO <sub>2</sub> )			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	48		
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 <sub>2</sub> Span	400.0	400.2	0.050	400.0	1.014
API Model TML-50 SO <sub>2</sub> 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	103.1	mV	-20-150 with Zero Air		
UV LAMP	3010.2	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	675	V	550-900 constant		
DCPS	2515	mV	2500 ± 200		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.5	°C	5-40		
PMT TEMP	7.3	°C	7 ± 2.0		
SO <sub>2</sub> Span Conc	400	PPB	20-20,000		
SO <sub>2</sub> Slope	1.014	-	1.0 ± 0.3		
SO <sub>2</sub> 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)		



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	23 May 2024	BRAND :	API	MODEL :	100E
NO.	SO <sub>2</sub> -R03	SERIAL NO.	3488		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 08 August 2023			Serial No. : 911		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO <sub>2</sub> )			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	48		
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 <sub>2</sub> Span	400.0	400.1	0.025	400.0	1.012
API Model 100E SO <sub>2</sub> 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	654	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3018.4	mV	1000-4900		
STR. LGT	61.8	PPB	<100		
DRK PMT	63.3	mV	-50 - 200		
DRK LMP	58.1	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 <sub>2</sub> Span Conc	400	PPB	20-20,000		
SO <sub>2</sub> Slope	1.012	-	1.0 ± 0.3		
SO <sub>2</sub> 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)		





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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	23 May 2024	BRAND :	TELEDYNE	MODEL :	TML-60
NO.	SO <sub>2</sub> -R07	SERIAL NO.	TRS1068		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )		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	48				
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 <sub>2</sub> Span	400.0	399.7	-0.075	400.0	1.008
API Model TML-60 SO <sub>2</sub> 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	656	cc/min	650 ± 10%		
PMT	103.4	mV	-20-150 with Zero Air		
UV LAMP	3037.5	mV	1000-4900		
STR. LGT	61.7	PPB	<100		
DRK PMT	63.2	mV	-50 - 200		
DRK LMP	58.0	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2523	mV	2500 ± 200		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.2	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO <sub>2</sub> Span Conc	400	PPB	20-20,000		
SO <sub>2</sub> Slope	1.008	-	1.0 ± 0.3		
SO <sub>2</sub> 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)		



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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 <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	23 May 2024	BRAND :	API	MODEL :	200A
NO.	NO <sub>x</sub> -B02	SERIAL NO.	2409		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	48				
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	1.005
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.009
API Model 200A NO <sub>x</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	507	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.9	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	670	V	420 - 900 constant		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.2	°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	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.009	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO <sub>x</sub> 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		



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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	23 May 2024	BRAND :	API	MODEL :	200A
NO.	NOX-B03	SERIAL NO.	2617		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	48				
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	400.1	0.025	400.0	1.009
NO <sub>x</sub> Span	400	400.3	0.075	400.0	1.012
API Model 200A NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.0	°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	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.009	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.7	mV	-20 to +150		
NO <sub>x</sub> 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		



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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	23 May 2024	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B18	SERIAL NO.	N07543		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	48				
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	1.007
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.011
API Model TML-41M NO <sub>x</sub> 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	504	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.1	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.1	°C	315 ± 5		
RCELL PRESS	8.3	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 <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.007	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.6	mV	-20 to +150		
NO <sub>x</sub> 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		



CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	23 May 2024	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B22	SERIAL NO.	NO1618		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	08 August 2023		Serial No. :	911	
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)		Cylinder No. :	A00726SV	
Certified Date :	05 January 2023	Expired Date :	05 January 2026	Cylinder Conc. :	48.8 ppm
CALIBRATING CONDITION					
Pressure	1011 mmbar	Temp.	24.6 °C	% RH	48
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 <sub>x</sub> Span	400	399.9	-0.025	400.0	1.007
API Model TML-41M NO <sub>x</sub> 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	93.9	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.5	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO <sub>x</sub> 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		



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.



