

## ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>1. คุณภาพอากาศในบรรยากาศ</b>		
TSP	High Volume Air Sampler No. B02, B08, B14, B33	Digital Balance
PM-10	High Volume PM-10 Air Sampler No. B05, B08, B16, B17	Digital Balance
NO <sub>2</sub>	NO <sub>2</sub> Analyzer No. B04, B05, B06, B11	NO <sub>2</sub> Analyzer No. B04, B05, B06, B11
SO <sub>2</sub>	SO <sub>2</sub> Analyzer No. B07, B08, B16, B20	SO <sub>2</sub> Analyzer No. B07, B08, B16, B20
<b>2. คุณภาพอากาศจากปล่อง</b>		
Particulate	Console No. B04, B05, R04 Pitot Tube No. B21, B35	Digital Balance
NO <sub>x</sub>	Vacuum Gauge	Spectrophotometer
SO <sub>2</sub>	Personal Pump SKC No. B26, B52 Rotameter No. H-B08	Digital Balance
<b>3. ระดับเสียงในบรรยากาศ</b>		
L <sub>eq</sub> 1 hr, L <sub>eq</sub> 8 hr, L <sub>eq</sub> 24 hr, L <sub>dn</sub> , L <sub>max</sub> และ L <sub>90</sub>	Acoustic Calibrator Sound Level Meter No. CR-B03, B05, B06, B11	-
<b>4. คุณภาพน้ำ</b>		
Temperature	-	Thermometer
Conductivity	-	Conductivity Meter
Turbidity	-	Turbidity Meter
Color	-	Spectrophotometer
pH	-	pH Meter
BOD <sub>5</sub>	-	BOD Analyzer
COD	-	COD Reactor
Total Suspended Solids	-	Digital Balance
Total Dissolved Solids	-	Digital Balance
Grease & Oil	-	Digital Balance
Nitrate-Nitrogen	-	Spectrophotometer
Phosphate-Phosphorus	-	Spectrophotometer
Cadmium	-	ICP
Lead	-	ICP
Mercury	-	AAS
Manganese	-	ICP
Fluoride	-	Spectrophotometer
Sulfate	-	Spectrophotometer
Total Iron	-	ICP

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>
B01	B01	01/02/2023	$y = 1.278x - 5.652$	0.997
B02	B02	02/02/2023	$y = 1.147x + 0.663$	0.999
B03	B03	01/02/2023	$y = 1.123x - 0.622$	0.995
B04	B04	01/02/2023	$y = 1.229x - 4.835$	0.996
B05	B05	02/02/2023	$y = 1.280x - 6.358$	0.997
B06	B06	01/02/2023	$y = 1.251x - 5.438$	0.999
B07	B07	03/02/2023	$y = 1.165x - 3.515$	0.996
B08	B08	03/02/2023	$y = 1.269x - 7.559$	0.997
B09	B09	01/02/2023	$y = 1.198x - 2.843$	0.998
B10	B10	01/02/2023	$y = 1.128x + 0.785$	0.999
B11	B11	02/02/2023	$y = 1.138x - 1.752$	0.999
B12	B12	01/02/2023	$y = 1.195x - 4.080$	0.998
B13	B13	01/02/2023	$y = 1.254x - 5.913$	0.999
B14	B14	03/02/2023	$y = 1.291x - 7.822$	0.999
B15	B15	01/02/2023	$y = 1.149x - 1.829$	0.997
B16	B16	01/02/2023	$y = 1.287x - 7.502$	0.997
B17	B17	02/02/2023	$y = 1.207x - 4.147$	1.000
B18	B18	01/02/2023	$y = 1.277x - 7.238$	0.999
B19	B19	03/02/2023	$y = 1.243x - 6.520$	0.995
B20	B20	01/02/2023	$y = 1.267x - 7.055$	1.000
B21	B21	03/02/2023	$y = 1.141x - 1.101$	0.999
B22	B22	03/02/2023	$y = 1.221x - 5.534$	0.996
B23	B23	02/02/2023	$y = 1.197x - 4.328$	0.995
B24	B24	01/02/2023	$y = 1.159x - 2.269$	0.999
B25	B25	01/02/2023	$y = 1.050x + 2.684$	0.998
B26	B26	03/02/2023	$y = 1.253x - 6.203$	0.997
B27	B27	03/02/2023	$y = 1.220x - 5.822$	0.997
B28	B28	01/02/2023	$y = 1.251x - 6.762$	0.999
B29	B29	01/02/2023	$y = 1.201x - 3.793$	0.998
B30	B30	03/02/2023	$y = 1.242x - 6.540$	0.995
B31	B31	03/02/2023	$y = 1.255x - 6.608$	0.999
B32	B32	02/02/2023	$y = 1.249x - 6.292$	0.997
B33	B33	02/02/2023	$y = 1.260x - 5.168$	0.997
B34	B34	01/02/2023	$y = 1.272x - 7.454$	1.000

