

## เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

ลำดับที่ 1 คุณภาพอากาศในบรรยากาศ

ลำดับที่ 2 ระดับเสียงในบรรยากาศ

ลำดับที่ 3 คุณภาพน้ำ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวิเคราะห์	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>1. คุณภาพอากาศในบรรยากาศ</b>		
TSP	High Volume Air Sampler No. B40, R02, R06, R08	Digital Balance
PM <sub>10</sub>	High Volume PM <sub>10</sub> Air Sampler No. R03, R05, R09, R12	Digital Balance
SO <sub>2</sub>	SO <sub>2</sub> Analyzer No. R01, R05, R09, R10	SO <sub>2</sub> Analyzer No. R01, R05, R09, R10
NO <sub>2</sub>	NO <sub>x</sub> Analyzer No. R03, R04, R09, R11	NO <sub>x</sub> Analyzer No. R03, R04, R09, R11
CO	CO Analyzer No. B07, B09, R02, R03	CO Analyzer No. B07, B09, R02, R03
Total VOC	Personal pump SKC No. R03, R06, R35, R36 Rotameter No. H-R01	VOC Analyzer No. R01
<b>2. ระดับเสียงในบรรยากาศ</b>  L <sub>eq</sub> 24 hr, L <sub>eq</sub> 1 hr, L <sub>eq</sub> 5 min, L <sub>max</sub> , L <sub>90</sub> 1 hr, L <sub>90</sub> 5 min, เสียงรบกวน	Acoustic Calibrator Sound Level Meter No. ACO-C1-B01, B02 Sound Level Meter No. CR-B09, B10	-
<b>3. คุณภาพน้ำ</b>		
pH	-	pH meter
Temperature	-	Thermometer
Turbidity	-	Turbidity meter
Salinity	-	Conductivity meter
Total Suspended Solids	-	Digital Balance
Total Dissolved Solids	-	Digital Balance
Dissolved Oxygen	-	DO meter
BOD <sub>5</sub>	-	DO meter
COD	-	COD Reactor
Phosphate-Phosphorus	-	Spectrophotometer
Cyanide	-	Spectrophotometer
Free Chlorine	-	Spectrophotometer
Fluoride	-	Spectrophotometer
Arsenic	-	AAS
Barium	-	ICP
Cyanide	-	Spectrophotometer
Nickel	-	AAS
		ICP
Zinc	-	AAS
		ICP
Manganese	-	AAS
		ICP
Copper	-	AAS
		ICP
Cadmium	-	AAS
		ICP

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวิเคราะห์	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>3. คุณภาพน้ำ (ต่อ)</b>		
Mercury	-	AAS
Total Iron	-	ICP
Total Chromium	-	ICP
Lead	-	AAS
		ICP
Selenium	-	AAS
Hexavalent Chromium	-	Spectrophotometer
Total Coliform Bacteria	-	Incubator
		Water Bath
VOCs	-	GC/MS
Formaldehyde	-	Spectrophotometer

## ลำดับที่ 1

คุณภาพอากาศในบรรยากาศ





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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>
B35	B35	04/11/2024	y = 1.159x-2.093	0.999
B36	B36	04/11/2024	y = 1.167x-3.333	0.996
B37	B37	06/11/2024	y = 1.152x-2.051	0.997
B38	B38	04/11/2024	y = 1.144x-4.581	0.998
B39	B39	05/11/2024	y = 1.160x-3.397	0.997
B40	B40	01/11/2024	y = 1.168x-3.661	0.996
B41	B41	04/11/2024	y = 1.150x-2.581	0.999
B42	B42	04/11/2024	y = 1.177x-4.883	0.997
B43	B43	01/11/2024	y = 1.165x-3.033	0.998
B44	B44	05/11/2024	y = 1.173x-1.743	0.999
R01	R01	04/11/2024	y = 1.134x-3.385	0.998
R02	R02	04/11/2024	y = 1.173x-4.742	0.998
R03	R03	04/11/2024	y = 1.166x-4.405	0.998
R04	R04	01/11/2024	y = 1.133x-2.807	0.998
R05	R05	01/11/2024	y = 1.148x-2.112	0.997
R06	R06	01/11/2024	y = 1.196x-4.533	0.998
R07	R07	01/11/2024	y = 1.082x+0.340	0.999
R08	R08	01/11/2024	y = 1.112x-1.862	0.997
R09	R09	04/11/2024	y = 1.166x-3.534	0.997
R10	R10	04/11/2024	y = 1.191x-4.707	0.998
R11	R11	05/11/2024	y = 1.170x-4.815	0.997
R12	R12	05/11/2024	y = 1.138x-3.913	0.998
R13	R13	05/11/2024	y = 1.105x-2.238	0.998
R14	R14	06/11/2024	y = 1.183x-3.021	0.999
R15	R15	06/11/2024	y = 1.190x-5.879	0.999
R16	R16	06/11/2024	y = 1.137x-3.608	0.999
R17	R17	01/11/2024	y = 1.140x-2.475	0.998
R18	R18	01/11/2024	y = 1.142x-2.703	0.998
R19	R19	01/11/2024	y = 1.134x-4.199	0.999
R20	R20	04/11/2024	y = 1.147x-3.807	0.998

Calibrated by :

(Mr.Adul Dangklorn)

Approved by :

(Mr. Peera Detudom)



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### High Volume PM-10 Air Sampler Calibration Report

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

#### Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
R01	R01	01/11/2024	y = 1.175x-5.215	0.998
R02	R02	01/11/2024	y = 1.157x-3.322	0.996
R03	R03	06/11/2024	y = 1.147x-4.899	0.998
R04	R04	06/11/2024	y = 1.158x-5.443	0.997
R05	R05	01/11/2024	y = 1.128x-3.926	0.997
R06	R06	01/11/2024	y = 1.135x-2.508	0.996
R07	R07	06/11/2024	y = 1.156x-2.437	0.996
R08	R08	06/11/2024	y = 1.163x-5.100	0.998
R09	R09	01/11/2024	y = 1.142x-4.291	0.996
R10	R10	01/11/2024	y = 1.184x-4.270	0.999
R11	R11	01/11/2024	y = 1.140x-1.292	0.997
R12	R12	01/11/2024	y = 1.182x-4.934	0.998
R13	R13	05/11/2024	y = 1.130x-1.455	0.997
R14	R14	04/11/2024	y = 1.177x-4.675	0.996
R15	R15	04/11/2024	y = 1.144x-4.059	0.998
R16	R16	01/11/2024	y = 1.163x-2.835	0.997
R17	R17	04/11/2024	y = 1.178x-3.580	0.996
R18	R18	04/11/2024	y = 1.136x-3.484	0.997
R19	R19	06/11/2024	y = 1.166x-4.037	0.996
R20	R20	06/11/2024	y = 1.152x-4.500	0.997

Calibrated by :

(Mr.Adul Dangklorn)