# 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 : 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 :-

	<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

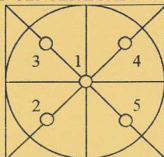
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 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

ภาคผนวก ง-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียง





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) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer 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

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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
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Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

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Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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 20µPa at 1000 Hz

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

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 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	±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	±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 : 201126702200795001

End of Certificate

2 / 2

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

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FM.BL.MTC.002 Rev.4

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Thailand  
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Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th

Noise B\_192\_1/24

## 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	23 May 2024	93.9	93.9
ACO-B29	ACO	6236	00182011	23 May 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

## 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 : Acoustic Calibrator

Manufacturer : Cirrus

Model : CR:515

Serial No. : 92002

### Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N 4106495.

7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

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 : 22 Feb. 2024

Date of Calibration : 5 Mar. 2024

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  
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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  
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E-mail : mtc@tistr.or.th

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Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
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E-mail : sumalee@tistr.or.th





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

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 $\mu$ Pa at 1000 Hz

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

### 1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	94.04	0.04	$\pm 0.10$	$\pm 0.40$ dB

### 2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1000.3	0.3	$\pm 1.5$	$\pm 1.0\%$

### 3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.70	$\pm 0.50$	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 5 Mar. 2024

Date of Issue : 6 Mar. 2024

Ref : 2011267022200795002

End of Certificate

2 / 2

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

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FM.BL.MTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
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Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,  
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Thailand  
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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 แขวงจตุจักร 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\_192\_1/24

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

Brand	CIRRUS	Number	AC-CR01/63
Model	CR515	Serial No.	92002
Calibration Range	94 dB, 1000 Hz	Last Calibration	05 March 2024
		Due Date	05 March 2025

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B01	Cirrus	CR161B	G301393	23 May 2024	93.9	94.0
CR-B02	Cirrus	CR161B	G301157	23 May 2024	94.1	94.0
CR-B04	Cirrus	CR161B	G301404	23 May 2024	94.0	94.0
CR-B05	Cirrus	CR161B	G301134	23 May 2024	93.9	94.0
CR-B07	Cirrus	CR161B	G301167	23 May 2024	94.0	94.0
CR-B08	Cirrus	CR161B	G301397	23 May 2024	94.0	94.0
CR-B09	Cirrus	CR161B	G301401	23 May 2024	94.0	94.0
CR-B10	Cirrus	CR161B	G301407	23 May 2024	94.1	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					94.04 $\pm$ 0.10 dB	

ภาคผนวก ง-3

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำ



**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 : 23E8494  
REFERENCE No : 70413-1

PAGE : 1 OF 3

**Certificate of Calibration**

**EQUIPMENT** : pH METER  
**MANUFACTURER** : HANNA  
**MODEL** : HI 3512  
**SERIAL No** : TH118035  
**ID No** : pH04/56  
**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** : 06-Sep-23

**APPROVED BY** : [Signature]  
PONGSAK J.

**ISSUED DATE** : 06-Sep-23

**RECEIVED DATE** : 31-Aug-23

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

F-G010 REV 03

**QUALITY CALIBRATION CO.,LTD.**

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

CERTIFICATE No : 23E8494

PAGE : 2 OF 3

**Calibration Report**

**EQUIPMENT** : pH METER  
**MANUFACTURER** : HANNA  
**ID No** : pH04/56  
**RECEIVED DATE** : 31-Aug-23  
**AMBIENT TEMPERATURE** : 23 ° C ± 3 ° C  
**MODEL** : HI 3512  
**SERIAL NUMBER** : TH118035  
**CALIBRATION DATE** : 06-Sep-23  
**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/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Apr-24
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23
- THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-
  - NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
  - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

**RESULT OF CALIBRATION : ADJUSTMENT****1. DISPLAY UNIT ONLY**

SLOPE FACTOR k = 2.303 RT/F = 59 mV/pH

mV APPLIED	UUC READING (mV)	CORRECTION (mV)	UUC READING (pH)	UNCERTAINTY OF MEASUREMENT (± mV)	COVERAGE FACTOR k
414.11	414.6	-0.49	-0.290	0.15	2.00
354.95	355.4	-0.45	0.741	0.15	2.00
295.80	296.3	-0.50	1.773	0.15	2.00
236.64	237.1	-0.46	2.804	0.15	2.00
177.48	177.9	-0.42	3.835	0.15	2.00
118.32	118.7	-0.38	4.867	0.15	2.00
59.16	59.6	-0.44	5.898	0.15	2.00
0.00	0.4	-0.40	6.930	0.15	2.00
-59.16	-58.8	-0.36	7.961	0.15	2.00
-118.32	-117.9	-0.42	8.992	0.15	2.00
-177.48	-177.1	-0.38	10.024	0.15	2.00
-236.64	-236.3	-0.34	11.055	0.15	2.00
-295.80	-295.5	-0.30	12.087	0.15	2.00
-354.95	-354.6	-0.35	13.118	0.15	2.00
-414.11	-413.8	-0.31	14.149	0.15	2.00