Calibrated by :

(Mr. Adul Dangklom)

(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>
B01	B01	02/02/2023	$y = 1.210x - 0.261$	0.997
B02	B02	02/02/2023	$y = 1.046x + 2.414$	0.998
B03	B03	02/02/2023	$y = 1.199x - 4.047$	0.996
B04	B04	02/02/2023	$y = 1.288x - 7.602$	0.997
B05	B05	01/02/2023	$y = 1.222x - 4.886$	1.000
B06	B06	01/02/2023	$y = 1.210x - 3.612$	0.996
B07	B07	03/02/2023	$y = 1.270x - 6.088$	0.999
B08	B08	01/02/2023	$y = 1.277x - 5.288$	0.998
B09	B09	03/02/2023	$y = 1.289x - 6.478$	0.999
B10	B10	03/02/2023	$y = 1.266x - 8.106$	0.997
B11	B11	01/02/2023	$y = 1.258x - 6.917$	0.995
B12	B12	02/02/2023	$y = 1.192x - 3.640$	0.998
B13	B13	02/02/2023	$y = 1.289x - 7.913$	0.998
B14	B14	02/02/2023	$y = 1.250x - 4.233$	0.999
B15	B15	01/02/2023	$y = 1.118x + 0.802$	0.999
B16	B16	03/02/2023	$y = 1.297x - 3.106$	0.998
B17	B17	01/02/2023	$y = 1.204x - 4.477$	0.996
B18	B18	02/02/2023	$y = 1.176x - 1.624$	0.998
B19	B19	02/02/2023	$y = 1.097x + 1.230$	0.999
B20	B20	03/02/2023	$y = 1.188x - 4.372$	0.999
B21	B21	03/02/2023	$y = 1.156x - 0.146$	0.996
B22	B22	03/02/2023	$y = 1.269x - 6.647$	0.998
B23	B23	02/02/2023	$y = 1.197x - 2.685$	1.000
B24	B24	02/02/2023	$y = 1.251x - 6.437$	0.995
B25	B25	01/02/2023	$y = 1.144x - 2.851$	0.997
B26	B26	01/02/2023	$y = 1.249x - 5.704$	0.996
B27	B27	01/02/2023	$y = 1.241x - 5.428$	0.997
B28	B28	01/02/2023	$y = 1.198x - 4.626$	0.998
B29	B29	02/02/2023	$y = 1.244x - 7.658$	0.997
B30	B30	02/02/2023	$y = 1.246x - 7.229$	0.997
B31	B31	02/02/2023	$y = 1.178x - 0.243$	0.995
B32	B32	03/02/2023	$y = 1.201x - 2.954$	0.998
B33	B33	03/02/2023	$y = 1.168x - 1.341$	0.997
B34	B34	01/02/2023	$y = 1.237x - 2.684$	0.995

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)



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### CALIBRATION REPORT

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

DATE : 04 February 2023

BRAND : API

MODEL : 100E

NO. SO<sub>2</sub>-B04

SERIAL NO. 3159

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

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

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 50.0 ppm

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO <sub>2</sub> Span	400.0	400.3	0.075	400.0	1.017

#### 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	662	cc/min	650 ± 10%
PMT	103.4	mV	-20-150 with Zero Air
UV LAMP	3049.7	mV	1000-4900
STR. LGT	61.9	PPB	<100
DRK PMT	63.5	mV	-50 - 200
DRK LMP	58.2	mV	-50 - 200
HVPS	675	V	550-900 constant
DCPS	2522	mV	2500 ± 200
RCELL TEMP	50.5	°C	50 ± 1
BOX TEMP	29.3	°C	5-40
PMT TEMP	7.2	°C	7 ± 2.0
SO <sub>2</sub> Span Conc	400	PPB	20-20,000
SO <sub>2</sub> Slope	1.017	-	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)