Approved by :

(Mr. Peera Detudom)



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	04 November 2024	BRAND :	API	MODEL :	100E
NO.	SO <sub>2</sub> -R01	SERIAL NO.	3415		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )		Cylinder No.	: A008145K	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 49.8 ppm				
CALIBRATING CONDITION					
Pressure	1010	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO <sub>2</sub> Span	400.0	400.1	0.025	400.0	1.010
API Model 100E SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	658	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3024.7	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	669	V	550-900 constant		
DCPS	2518	mV	2500 ± 200		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	28.9	°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	1.010	-	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)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	04 November 2024	BRAND :	API	MODEL :	100E
NO.	SO <sub>2</sub> -R05	SERIAL NO.	3490		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )		Cylinder No.	: A008145K	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 49.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.7	-0.075	400.0	1.007
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	655	cc/min	650 ± 10%		
PMT	103.0	mV	-20-150 with Zero Air		
UV LAMP	3015.3	mV	1000-4900		
STR. LGT	61.8	PPB	<100		
DRK PMT	63.2	mV	-50 - 200		
DRK LMP	58.0	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2521	mV	2500 ± 200		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.2	°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	1.007	-	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)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	04 November 2024	BRAND :	API	MODEL :	100E
NO.	SO <sub>2</sub> -R09	SERIAL NO.	76		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )		Cylinder No.	: A008145K	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 49.8 ppm				
CALIBRATING CONDITION					
Pressure	1010	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.8	-0.050	400.0	1.009
API Model 100E SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.4	in-Hg	25-35		
SAMPLE FLOW	659	cc/min	650 ± 10%		
PMT	103.1	mV	-20-150 with Zero Air		
UV LAMP	3019.5	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	57.7	mV	-50 - 200		
HVPS	672	V	550-900 constant		
DCPS	2523	mV	2500 ± 200		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.3	°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	1.009	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	22.0	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.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	04 November 2024	BRAND :	TELEDYNE	MODEL :	100E
NO.	SO <sub>2</sub> -R10	SERIAL NO.	TRS1065		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )		Cylinder No.	: A008145K	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 49.8 ppm				
CALIBRATING CONDITION					
Pressure	1010	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO <sub>2</sub> Span	400.0	400.2	0.050	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	28.6	in-Hg	25-35		
SAMPLE FLOW	654	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	3035.8	mV	1000-4900		
STR. LGT	61.9	PPB	<100		
DRK PMT	63.3	mV	-50 - 200		
DRK LMP	58.1	mV	-50 - 200		
HVPS	674	V	550-900 constant		
DCPS	2527	mV	2500 ± 200		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO <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	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 :

(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	04 November 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R03	SERIAL NO.	4410		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 05 August 2024			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.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.1	0.025	400.0	1.009
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.013
API Model 200E 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	103.1	mV	-20 - 150		
AZERO	93.8	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.1	°C	8 - 48		
PMT TEMP	7.0	°C	7 ± 2		
MOLY TEMP	315.3	°C	315 ± 5		
RCCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.009	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.013	-	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		

Calibrated by :

(Mr.Adul Dangklom)

Approved by

(Mr.Peera Detudom)



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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 :	04 November 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R04	SERIAL NO.	4411		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 05 August 2024			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	1010	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.005
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.008
API Model 200E 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	102.9	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	674	V	420 - 900 constant		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	315.1	°C	315 ± 5		
RCCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.3	mV	-20 to +150		
NO <sub>x</sub> Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by

(Mr.Adul Dangklom)

Approved by

(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	04 November 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R09	SERIAL NO.	252		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 05 August 2024			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.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.006
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.010
API Model 200E 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	508	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	670	V	420 - 900 constant		
RCCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCCELL 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	1.006	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.010	-	1.0 ± 0.3		
NO Offset	1.4	mV	-20 to +150		
NO <sub>x</sub> Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

(Mr.Adul Dangklom)

Approved by

(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	04 November 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R11	SERIAL NO.	2621		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 05 August 2024			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	1010	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.004
NO <sub>x</sub> Span	400	399.9	-0.025	400.0	1.007
API Model 200E 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	506	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	671	V	420 - 900 constant		
RCCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	28.9	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.9	°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 <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	1.0	mV	-20 to +150		
NO <sub>x</sub> Offset	0.6	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.Adul Dangklom)

Approved by

(Mr.Peera Detudom)



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Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	04 November 2024	Brand :	Thermo	Model :	48C
No.	CO-B07	Serial No.	0335203746		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D711839	
Certified Date	: 14 March 2024	Expired Date	: 14 March 2032	Cylinder Conc.	: 4,580 ppm
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	50	
Calibration Setting					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	39.93	-0.175	40.00	
Instrument Status					
Chamber Temp	47.4 °C		Flow	1.5 LPM	
Pressure	730.6 mm Hg		Motor Speed	100.00%	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	04 November 2024	Brand :	Thermo	Model :	48C
No.	CO-B09	Serial No.	65433-348		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D711839	
Certified Date	: 14 March 2024	Expired Date	: 14 March 2032	Cylinder Conc.	: 4,580 ppm
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	50	
Calibration Setting					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	39.97	-0.075	40.00	
Instrument Status					
Chamber Temp	47.5 °C		Flow	1.5 LPM	
Pressure	730.4 mm Hg		Motor Speed	100.00%	

Calibrated by :


(Mr.Adul Dangklom)

Approved by :

(Mr. Peera Detudom)


Calibration Report			
Non-Dispersive Infrared CO Analyzer			
Date :	04 November 2024	Brand :	API
No.	CO-R02	Model :	300E
		Serial No.	171-S
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	05 August 2024	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	D711839
Certified Date :	14 March 2024	Expired Date :	14 March 2032
		Cylinder Conc. :	4,580 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.5 °C
		% RH	50
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif
Zero	0	-0.10	-
CO Span	40.00	39.90	-0.250
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	< 1 ppm With Zero Air
CO Measure	4014.7	mV	2500-4800 mV
CO Reference	3946.1	mV	2500-4800 mV
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air
Sample Pressure	28.4	In-Hg-A	~2" < Ambient Absolute Pressure
Sample Flow	810	CC/Min	800 ± 10%
Sample Temperature	48.4	°C	48 ± 4
Bench Temperature	48.2	°C	48 ± 2
Wheel Temperature	68.5	°C	68 ± 2
Box Temperature	30.7	°C	Ambient Temp + 7 ± 10
Photo-Drive	3039.1	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :   
(Mr. Adul Dangklom)

Approved by :   
(Mr. Peera Detudom)