END OF CALIBRATION REPORT PAGE 2 OF 3



## 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%

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## 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 -



## Certificate of Calibration

Certificate No. : 66-400065-2

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 : 01 February 2023

Date of Calibration : 06 February 2023

Date of Issue : 06 February 2023

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	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	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. : 66-400065-2

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 0.3606 °C

Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
20.3607	20	0.4	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%

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CERTIFICATE No : 23M2442  
REFERENCE No : 68471-2

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 : 10-Mar-23  
APPROVED BY :  
ISSUED DATE : 16-Mar-23  
RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23M2442

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW  
MANUFACTURER : SARTORIUS S/N : 36591843  
ID No : BA 09/61 RECEIVED DATE : 10-Mar-23  
AIR PRESSURE : 1010mbar  $\pm$  1mbar CALIBRATION DATE : 10-Mar-23  
AMBIENT TEMPERATURE : 23°C  $\pm$  1°C RELATIVE HUMIDITY : 49% RH  $\pm$  10% RH

### CONDITION OF THIS RESULTS OF CALIBRATION

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

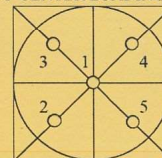
INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	M2302013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2302014S	02-Feb-25
- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- 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

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.0	0.0000	0.0000	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
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	99.9999
3	99.9998
4	100.0001
5	100.0000
OFF-CENTER LOADING	0.0002

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 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 :

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 : 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 :-

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

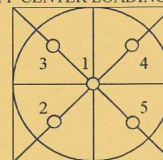
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 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-U017D

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

Calibration Date : 3 Apr 23

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

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

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 15B100751

Probe : YSI 5010

S/N : 22D100097

ID NO. : -

Air Temp ref : S/N. E00522

Barometric ref : S/N. E00522

Water Temp ref : S/N. 11431

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

(Natenapha Pisatkunchon)



CERT.No.: HS-V015C

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

Calibration Date : 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](http://www.qcalibration.com)CERTIFICATE No : 23T0959  
REFERENCE No : 68047-2

PAGE : 1 OF 3

**Certificate of Calibration**

**EQUIPMENT** : COD REACTOR

**MANUFACTURER** : HACH

**MODEL** : DRB200

**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** : 07-Feb-23**APPROVED BY** :   
PONGSAK J.**ISSUED DATE** : 07-Feb-23**RECEIVED DATE** : 31-Jan-23THIS 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, Bangkae, Bangkok 10160

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

CERTIFICATE No : 23T0959

PAGE : 2 OF 2

**Calibration Report**

**EQUIPMENT** : COD REACTOR

**MANUFACTURER** : HACH

**ID NUMBER** : CRB 05/59

**RECEIVED DATE** : 31-Jan-23

**AMBIENT TEMPERATURE** : 23° C ± 1° C

**MODEL** : DRB200

**SERIAL NUMBER** : 15110C0235

**CALIBRATION DATE** : 07-Feb-23

**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.

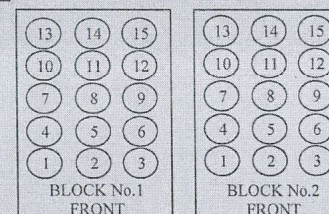
**2. REFERENCE STANDARD INSTRUMENTS :-**

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	22T7511	10-Jul-23

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	149.4
	2	149.5
	3	149.4
	4	149.7
	5	149.4
	6	149.6
	7	149.3
	8	149.6
	9	149.7
	10	149.3
	11	149.5
	12	149.4
	13	149.5
	14	149.4
	15	149.3
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

F-G



**QUALITY CALIBRATION CO.,LTD.**

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

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

[www.qcalibration.com](http://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** : 