(Mr. Peera Detudom)



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	04 February 2023	BRAND :	API	MODEL :	100E
NO.	SO <sub>2</sub> -B05			SERIAL NO.	3270
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 04 August 2022			Serial No.	: 911
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.7	-0.075	400.0	1.006
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	103.1	mV	-20-150 with Zero Air		
UV LAMP	3025.6	mV	1000-4900		
STR. LGT	61.7	PPB	<100		
DRK PMT	63.1	mV	-50 - 200		
DRK LMP	57.9	mV	-50 - 200		
HVPS	670	V	550-900 constant		
DCPS	2527	mV	2500 ± 200		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.5	°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	1.006	-	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)

(Mr.Peera Detudom)





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CALIBRATION REPORT						
SO <sub>2</sub> FLUORESCENT ANALYZER						
DATE :	04 February 2023	BRAND :	API	MODEL :	100E	
NO.	SO <sub>2</sub> -B06	SERIAL NO.	3430			
Calibrator (Dilution System)						
Brand	: API			Model	: 700	
Last Cal. Date	: 04 August 2022			Serial No.	: 911	
Reference Standard Gas						
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )			Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm	
CALIBRATING CONDITION						
Pressure	1011	mmbar	Temp.	24.5	°C	
% RH						49
CALIBRATION SETTING						
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB		
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope	
Zero	0	-0.10	-	0	-	
SO <sub>2</sub> Span	400.0	400.2	0.050	400.0	1.014	
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	656	cc/min	650 ± 10%			
PMT	102.9	mV	-20-150 with Zero Air			
UV LAMP	3006.5	mV	1000-4900			
STR. LGT	61.4	PPB	<100			
DRK PMT	62.9	mV	-50 - 200			
DRK LMP	57.7	mV	-50 - 200			
HVPS	669	V	550-900 constant			
DCPS	2516	mV	2500 ± 200			
RCELL TEMP	50.1	°C	50 ± 1			
BOX TEMP	29.2	°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	1.014	-	1.0 ± 0.3			
SO <sub>2</sub> Offset	22.1	mV	<250			
Stability at Zero	0.1	PPB	<0.2			
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)			

Calibrated by :

(Mr.Adul Dangklom)

(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	04 February 2023	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO <sub>2</sub> -B11			SERIAL NO.	SO2187
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 04 August 2022			Serial No.	: 911
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO <sub>2</sub> Span	400.0	400.1	0.025	400.0	1.010
API Model TML-50 SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.6	in-Hg	25-35		
SAMPLE FLOW	653	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3015.4	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	63.2	mV	-50 - 200		
DRK LMP	58.0	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2520	mV	2500 ± 200		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.1	°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	1.010	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	21.7	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

(Mr.Peera Detudom)



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### CALIBRATION REPORT

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 04 February 2023

BRAND : API

MODEL : 200E

NO. NOX-B07

SERIAL NO. 4338

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.2	0.050	400.0	1.010
NO <sub>x</sub> Span	400	400.3	0.075	400.0	1.015

#### 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	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	675	V	420 - 900 constant
RCELL TEMP	50.5	°C	50 ± 1
BOX TEMP	29.2	°C	8 - 48
PMT TEMP	7.4	°C	7 ± 2
MOLY TEMP	315.2	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.010	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.015	-	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)

(Mr.Peera Detudom)



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

### CALIBRATION REPORT

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 04 February 2023

BRAND : API

MODEL : 200E

NO. NOX-B08

SERIAL NO. 4336

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.003
NO <sub>x</sub> Span	400	399.8	-0.050	400.0	1.006

#### 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	509	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.4	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	0.999	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.004	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO <sub>x</sub> Offset	0.7	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

(Mr.Adul Dangklom)

(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 February 2023

BRAND : API

MODEL : 200E

NO. NOX-B16

SERIAL NO. 249

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.008
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.011

#### 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	507	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.5	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	671	V	420 - 900 constant
RCELL TEMP	50.3	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	314.7	°C	315 ± 5
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.008	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.011	-	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. Abdul Dangklom)

(Mr. Peera Detudom)





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### CALIBRATION REPORT

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 04 February 2023

BRAND : API

MODEL : TML-41M

NO. NOX-B20

SERIAL NO. N02782

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.005
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.009

#### API Model TML-41M NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	507	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.0	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	315.4	°C	315 ± 5
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.005	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.009	-	1.0 ± 0.3
NO Offset	1.2	mV	-20 to +150
NO <sub>x</sub> Offset	0.8	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

(Mr.Adul Dangklom)

(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 : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS 105DU

**SERIAL No** : 1126422905

**ID No** : BA 05/50

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : TETNITHI W.