Calibration Report			
Non-Dispersive Infrared CO Analyzer			
Date :	04 November 2024	Brand :	API
No.	CO-R03	Model :	300E
		Serial No.	1352
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	05 August 2024	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	D711839
Certified Date :	14 March 2024	Expired Date :	14 March 2032
		Cylinder Conc. :	4,580 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.5 °C
		% RH	50
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif
Zero	0	0.10	-
CO Span	40.00	39.94	-0.150
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	< 1 ppm With Zero Air
CO Measure	4013.5	mV	2500-4800 mV
CO Reference	3949.4	mV	2500-4800 mV
Measure/Reference Ratio	1.179	-	1.1-1.3 W/Zero Air
Sample Pressure	28.7	In-Hg-A	~2" < Ambient Absolute Pressure
Sample Flow	813	CC/Min	800 ± 10%
Sample Temperature	48.2	°C	48 ± 4
Bench Temperature	48.0	°C	48 ± 2
Wheel Temperature	68.2	°C	68 ± 2
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10
Photo-Drive	3043.8	mV	250 mV to 4750 mV
Slope	1.016	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :   
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Approved by :   
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### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

Temperature 25 ± 3 °C  
Pressure 1010 ± 15 mmbar

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)			y		
					1	2	3	1	2	3	y	R <sup>2</sup>	
R01	SKC	224-PCXR4	602467	03/10/2024	1,000	1,500	2,000	1,005	1,505	2,008	1.006x - 6.472	1.000	
R02	SKC	224-PCXR4	626450	04/10/2024	1,000	2,000	3,000	1,003	1,503	2,006	1.009x - 16.691	0.999	
R03	SKC	224-PCXR4	691592	03/10/2024	1,000	1,500	2,000	996	1,506	2,006	1.008x - 13.145	1.000	
R04	SKC	224-PCXR4	691672	02/10/2024	1,000	1,500	2,000	1,003	1,502	2,000	0.995x + 7.476	1.000	
R05	SKC	224-PCXR4	798470	02/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.005x - 7.440	1.000	
R06	SKC	224-PCXR4	798456	04/10/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.003x - 1.855	1.000	
R07	SKC	224-PCXR4	798480	03/10/2024	1,000	1,500	2,000	995	1,501	1,997	1.002x - 6.149	1.000	
R08	SKC	224-PCXR4	883215	04/10/2024	1,000	1,500	2,000	995	1,509	2,004	1.011x - 20.001	0.999	
R09	SKC	224-PCXR4	034650	02/10/2024	1,000	1,500	2,000	996	1,500	1,997	1.000x - 1.051	1.000	
R10	SKC	224-PCXR4	091765	03/10/2024	1,000	1,500	2,000	1,002	1,503	2,006	1.007x - 9.531	1.000	
R11	SKC	224-PCXR4	091763	03/10/2024	1,000	1,500	2,000	999	1,506	2,001	1.010x - 20.761	0.999	
R12	SKC	224-PCXR4	091568	03/10/2024	1,000	1,500	2,000	1,012	1,504	2,001	0.990x + 19.294	1.000	
R13	SKC	224-PCXR4	091638	04/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.008x - 10.210	1.000	
R14	SKC	224-PCXR4	091764	03/10/2024	1,000	1,500	2,000	998	1,498	1,997	0.999x + 0.148	1.000	
R15	SKC	224-PCXR8	529457	03/10/2024	1,000	1,500	2,000	1,003	1,497	2,000	0.996x + 5.377	1.000	
R16	SKC	224-PCXR8	529643	04/10/2024	1,000	1,500	2,000	996	1,505	2,006	1.012x - 19.118	1.000	
R17	SKC	224-PCXR8	529645	04/10/2024	1,000	1,500	2,000	1,004	1,503	2,006	1.002x - 3.334	1.000	
R18	SKC	224-PCXR8	566756	04/10/2024	1,000	1,500	2,000	997	1,504	1,998	1.001x - 3.462	1.000	
R19	SKC	224-PCXR8	566802	03/10/2024	1,000	1,500	2,000	1,005	1,504	2,007	1.004x - 4.118	1.000	
R20	SKC	224-PCXR8	529089	01/10/2024	1,000	1,500	2,000	999	1,493	2,006	1.005x - 8.571	1.000	
R21	SKC	224-PCXR8	665728	03/10/2024	1,000	1,500	2,000	1,004	1,503	1,996	0.993x + 9.763	1.000	
R22	SKC	224-PCXR8	707444	04/10/2024	1,000	1,500	2,000	999	1,504	2,000	1.001x - 0.963	1.000	
R23	SKC	224-PCXR8	761067	04/10/2024	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000	
R24	SKC	224-PCXR8	707893	04/10/2024	1,000	1,500	2,000	997	1,495	2,003	1.006x - 11.110	1.000	
R25	SKC	224-PCXR8	761052	04/10/2024	1,000	1,500	2,000	1,016	1,507	2,003	0.992x + 15.204	1.000	
R26	SKC	224-PCXR8	707956	04/10/2024	1,000	1,500	2,000	1,002	1,499	2,002	1.001x - 0.028	1.000	
R27	SKC	224-PCXR8	707398	01/10/2024	1,000	1,500	2,000	1,008	1,505	2,008	1.006x - 6.261	1.000	
R28	SKC	224-PCXR8	707481	03/10/2024	1,000	1,500	2,000	1,005	1,505	2,004	0.999x + 1.175	1.000	
R29	SKC	224-PCXR8	707402	01/10/2024	1,000	1,500	2,000	1,001	1,500	1,996	1.001x - 4.617	1.000	
R30	SKC	224-PCXR8	093811	03/10/2024	1,000	1,500	2,000	1,000	1,506	1,998	0.998x + 6.228	1.000	
R31	SKC	224-PCXR8	093183	04/10/2024	1,000	1,500	2,000	1,005	1,502	1,999	1.006x - 13.357	0.999	
R32	SKC	224-PCXR8	671950	03/10/2024	1,000	1,500	2,000	996	1,504	2,004	1.008x - 14.572	1.000	
R33	SKC	224-PCXR4	626254	03/10/2024	1,000	1,500	2,000	1,005	1,503	2,008	1.007x - 9.639	1.000	
R34	SKC	224-PCXR4	626131	04/10/2024	1,000	1,500	2,000	996	1,495	2,001	1.002x - 5.649	1.000	
R35	SKC	224-PCXR8	707460	03/10/2024	1,000	1,500	2,000	999	1,498	1,999	0.997x + 2.375	1.000	
R36	SKC	224-PCXR8	707446	04/10/2024	1,000	1,500	2,000	1,000	1,495	1,997	0.995x + 4.558	1.000	
R37	SKC	224-PCXR8	707432	04/10/2024	1,000	1,500	2,000	994	1,502	1,996	1.000x - 2.818	1.000	
R38	SKC	224-PCXR8	707349	04/10/2024	1,000	1,500	2,000	997	1,507	2,004	1.005x - 6.648	1.000	
R39	SKC	224-PCXR8	761085	04/10/2024	1,000	1,500	2,000	1,000	1,496				

Calibrated by :

Approved by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)