**ISSUED DATE** : 5-Feb-24

**RECEIVED DATE** : 5-Feb-24

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

F-G010 REV : 02

**QUALITY CALIBRATION CO.,LTD.**

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

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

CERTIFICATE No : 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 :-**

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
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**

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

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

**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	150.1
	6	150.7
	7	149.9
	8	149.9
	9	150.8
	10	149.5
	11	150.2
	12	150.0
	13	149.5
	14	149.5
	15	149.6
Uncertainty of Measurement(± °C)		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

F-G010 REV : 02



# SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd.,Bangbunru, 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.

SITHIPORN  
associates

SITHIPORN ASSOCIATES CO.,LTD.  
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



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL  
OPTIMA 5300DV

**Customer :** S.P.S.Consulting Service Co.,Ltd Date Tested: January 4, 2024  
Recommendation Recertification  
**Address :** 7 Soi Phaholyothin 24 Period 6 Months  
Paholyothin Road Recertification Due: July 4, 2024  
Jompol Chatuchak, Bangkok 1090 Date Last Certified: July 6, 2023  
**User Name:** K.Phenpha Vipasthawat Visit Number: 2 of 2  
**Phone:** 083-9269252 PerkinElmer Phone: 02-719-6420 ext 206  
**Fax:** 02-513-4221 PerkinElmer Fax: 02-318-5597

## CONFIGURATION TESTED

**MODEL**  
OPTIMA 5300DV**SERIAL NUMBER**  
077C7042401ACCESSORIES/COMPONENT  
NOT INCLUDED

## TESTED EQUIPMENT

IPV Methods

## CALIBRATION NUMBER

## EXPIRATION

## TEST STANDARD USED

Multielement Standard

## PART NUMBER

N069-1579

## EXPIRATION DATE

December 30, 2024

Wavecal Solution

N058-2152

March 30, 2024

VIS Wavecal solution

N930-2946

February 28, 2024

Instrument Cal. STD4

N930-0221

November 30, 2024

## CUSTOMER SUPPLIED

2 % HNO3

## COMMENTS

10 % HNO3

## CUSTOMER INITIALS



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

<b>SERIAL NUMBER</b> <u>077C7042401</u>	<b>DATE TESTED</b> <u>January 4, 2024</u>
<b>1. MECHANICAL CHECKS</b>	
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
<b>2. OPTICAL CHECKS</b>	
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
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every year.	<input type="checkbox"/> N/A
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

<b>SERIAL NUMBER</b> : <u>077C7042401</u>	<b>DATE TESTED</b> : <u>January 4, 2024</u>
<b>PARAMETER</b>	<b>SPECIFICATION</b>
<b>Spectral Resolution : UV</b>	As 193.696 nm ≤ 0.007 <u>0.00529</u>
	Ni 231.604 nm ≤ 0.008 <u>0.00672</u>
	Ni 341.476 nm ≤ 0.012 <u>0.00793</u>
<b>Spectral Resolution : VIS</b>	La 408.672 nm ≤ 0.020 <u>0.01588</u>
	Ba 455.403 nm ≤ 0.025 <u>0.02280</u>
<b>Precision</b>	As 193.656 nm % RSD < 1.0 <u>0.92</u> %
	Zn 213.856 nm % RSD < 1.0 <u>0.95</u> %
	Mn 257.610 nm % RSD < 1.0 <u>0.75</u> %
	La 379.478 nm % RSD < 1.0 <u>0.44</u> %
	Ba 455.403 nm % RSD < 1.0 <u>0.46</u> %
	Ba 493.408 nm % RSD < 1.0 <u>0.37</u> %
<b>Detection Limits : Axial</b>	Tl 190.080 nm 3(sd) <u>19.99</u> ppb
	As 193.696 nm 3(sd) <u>26.66</u> ppb
	Pb 220.353 nm 3(sd) <u>1.81</u> ppb
<b>Detection Limits : Radial</b>	As 193.696 nm 3(sd) <u>38.21</u> ppb
	Zn 213.856 nm 3(sd) <u>2.48</u> ppb
	Mn 257.610 nm 3(sd) <u>0.59</u> ppb
	La 379.478 nm 3(sd) <u>5.52</u> ppb
	Ba 455.403 nm 3(sd) <u>0.13</u> ppb
	Ba 493.408 nm 3(sd) <u>1.08</u> ppb
<b>BEC : Axial (IB X 500)/(IS-IB)</b>	Cd 226.502 nm ≤ 150 ppb <u>141.47</u>
<b>BEC : Radial (IB X 1000)/(IS-IB)</b>	Mn 257.610 nm ≤ 45 ppb <u>29.04</u>