**CALIBRATION DATE** : 11-Mar-22

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

**ISSUED DATE** : 17-Mar-22

**RECEIVED DATE** : 11-Mar-22

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





CERTIFICATE No : 22M2567

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	MODEL	:	XS 105DU
MANUFACTURER	:	METTLER TOLEDO	S/N	:	1126422905
ID No	:	BA 05/50	RECEIVED DATE	:	11-Mar-22
AIR PRESSURE	:	1008mbar $\pm$ 1mbar	CALIBRATION DATE	:	11-Mar-22
AMBIENT TEMPERATURE	:	22° C $\pm$ 1° C	RELATIVE HUMIDITY	:	49 %RH $\pm$ 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

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

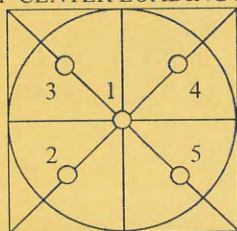
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g
4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g
5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.0000	0.0000	0.00011
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001

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

END OF CALIBRATION REPORT

คุณภาพอากาศจากปล่องระบาย





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

## Console Calibration Report

Calibration Method

Critical Orifices

### Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{@}$ (mmH <sub>2</sub> O)
B01	1563	01/12/2022	1.007	49.94
B02	8002514	02/12/2022	1.002	49.41
B03	1503016	05/12/2022	1.004	50.46
B04	00006659	01/12/2022	1.007	49.43
B05	00007428	01/12/2022	0.998	49.80
R01	1561	01/12/2022	1.004	49.52
R02	8002513	01/12/2022	1.003	49.77
R03	1570	05/12/2022	1.008	49.68
R04	8002519	05/12/2022	0.997	50.12
R05	1503015	01/12/2022	1.003	50.08

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

Accept Value of  $\Delta H_{@}$  (test) is  $46.7 \pm 6.4$  (mmH<sub>2</sub>O)

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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## Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	02/02/2023	0.84	0.84
B04	S	0.99	01/02/2023	0.84	0.83
B05	S	0.99	02/02/2023	0.84	0.85
B07	S	0.99	02/02/2023	0.85	0.84
B08	S	0.99	01/02/2023	0.83	0.84
B09	S	0.99	01/02/2023	0.84	0.84
B11	S	0.99	01/02/2023	0.84	0.84
B16	S	0.99	01/02/2023	0.84	0.83
B18	S	0.99	02/02/2023	0.84	0.84
B19	S	0.99	02/02/2023	0.85	0.84
B21	S	0.99	03/02/2023	0.84	0.84
B24	S	0.99	03/02/2023	0.84	0.83
B27	S	0.99	02/02/2023	0.84	0.84
B30	S	0.99	01/02/2023	0.83	0.84
B31	S	0.99	02/02/2023	0.84	0.85
B33	S	0.99	03/02/2023	0.84	0.84
B35	S	0.99	02/02/2023	0.84	0.85

Remark : Accept value of Cp (test) is  $0.84 \pm 0.01$

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)

## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220066-1]  
CLID. NO. : 212201112  
JOB CONTROL NO. : 220720073201

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

DATE OF RECEIVED : 20 July 2022

DATE OF ISSUED : 22 July 2022

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee  
Calibration Engineer



Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
22 July 2022



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. Q22073201

F3-011-04/01-12

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## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220066-1]  
DATE OF CALIBRATION : 21 July 2022

---

#### ENVIRONMENT CONDITIONS :

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

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

#### PROCEDURE USED :

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

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

#### REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 744 S/N. 9226007 with Pressure Module Model 700PV4 S/N. 19298401.

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).  
Certificate No. MP-0196-21, Due Date 17 November 2022.