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

### Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Calibration Data

Rotameter Data			Calibration Data									
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve		
				Flow Rate (Reading)			Actual (Q std.)			y		
				1	2	3	1	2	3	y	R <sup>2</sup>	
H-R01	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	500.9	1000.8	1994.3	1.003x + 0.055	1.000	
H-R02	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	500.1	998.9	1992.4	1.002x - 3.472	0.999	
H-R03	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	501.6	999.3	2001.6	0.994x + 6.383	1.000	
H-R04	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	503.3	999.8	1993.2	1.001x - 1.914	0.999	
H-R05	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	500.2	1002.6	2000.4	1.002x - 0.160	1.000	
H-R06	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	503.1	1002.8	1999.6	0.999x + 5.589	1.000	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



**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 : 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.

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

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

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

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

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

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

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

**RESULT OF CALIBRATION** :- WITHOUT ADJUSTMENT

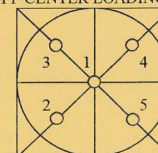
1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.00001	-0.00001	0.00019
120.00	120.00001	-0.00001	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



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

### Calibration Report

#### Photo-Ionization Detector VOC Analyzer

Date : 01 November 2024 Brand : Mini RAE System Model : Mini RAE 3000  
No. R01 Serial No. 592-902403

#### Reference Standard Gas

Standard Gas : Isobutylene (C<sub>4</sub>H<sub>8</sub>) Cylinder No. : 1496584  
Certified Date : 24 June 2021 Expired Date : 7 January 2026 Cylinder Conc. : 100 ppm

#### Calibrating Condition

Pressure 1011 mmbar Temp. 24.5 °C % RH 50

#### Calibration Setting

Span Set Point	Initial Reading (Before Adj.)			Final Reading (After Adj.)
	PPM			PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero (Fresh Air)	0	0.1	-	0
VOC Span (Isobutylene)	100	99.7	-0.30	100

Calibrated by :

(Mr.Adul Dangkiom)

Approved by :

(Mr. Peera Detudom)

## ลำดับที่ 2

ระดับเสียงในบรรยากาศ





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

## CALIBRATION CERTIFICATE

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

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

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

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

### Ambient Environment

Temperature : (23 + 3) °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 /

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,  
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Fax. (66) 0 2577 9009  
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory  
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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
E-mail : mtc@tistr.or.th

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



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 :

Approved by :

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev.4

Head Office  
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9000  
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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

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

精密騒音計  
Precision Sound Level Meter  
TYPE 6238

検査成績書  
INSPECTION CERTIFICATE

Serial No. of boy : 223038

Serial No. of Microphone: 80280  
Ver:5.0 22-01-08

Date: June 2, 2024



株式会社 アコー  
ACO CO., LTD.

宮崎県西諸県郡高原町大字蒲牟田1-8  
株式会社アコー  
代表取締役 寺園信一  
1-8 Kamamuta Takaharucho  
Nishimorokatagun Miyazaki Japan  
President : Shinichi Terazono  
ACO CO., LTD.

1. Inspection Date : June 2, 2024

2. Inspection Condition

Temperature : 26 °C  
Humidity: 44%  
Barometric pressure : 995 hPa

3. Inspection Results

1) RANGE The RANGE Shifting Error

RANGE : 20-100dB 70dB  $\pm 0.5$ dB

Within  $\pm 0.5$ dB of the value at 70dB input, Range 20-100dB.

RANGE (dB)	Input level (dB)	Frequency (Hz)		
		31.5	1000	12500
20-80	70	0.0	-0.1	-0.1
20-90	70	0.1	0.0	0.0
20-100	70	0.0	0.0	0.0
20-110	70	0.1	0.0	0.1
30-120	70	0.0	-0.1	0.1
40-130	70	-0.1	-0.1	0.0
Passed		Pass		

2) Stability Characteristic

RANGE : 20-100dB  $\pm 0.5$ dB

Within  $\pm 0.5$ dB of the value one minute later, Range 20-100dB.

Error (dB)	ten minutes later
	0.0
Passed	Pass

## 3) The Scale Error

RANGE : 30-120dB 31.5Hz 75.0dB 1kHz, 12.5kHz 95dB

31.5Hz is 75.0dB input standard 1kHz, 12.5kHz is 95dB input standard

A weighting

Input (dB)	Standard (dB)	Frequency (Hz)
		31.5
120		
118		
115		
110		
105		
100		
95		
90		
85		
80	±0.3	0.0
75	0.0	0.0
70	±0.3	-0.1
65	±0.3	-0.2
60	±0.3	-0.1
55	±0.3	0.0
50	±0.3	-0.1
45	±0.3	-0.1
40	±0.3	-0.1
35	±0.3	0.1
Passed		Pass

A weighting

Input (dB)	Standard (dB)	Frequency (Hz)	
		1000	12500
120	±0.3	0.0	
118	±0.3		0.0
115	±0.3	0.0	0.0
110	±0.3	-0.1	-0.1
105	±0.3	-0.1	0.0
100	±0.3	-0.2	0.0
95	0.0	0.0	0.0
90	±0.3	-0.1	-0.1
85	±0.3	-0.1	0.0
80	±0.3	0.0	0.1
75	±0.3	0.0	0.0
70	±0.3	-0.3	0.0
65	±0.3	-0.2	-0.1
60	±0.3	-0.2	-0.1
55	±0.3	-0.1	0.0
50	±0.3	-0.1	0.0
45	±0.3	0.0	-0.1
40	±0.3	-0.2	-0.1
35	±0.3	-0.1	0.0
Passed		Pass	

## 4) Dynamic Characteristic

RANGE 20-100dB 100dB, 1kHz

When 100dB input, Range 20-100dB at 1kHz.

	Standard	Measured Value
FAST	-1.0 <sup>+0.5</sup> <sub>-1.0</sub> (dB)	-1.5
SLOW	-4.0±1.0 (dB)	-4.5
Passed		Pass