**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**OPTIMA 5300DV**

SERIAL NUMBER 077C7042401 DATE TESTED January 4, 2024

**Remarks :**

Commissioning follow as commissioning performance sheets.

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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:

(

Service Engineer



# PinAAcle 900T

## Preventive Maintenance Report

Company Name: S.P.S. Consulting Service Co.,Ltd.


Instrument Location: AAS Room

Instrument Serial No.: PTCS14111103

Date: 04-Jan-2024



***PinAAcle 900T Preventive Maintenance (PM)***

Company Name:	S.P.S. Consulting Service Co.,Ltd.		
Address (Instrument Location):	7, Soi Phaholyothin 24, Phaholyothin Road , Ladyao, Khet Jatujak,Bangkok, 		
Serial Number:	PTCS14111103	PM Number:	1OF2
Customer Name (if applicable):	K PHENPA	Telephone Number:	
Customer Support Engineer Name:	WIPHAN	Service Order Number:	WO-02602325
Date PM Performed: (DD-MMM-YYYY)	04-Jan-2024	Next PM Due Date: (DD-MMM-YYYY)	04-Jul-2024
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370143 Rev.8	A	January 2018	

**Scope**

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900T 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

**Parts Lists**

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	1
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A
N3160156	O-Ring Kits for Sampling Introduction ( Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction ( Plastic Nebulizer)	1
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	1

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CYUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	58-142CRY1	30-Oct-2024

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 <sub>3</sub>	250 ml.	AR	AR

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
B3100652 Or N9307029	Electronic Flow Meter	1	N/A
B0505495	Test Jig	1	N/A
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	1-2416--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.

#### 3.1 Flame Technique

- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).

#### 3.2 THGA Technique

- ☒ 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 09905148
- ☒ 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.

#### 4. Electrical:

- ✓ Inspect PC boards. Clean if necessary.
- ✓ Carefully check all internal and external cable connections.
- ✓ 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. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
C <sub>2</sub> H <sub>2</sub> Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C <sub>2</sub> H <sub>2</sub> Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

#### 8. After PM Performance tests [Flame]:

##### 8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.		0.1789	Passed
0.2 A ND Filter	± 5% from Cert.		1.0186	Passed

##### 8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0017	Passed

##### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0001	Passed

##### 8.4 D<sub>2</sub> Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0084	Passed

##### 8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0004	Passed

#### 8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	$\leq 0.005$	0.0013	Passed

#### 8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	$> 0.250$ Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	$> 0.250$ Abs.	0.4241	Passed

### 9. After PM Performance tests [THGA]:

#### 9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

Parameter	Specification	Test Results	Pass/Fail
Internal Flow Rate	250 mL/min $\pm$ 25 mL/min	251	Passed
External Flow Rate	100 mL/min $\pm$ 10 mL/min	102	Passed

#### 9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	$\leq 0.005$ Abs.	0.0008	Passed
Standard Deviation	$\leq 0.005$	0.0003	Passed

#### 9.3 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	$\leq 7.0$ pg/0.0044 A-s	6.2	Passed
Precision	$\leq 2.0$ %	0.61	Passed

#### 9.4 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	$\leq 16.5$ pg/0.0044 A-s	13.6	Passed
Zeeman Ratio	$0.52 \pm 0.04$	0.544	Passed

### 10. 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	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1602}{0.2940}$ $= 0.544$

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.</i>	
<i>This PinAAcle 900T <input checked="" type="checkbox"/> Passes <input type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	<div></div> <div>Date: 04-Jan-2024 <small>(DD-MMM-YYYY)</small></div>
Authorized Customer Representative:	<div></div> <div>Date: 04-Jan-2024 <small>(DD-MMM-YYYY)</small></div>