#### UNCERTAINTY :

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

Certificate No. **Q22073201**

F3-011-04/01-12

page 2 of 3



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**CLC**  
Accredited  
ISO/IEC 17025

# 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 : GOOD**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

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

## CALIBRATION DATA

### **CORRECTION OF PRESSURE**

DUC Test point ( inHg )	STD Reading ( inHg )		Correction ( inHg )	
	Up	Down	Up	Down
0	0.0	0.0	0.0	0.0
-5	-4.6	-4.7	+0.4	+0.3
-10	-9.5	-9.6	+0.5	+0.4
-15	-14.4	-14.5	+0.6	+0.5
-20	-19.4	-19.5	+0.6	+0.5
-25	-24.5	-24.5	+0.5	+0.5
-30	-29.5	-29.5	+0.5	+0.5

Uncertainty of measurement  $\pm 0.2$  inHg

Transmitting fluid : Air.

Technical Note. k factor 1 kPa = 0.2952998 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

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

**### End of Certificate ###**

Certificate No. Q22073201

F3-011-04/01-12

page 3 of 3



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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900  
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

Temperature : 25  $\pm$  3  $^{\circ}$ C  
Pressure : 1010  $\pm$  15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B01	SKC	224-PCXR4	262101	03/01/2023	1,000	1,500	2,000	993	1,497	1,998	1.003x - 5.584	1.000
B02	SKC	224-PCXR4	626166	03/01/2023	1,000	1,500	2,000	1,003	1,505	2,001	1.009x - 19.667	0.999
B03	SKC	224-PCXR4	612968	03/01/2023	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.109	1.000
B04	SKC	224-PCXR4	602804	04/01/2023	1,000	1,500	2,000	1,000	1,502	1,995	1.000x - 0.893	1.000
B05	SKC	224-PCXR4	612693	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 22.224	0.999
B06	SKC	224-PCXR4	262188	03/01/2023	1,000	1,500	2,000	995	1,508	2,005	1.011x - 20.273	1.000
B07	SKC	224-PCXR4	626262	03/01/2023	1,000	1,500	2,000	998	1,492	1,995	0.993x + 6.086	1.000
B08	SKC	224-PCXR4	626100	03/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 23.308	0.999
B09	SKC	224-PCXR4	626479	03/01/2023	1,000	1,500	2,000	996	1,490	1,994	0.995x + 1.117	1.000
B10	SKC	224-PCXR4	091950	03/01/2023	1,000	1,500	2,000	992	1,503	2,001	1.018x - 36.582	0.999
B11	SKC	224-PCXR8	564315	05/01/2023	1,000	1,500	2,000	996	1,490	1,999	1.003x - 8.256	1.000
B12	SKC	224-PCXR4	034656	05/01/2023	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.324	0.999
B13	SKC	224-PCXR4	602073	05/01/2023	1,000	1,500	2,000	995	1,500	1,998	1.001x - 3.474	1.000
B14	SKC	224-PCXR4	626313	04/01/2023	1,000	1,500	2,000	999	1,491	1,988	0.992x + 6.844	1.000
B15	SKC	224-PCXR4	626474	04/01/2023	1,000	1,500	2,000	1,001	1,502	2,005	1.014x - 25.558	0.999
B16	SKC	224-PCXR4	626477	04/01/2023	1,000	1,500	2,000	994	1,504	2,001	1.015x - 31.345	0.999
B17	SKC	224-PCXR4	626860	04/01/2023	1,000	1,500	2,000	997	1,494	1,991	0.997x - 0.359	1.000
B18	SKC	224-PCXR4	691484	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,001	1.008x - 17.589	0.999
B19	SKC	224-PCXR4	691599	03/01/2023	1,000	1,500	2,000	993	1,503	1,999	1.007x - 11.574	1.000
B20	SKC	224-PCXR4	691587	03/01/2023	1,000	1,500	2,000	992	1,504	1,999	1.015x - 32.235	0.999
B21	SKC	224-PCXR4	691531	03/01/2023	1,000	1,500	2,000	993	1,499	1,994	1.001x - 7.107	1.000
B22	SKC	224-PCXR4	691654	05/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 21.107	0.999
B23	SKC	224-PCXR4	798393	05/01/2023	1,000	1,500	2,000	992	1,507	2,002	1.018x - 34.883	0.999
B24	SKC	224-PCXR4	626363	05/01/2023	1,000	1,500	2,000	1,000	1,502	2,000	1.011x - 22.387	0.999
B25	SKC	224-PCXR4	798489	05/01/2023	1,000	1,500	2,000	1,001	1,492	2,001	0.998x + 1.101	1.000
B26	SKC	224-PCXR4	798479	05/01/2023	1,000	1,500	2,000	999	1,500	1,993	0.996x + 4.008	1.000
B27	SKC	224-PCXR4	691673	04/01/2023	1,000	1,500	2,000	994	1,503	2,002	1.016x - 32.071	0.999
B28	SKC	224-PCXR4	691570	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.012x - 22.515	0.999
B29	SKC	224-PCXR4	626472	04/01/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.001x - 4.942	1.000
B30	SKC	224-PCXR4	691489	03/01/2023	1,000	1,500	2,000	1,004	1,510	2,004	1.008x - 12.460	0.999
B31	SKC	224-PCXR4	691509	03/01/2023	1,000	1,500	2,000	992	1,497	1,998	1.006x - 12.711	1.000
B32	SKC	224-PCXR4	091567	05/01/2023	1,000	1,500	2,000	991	1,504	2,001	1.016x - 32.322	0.999
B33	SKC	224-PCXR4	091756	05/01/2023	1,000	1,500	2,000	993	1,497	1,991	0.997x - 0.004	1.000
B34	SKC	224-PCXR4	612962	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,002	1.007x - 14.195	1.000
B35	SKC	224-PCXR4	602682	05/01/2023	1,000	1,500	2,000	993	1,498	1,995	1.002x - 8.448	1.000
B36	SKC	224-PCXR4	626164	03/01/2023	1,000	1,500	2,000	999	1,496	1,999	1.001x - 5.424	1.000
B37	SKC	224-PCXR4	626256	03/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.013x - 27.815	0.999
B38	SKC	224-PCXR4	626167	03/01/2023	1,000	1,500	2,000	997	1,496	1,996	0.999x - 0.997	1.000
B39	SKC	224-PCXR4	034637	03/01/2023	1,000	1,500	2,000	1,005	1,501	2,001	1.010x - 18.618	0.999
B40	SKC	224-PCXR4	798349	05/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.014x - 29.602	0.999