## 5) Frequency Response

RANGE : 20-100dB 95dB

When 95dB input, including Microphone value, Range 20-100dB

Frequency (Hz)	A			C			Z	Tolerance (dB)
	Standard (dB)	Response (dB)	Deviation (dB)	Standard (dB)	Response (dB)	Deviation (dB)	Response (dB)	
10	-70.4	-69.0	1.4	-14.3	-12.5	1.8	-0.4	+3.0, -exj
20	-50.5	-50.6	-0.1	-6.2	-5.7	0.5	-0.2	±2.0
40	-34.6	-34.9	-0.3	-2.0	-2.1	-0.1	-0.1	±1.0
100	-19.1	-19.3	-0.2	-0.3	-0.3	0.0	0.0	±1.0
250	-8.6	-8.8	-0.2	0.0	-0.1	-0.1	-0.1	±1.0
500	-3.2	-3.3	-0.1	0.0	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	±0.7
2k	1.2	1.2	0.0	-0.2	-0.3	-0.1	-0.1	±1.0
4k	1.0	0.5	-0.5	-0.8	-1.5	-0.7	-0.4	±1.0
5k	0.5	0.2	-0.3	-1.3	-1.8	-0.5	-0.2	±1.5
6.3k	-0.1	-0.5	-0.4	-2.0	-2.6	-0.6	-0.2	+1.5, -2.0
8k	-1.1	-1.9	-0.8	-3.0	-3.9	-0.9	-0.5	+1.5, -2.5
10k	-2.5	-3.2	-0.7	-4.4	-5.3	-0.9	-0.9	+2.0, -3.6
12.5k	-4.3	-4.6	-0.3	-6.2	-6.5	-0.3	-0.9	+2.0, -5.0
16k	-6.6	-6.8	-0.2	-8.5	-8.9	-0.4	-1.5	+2.5, -16.0
20k	-9.3	-10.4	-1.1	-11.2	-12.1	-0.9	-2.6	+3.0, -exj
Passed		Pass						

## 6) 1.0dB

Within 1.0dB on the Burst signal of the peak factor 3, Range 20-100dB.

Frequency 2kHz, Repeat frequency 40Hz

Effective value Error (dB)	Passed
0.3	Pass

## 7) Self-noise

RANGE : 20-80dB

RANGE : 20-80dB (Including Microphone value)	A	C	Z
Standard (dB)	Below 20	Below 29	Below 31
Self-noise (dB)	17.7	28.5	30.5
Passed	Pass		



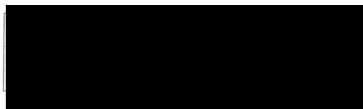
精密騒音計  
Precision Sound Level Meter  
TYPE 6238

検査成績書  
INSPECTION CERTIFICATE

Serial No. of boy : 223039

Serial No. of Microphone: 80281  
Ver:5.0 22-01-08

Date: June 2,2024



株式会社 アコー  
ACO CO., LTD.

宮崎県西諸県郡高原町大字蒲牟田1-8  
株式会社アコー  
代表取締役 寺園信一  
1-8 Kamamuta Takaharucho  
Nishimorokatagun Miyazaki Japan  
President : Shinichi Terazono  
ACO CO., LTD.

1.Inspection Date : June 2,2024

2.Inspection Condition

Temperature : 26 °C  
Humidity: 44%  
Barometric pressure : 995 hPa

3. Inspection Results

1) RANGE The RANGE Shifting Error

RANGE : 20-100dB 70dB  $\pm 0.5$ dB

Within  $\pm 0.5$ dB of the value at 70dB input, Range 20-100dB.

RANGE (dB)	Input level (dB)	Frequency (Hz)		
		31,5	1000	12500
20-80	70	0.0	-0.1	-0.1
20-90	70	0.1	0.0	0.0
20-100	70	0.0	0.0	0.0
20-110	70	0.1	0.0	0.1
30-120	70	0.0	-0.1	0.0
40-130	70	-0.1	-0.1	0.0
Passed		Pass		

2)Stability Characteristic

RANGE : 20-100dB  $\pm 0.5$ dB

Within  $\pm 0.5$ dB of the value one minute later, Range 20-100dB.

Error (dB)	ten minutes later
	0.0
Passed	Pass

## 3) The Scale Error

RANGE : 30-120dB 31.5Hz 75.0dB 1kHz, 12.5kHz 95dB

31.5Hz is 75.0dB input standard 1kHz, 12.5kHz is 95dB input standard

A weighting

Input (dB)	Standard (dB)	Frequency (Hz)
		31.5
120		
118		
115		
110		
105		
100		
95		
90		
85		
80	±0.3	0.1
75	0.0	0.0
70	±0.3	-0.1
65	±0.3	-0.2
60	±0.3	-0.1
55	±0.3	0.0
50	±0.3	0.0
45	±0.3	0.0
40	±0.3	0.0
35	±0.3	0.1
Passed		Pass

A weighting

Input (dB)	Standard (dB)	Frequency (Hz)	
		1000	12500
120	±0.3	0.1	
118	±0.3		0.0
115	±0.3	0.1	0.1
110	±0.3	-0.1	-0.1
105	±0.3	0.0	0.0
100	±0.3	-0.1	0.0
95	0.0	0.0	0.0
90	±0.3	-0.1	-0.1
85	±0.3	0.0	0.1
80	±0.3	0.0	0.0
75	±0.3	0.0	0.0
70	±0.3	-0.1	0.0
65	±0.3	-0.2	-0.1
60	±0.3	-0.1	-0.1
55	±0.3	0.0	0.0
50	±0.3	-0.1	0.0
45	±0.3	0.0	0.0
40	±0.3	0.0	-0.1
35	±0.3	0.1	0.2
Passed		Pass	

## 4) Dynamic Characteristic

RANGE 20-100dB 100dB, 1kHz

When 100dB input, Range 20-100dB at 1kHz.

	Standard	Measured Value
FAST	$-1.0^{+0.5}_{-1.0}$ (dB)	-1.5
SLOW	-4.0±1.0 (dB)	-4.5
Passed		Pass

## 5) Frequency Response

RANGE : 20-100dB 95dB

When 95dB input, including Microphone value, Range 20-100dB

Frequency (Hz)	A			C			Z	Tolerance (dB)
	Standard (dB)	Response (dB)	Deviation (dB)	Standard (dB)	Response (dB)	Deviation (dB)	Response (dB)	
10	-70.4	-69.1	1.3	-12.5	-12.5	1.8	-0.5	+3.0, -∞
20	-50.5	-50.6	-0.1	-6.2	-5.7	0.5	-0.3	±2.0
40	-34.6	-34.8	-0.2	-2.0	-2.1	-0.1	0.0	±1.0
100	-19.1	-19.3	-0.2	-0.3	-0.3	0.0	-0.1	±1.0
250	-8.6	-8.9	-0.3	0.0	-0.1	-0.1	-0.1	±1.0
500	-3.2	-3.4	-0.2	0.0	0.0	0.0	-0.1	±1.0
1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	±0.7
2k	1.2	1.2	0.0	-0.2	-0.3	-0.1	-0.1	±1.0
4k	1.0	0.6	-0.4	-0.8	-1.4	-0.6	-0.2	±1.0
5k	0.5	0.1	-0.4	-1.3	-1.9	-0.6	-0.2	±1.5
6.3k	-0.1	-0.4	-0.3	-2.0	-2.5	-0.5	-0.1	+1.5, -2.0
8k	-1.1	-1.6	-0.5	-3.0	-3.6	-0.6	-0.2	+1.5, -2.5
10k	-2.5	-3.0	-0.5	-4.4	-5.0	-0.6	-0.4	+2.0, -3.6
12.5k	-4.3	-4.3	0.0	-6.2	-6.2	0.0	-0.5	+2.0, -5.0
16k	-6.6	-7.5	-0.9	-8.5	-9.6	-1.1	-2.1	+2.5, -16.0
20k	-9.3	-11.7	-2.4	-11.2	-11.1	0.1	-4.0	+3.0, -∞
Passed		Pass						

## 6) 1.0dB

Within 1.0dB on the Burst signal of the peak factor 3, Range 20-100dB.

Frequency 2kHz, Repeat frequency 40Hz

Effective value Error (dB)	Passed
0.3	Pass

## 7) Self-noise

RANGE : 20-80dB

RANGE : 20-80dB (Including Microphone value)	A	C	Z
Standard (dB)	Below 20	Below 29	Below 31
Self-noise (dB)	17.9	28.6	30.2
Passed	Pass		



Noise R\_649-1/24

## 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-C1-B01	ACO	6238	00223038	04 November 2024	93.9	93.9
ACO-C1-B02	ACO	6238	00223039	04 November 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

*Adul Dangklom*  
(Mr. Adul Dangklom)

Approved by :

*Peera Detudom*  
(Mr. Peera Detudom)



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.

<b>Instrument Calibrated :</b>	<b>Ambient Environment</b>
Description : Acoustic Calibrator	Temperature : (23 ± 3) °C
Manufacturer : Cirrus	Relative Humidity : (50 ± 15) %
Model : CR:515	Ambient Pressure : (101.325 ± 1.500) kPa
Serial No. : 92002	

**Standards used :**

- Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
- Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
- Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
- Digital Multimeter Agilent 34401A S/N MY44005560.
- Pressure Transmitter Vaisala PTB202AD S/N T0650001.
- Audio Analyzer Keithley 2015-P S/N 4106495.
- 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

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

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Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
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 Briel&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 Briel&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 Briel&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 :

Approved by :

Date of Calibration : 5 Mar. 2024

Date of Issue : 6 Mar. 2024

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011267022200795002

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev.4

Head Office  
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Fax. (66) 0 2323 9165  
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Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th



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

Noise R\_649-2/24

## 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-B09	Cirrus	CR161B	G301401	04 November 2024	94.0 94.0
CR-B10	Cirrus	CR161B	G301407	04 November 2024	94.0 94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					94.04 $\pm$ 0.10 dB

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

Peera Detudom  
(Mr. Peera Detudom)

ลำดับที่ 3

คุณภาพน้ำ





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



CERTIFICATE No : 24E6416  
REFERENCE No : 73694-1

PAGE : 1 OF 3

### Certificate of Calibration

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
MODEL : HI 3512  
SERIAL No : TH118035  
ID No : pH 04/56  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.  
CALIBRATION DATE : 27-Jun-24

APPROVED BY : 

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24

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



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

CERTIFICATE No : 24E6416

PAGE : 2 OF 3

### Calibration Report

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

#### CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

#### RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3





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

CERTIFICATE No : 24E6416

PAGE : 3 OF 3

## Calibration Report

### RESULT OF CALIBRATION (CONTINUE):

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

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

#### 3. DISPLAY UNIT WITH TEMPERATURE

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

#### 4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com



NSC-TISI-TIS 17025  
CALIBRATION 0030

## 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

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.





# CAL

Calibratech Co.,Ltd.

7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120

Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech.cal@yahoo.com, calibratech.cal@hotmail.com

## 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%

- 000 -



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

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

TEL. 0-2717-3000-29 FAX. 0-2719-9484

## Certificate of Calibration

Cert.No.: 24CH285

Page.: 1 of 2

**Equipment :** Turbidity Meter  
**Manufacturer :** Eutech  
**Model :** CyberScan WLTB1000  
**Serial No. :** 201802206  
**ID. No. :** TB 03/61  
**Condition As-Received:** Used Item  
**Received Date :** 05 March 2024  
**Calibration Date :** 06 March 2024  
**Reference :** 2403-0144WN-1  
**Submitted by :** S.P.S. Consulting Service Co.,Ltd.  
7 Phaholyothin 24, Phaholyothin Road.,  
Jompol, Chatuchak, Bangkok 10900

**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 20) %  
**Calibration Procedure :** In - house method : CP-CH11  
based on direct measurement by  
using Formazin standard solution

**Calibrated by :** Walalak Sirithean

**Approved by :**

( ) Pornthippa Tameyakul  
( ) Unnopphol Harachai  
(✓) Saithip Meangmai

**Issue Date :** 06 March 2024

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

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



Cert.No. : 24CH285

Page. : 2 of 2

#### Condition of this calibration result

##### 1. Reference Standard Instruments :

This certification is traceable to the International System of unit (SI unit) through:-  
- Technology Promotion Association (Thailand-Japan).

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrograph	1103328	130EC010	23H1361	13 June 2024
2) Electronic Balance	14233821	110RC001	23MM405	16 July 2024

##### 2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0000493947	99.65%
2) Hydrazinium Sulfate	HIMEDIA	0000522014	99.40%

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

#### Calibration result

Performing three - Formazin suspension standard curve by using 0,10,1000 NTU

Turbidity Meter Serial Number : 201802206

Standard Formazine suspension ( NTU )	UUC* Reading ( NTU )	Uncertainty of Measurement ( ± NTU )	Coverage Factor k
20	19.2	0.38	2.00
40	39.4	0.40	2.00
100	99.0	0.70	2.00
400	389	1.5	2.00

**Remark** - UUC\* = Unit Under Calibration  
- NTU = Nephelometric Turbidity Units

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

-o0o-

a 1205398



**CALIBRATION LABORATORY Co.,LTD.**

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## CERTIFICATE OF CALIBRATION

### FOR

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

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

DATE OF RECEIVED : 13 February 2024

DATE OF ISSUED : 16 February 2024

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

Calibrated By :

Sukgasem Sechanart  
Calibration Engineer



Approved By :

Authorized Signatory  
16 February 2024

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

Certificate No. Q24016389

F3-011-05/12-23

page 1 of 4



@clccalibration





# CALIBRATION LABORATORY Co.,LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



# CALIBRATION LABORATORY Co.,LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## REPORT OF CALIBRATION

### FOR

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

#### ENVIRONMENT CONDITIONS :

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

#### PROCEDURE USED :

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

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

#### REFERENCE STANDARD USED :

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

Certificate No. Q24016389

F3-011-05/12-23

page 2 of 4



@clccalibration

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Hanna instruments.

Certificate No. 20F21 , Due Date June 2025 .

2. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC30595403 , Due Date 31 January 2026 .

3. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC20111554 , Due Date 30 September 2025.

4. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q23136342, Due Date 20 December 2024.

5. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0203/67, Due Date 07 December 2024.

6. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).

Certificate No. TT-0136-23, Due Date 12 December 2024.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q24016389

F3-011-05/12-23

page 3 of 4



@clccalibration





# CALIBRATION LABORATORY Co.,LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

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

## CALIBRATION DATA

### 1. Conductivity Solution Test @ 25°C

Standard Conductivity Solution	DUC Reading	Uncertainty of Measurement
*84.00 µS/cm	84.05 µS/cm [Cell Constant 0.548589]	± 1.00 µS/cm
1414.0 µS/cm	1415 µS/cm [Cell Constant 0.548589]	± 21.0 µS/cm
12.83 mS/cm	12.75 mS/cm [Cell Constant 0.548589]	± 0.19 mS/cm

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

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

### \*2. Temperature Result [ Probe Conductivity ]

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

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

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

### End of Certificate ###

Certificate No. Q24016389

F3-011-05/12-23

page 4 of 4



## 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 : 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 : [Redacted Signature]

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.

F-G010 REV 03





# QUALITY CALIBRATION CO.,LTD.

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

www.qcalibration.com

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

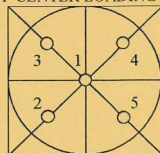
2. TARE FUNCTION : NORMAL

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-V015C

Calibration Date : 20 Mar 24

Submitted by : ASIA LAB @ CONSULTANT CO.,LTD

184 Soi Phutthamonthon Sai 2 Soi 12,

Bangphai, Bangkoe, 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 =  $\pm$  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.

(Kittipong Maekwong)

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

(Supreecha Sumaritam)



**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 24T0774  
REFERENCE No : 71986-2

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : COD REACTOR

**MANUFACTURER** : HACH

**MODEL** : DRB 200

**SERIAL No** : 15110C0235

**ID No** : CRB 05/59

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

**CALIBRATED BY** : CHAICHARN CH.

**CALIBRATION DATE** : 5-Feb-24

**APPROVED BY** :

**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, Bangkae, 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	150.1
	2	150.1
	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 CHAM

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

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

END OF CALIBRATION REPORT



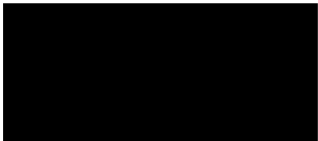
Cert. No. : SP24020  
Pages 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER  
Manufacturer : PERKINELMER  
Model : LAMBDA 25  
Serial No.: 501S14123010  
ID No.: SP03/58  
Calibration Mode : WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY  
  
Condition As Found : GOOD  
  
Customer : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.  
  
Location : WET CHEMISTRY LABORATORY IV  
  
Ambient Temperature : ( 28.1 ± 5 ) °C  
Relative Humidity : ( 47.2 ± 25 ) %  
  
Received Date : 27 AUGUST 2024  
Calibration Date : 27 AUGUST 2024  
Date of Issue : 27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :



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



Cert. No. : SP24020  
Job No. : VC67SP0013  
Pages : 2 of 3

Calibration Method :

This instrument was calibrated by using on-site calibration procedure In-house method : CP-SP-01  
The calibration procedure to direct measurement wavelength accuracy by using wavelength standard solution, Photometric accuracy by using absorbance standard filter and absorbance standard solution  
The calibration procedure used was based on ASTM E275-01,ASTM E925-02

Condition of this result of calibration :

1. Certified reference materials
- | Material                       | Ref. type     | Cell serial No. | Cert. No.  | Due Date   |
|--------------------------------|---------------|-----------------|------------|------------|
| Holmium liquid                 | RM-HL         | 29706           | 106864     | 01/11/2024 |
| Didymium liquid                | RM-DL         | 28912           | 106905     | 02/11/2024 |
| Neutral density filter         | RM-1N2N3N     | 13877           | 106918     | 03/11/2024 |
| Potassium dichromate solutions | RM-0204060810 | 14204           | 106902     | 02/11/2024 |
| Potassium Iodide solution      | -             | KI-0701-001     | CI-0185-24 | 14/05/2026 |
2. This result of calibration was found accurate as shown on date and place of calibration only.  
3. This certificate is traceable to the international system of unit maintained at :  
3.1 The UK National Physical Laboratory (NPL)  
3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy  
(Without adjustment)

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

UUC\* = Unit Under Calibration







Cert. No. : SP24020  
Job No. : VC67SP0013  
Pages : 3 of 3

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE  
ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL  
PinAAcle 900T

Result of calibration : Photometric Accuracy  
(Without adjustment)

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

UUC\* = Unit Under Calibration

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

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

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

\*\*Specific Acceptance :  
Transmission  $\leq$  1.0 T(%), Absorbance  $\geq$  2.0 A  
\*\*Stray light not TISI Accredited

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

End of Calibration Certificate

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

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103	DATE TESTED	July 4, 2024
PARAMETER	SPECIFICATION	ACTUAL VAULE	
<b>B. THGA Tests</b>			
1. Furnace Gas Flows			
Internal Flow	250 $\pm$ 25 mL/min	250 mL/min	
External Flow	100 $\pm$ 10 mL/min	100 mL/min	
2. Chromium Baseline Noise (357.87 nm) (mesure 5 furnace dry firings without any sample)			
Baseline $\leq 0.005$ Int.Abs		0.0021	
SD $\leq 0.005$ Int.Abs		0.0004 Int.Abs.	
3. Chromium Characteristic Mass( $m_0$ ) and Precition (357.87 nm) (measure 5 furnace firing using 20 ul sample injections of 10 ug/L Cr standard)			
m0 Results $\leq 7.0$ pg/0.0044A-s		7 pg/0.0044A-s	
Precision $\leq 2.0\%$		1.32 %	
4. Copper Characteristic Mass( $m_0$ ) and Zeeman Ratio (324.75 nm) (measure 5 furnace firing using 20 ul sample injections of 25 ug/L Cu standard)			
m0 Results $\leq 16.5$ pg/0.0044A-s		14.4 pg/0.0044A-s	
Zeeman Ratio 0.52 $\pm$ 0.04		0.559	

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 DATE TESTED July 4, 2024

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio = Atomic Signal(peak area)

Atomic Signal(peak area)+Background Signal(peak area)

= 0.1491/0.1491+0.1176

0.559

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

**Service Department PerkinElmer Ltd.**

Customer Service Engineer:

Service Engineer

## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

Customer : S.P.S.Consulting Service Co.,Ltd Date Tested: July 4, 2024  
Recommendation Recertification  
Address : 7 Soi Phaholyothin 24 Period 6 Months  
Paholyothin Road Recertification Due: January 4, 2025  
Jompol Chatuchak, Bangkok 1090 Date Last Certified: January 4, 2024  
User Name: K.Phenpha Vipasthawat Visit Number: 1 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

077C7042401

##### TESTED EQUIPMENT

IPV Methods

##### CALIBRATION NUMBER

##### PART NUMBER

N069-1579

N058-2152

N930-2946

N930-0221

##### COMMENTS

2 % HNO3

10 % HNO3

#### ACCESSORIES/COMPONENT NOT INCLUDED

##### EXPIRATION

##### EXPIRATION DATE

December 30, 2024

September 30, 2024

January 30, 2025

November 30, 2024

##### CUSTOMER INITIALS





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

<b>SERIAL NUMBER</b> 077C7042401	<b>DATE TESTED</b> July 4, 2024
<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> : 077C7042401		<b>DATE TESTED</b> : July 4, 2024	
PARAMETER	SPECIFICATION	FINAL VALUE	
<b>Spectral Resolution : UV</b>	As 193.696 nm $\leq 0.007$	0.00550	
	Ni 231.604 nm $\leq 0.008$	0.00714	
	Ni 341.476 nm $\leq 0.012$	0.00790	
<b>Spectral Resolution : VIS</b>	La 408.672 nm $\leq 0.020$	0.01655	
	Ba 455.403 nm $\leq 0.025$	0.02391	
<b>Precision</b>	As 193.656 nm % RSD < 1.0	0.72 %	
	Zn 213.856 nm % RSD < 1.0	0.66 %	
	Mn 257.610 nm % RSD < 1.0	0.30 %	
	La 379.478 nm % RSD < 1.0	0.98 %	
	Ba 455.403 nm % RSD < 1.0	0.95 %	
	Ba 493.408 nm % RSD < 1.0	0.78 %	
<b>Detection Limits : Axial</b>	Tl 190.080 nm 3(sd)	6.22 ppb	
	As 193.696 nm 3(sd)	6.44 ppb	
	Pb 220.353 nm 3(sd)	2.06 ppb	
<b>Detection Limits : Radial</b>	As 193.696 nm 3(sd)	78.26 ppb	
	Zn 213.856 nm 3(sd)	2.07 ppb	
	Mn 257.610 nm 3(sd)	0.52 ppb	
	La 379.478 nm 3(sd)	2.63 ppb	
	Ba 455.403 nm 3(sd)	0.08 ppb	
	Ba 493.408 nm 3(sd)	0.75 ppb	
<b>BEC : Axial (IB X 500)/(IS-IB)</b>	Cd 226.502 nm $\leq 150$ ppb	64.72	
<b>BEC : Radial (IB X 1000)/(IS-IB)</b>	Mn 257.610 nm $\leq 45$ ppb	15.04	

WO-02612424/2024



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

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

**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

**Service Department-PerkinElmer Ltd.**

**Authorized Representative:**



Service Engineer

Page 4 of 4

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



**MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD**

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



**CALIBRATION CERTIFICATE**

**Certificate No. :** S2024090374-0003

**Date Issued :** 23-Sep-24

**Customer**

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

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

**Equipment**

: Incubator

**Manufacturer**

: BINDER

**Model**

: BD 115

**Serial No.**

: 12-16967

**ID No./Tag No.**

: IN 05/56

**Date Received**

: 16-Sep-24

**Date Calibrated**

: 16-Sep-24

**Calibrated by**

: Anusak Songliam

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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

Result of Calibration

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

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

Approved by:



Page 1 of 2

Certificate No. : S2024090374-0003

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

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

Without adjustment

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

Decision Rule with Guard Band

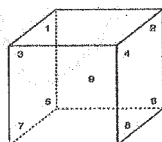
Calibration Temperature (°C)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	MPE (±°C)
35	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5
41.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5

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

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

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

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

- Notes :
- The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
  - 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.
  - Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
  - The uncertainty of measurement is included temperature stability.
  - 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

Page 2 of 2



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 : 24T2234  
REFERENCE No : 72448-8

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : WATER BATH  
MANUFACTURER : MEMMERT  
MODEL : WNB29  
SERIAL No : L614.0123  
ID No : WB-05/58  
CONDITION AS RECEIVED : USED ITEM  
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,  
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 08-Mar-24

APPROVED BY :

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.

F-G010 REV : 03





# 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

CERTIFICATE No : 24T2234

PAGE : 2 OF 2

## Calibration Report

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

### CONDITION OF THIS RESULTS OF CALIBRATION

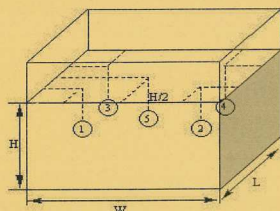
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2635A	7286308	23T6641	14-Jul-24

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION POSITION IN THE BATH

### GENERAL INFORMATION

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

### BATH PERFORMANCE

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

### TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

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

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

END OF CALIBRATION REPORT

## Turbomass/Clarus Mass/SQ8 MS Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	2 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-02927336
Date PM Performed: (DD-MMM-YYYY)	22-Aug-2024	Next PM Due Date: (DD-MMM-YYYY)	22-Feb-2025

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

### Scope

The purpose of this PM is to ensure the continued functionality of the Turbomass/Clarus MS SQ8 MS 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 #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3	PSS,PSS,FID
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

### Parts lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A				

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
N/A				
Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A				

### Procedure Checklist

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

#### General:

- ☒ Column type Elite 624
- ☒ Carrier gas flow rate 1 ml/min.
- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Check incoming AC line voltage for proper levels and grounding.

#### Mechanical:

- ☒ Inspect and clean all fans and filters.
- ☒ Check the level of FC-43 calibration compound in reference gas bulb and fill if necessary.
- ☒ Change the oil in the fore pump.
- ☒ Inspect cartridge in fore pump vacuum filter; replace adsorbent bead if necessary.
- ☒ Replace the exhaust vapor mist filter on the fore pump.
- ☒ Remove and clean the ion source assembly. Use the Insulator Replacement Kit and/or Optics Replacement Kit if necessary
- ☒ Replace the filament.
- ☒ Remove and clean the pre-quad rods.
- ☒ Observe Wide Range Gauge pressure; clean/adjust if required.
- ☒ Inspect and clean as needed all PC boards and bottom inside of MS chassis.

#### Electrical:

- ☒ Check head amp offset. Adjust if necessary for proper value (Service Manual ).

#### Operational Tests:

- ☒ Vacuum pressure.
- ☒ Air/water leak check
- ☒ AutoTune and mass calibration.
- ☒ Make a Chromatographic injection to verify peak shape and integrity only (not meant for sensitivity test).

**PC Maintenance:**

- ☒ Delete all unnecessary temporary files.
- ☒ Empty deleted files from recycle bin.
- ☒ Perform hard drive defragmentation.

**Review:**

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

**Additional Comments**

Additional Comments Regarding the PM

**Review**

<i>The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.</i>		
<i>This Turbomass/ClarusMS/SQ8    <b>Pass</b>                      the preventive maintenance.</i>		
<b>Review of Preventive Maintenance:</b>		
Authorized PerkinElmer Representative Monchai Kitcharoenkeat	<i>Monchai</i>	Date: 22-Aug-2024 (DD-MMM-YYYY)
Authorized Customer Representative: Ms. Naruecha	<i>Naruecha</i>	Date: 22-Aug-2024 (DD-MMM-YYYY)