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)





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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  $\pm$  3 °C  
Pressure : 1010  $\pm$  15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B41	SKC	224-PCXR4	612669	05/01/2023	1,000	1,500	2,000	998	1,497	1,990	0.997x + 0.718	1.000
B42	SKC	224-PCXR4	626041	05/01/2023	1,000	1,500	2,000	1,004	1,498	1,991	0.986x + 18.291	1.000
B43	SKC	224-PCXR4	034636	05/01/2023	1,000	1,500	2,000	1,000	1,501	1,992	0.991x + 11.882	1.000
B44	SKC	224-PCXR8	529341	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,002	1.005x - 9.213	1.000
B45	SKC	224-PCXR8	529594	06/01/2023	1,000	1,500	2,000	999	1,501	1,989	0.991x + 11.184	1.000
B46	SKC	224-PCXR8	566743	06/01/2023	1,000	1,500	2,000	995	1,504	2,002	1.014x - 30.571	0.999
B47	SKC	224-PCXR8	566747	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,004	1.013x - 24.601	0.999
B48	SKC	224-PCXR8	566753	04/01/2023	1,000	1,500	2,000	1,000	1,494	1,998	0.998x + 0.319	1.000
B49	SKC	224-PCXR8	566780	04/01/2023	1,000	1,500	2,000	1,003	1,502	2,006	1.013x - 23.982	0.999
B50	SKC	224-PCXR8	500400	04/01/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.001x - 3.538	1.000
B51	SKC	224-PCXR8	500363	04/01/2023	1,000	1,500	2,000	996	1,504	1,999	1.011x - 25.031	0.999
B52	SKC	224-PCXR8	093186	04/01/2023	1,000	1,500	2,000	995	1,496	1,994	0.997x - 0.602	1.000
B53	SKC	224-PCXR8	707670	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.008x - 15.403	0.999
B54	SKC	224-PCXR3	509821	03/01/2023	1,000	1,500	2,000	993	1,502	2,001	1.017x - 34.237	0.999
B55	SKC	224-PCXR3	510710	03/01/2023	1,000	1,500	2,000	999	1,494	1,994	0.997x - 0.989	1.000
B56	SKC	224-PCXR3	511450	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,001	1.004x - 8.081	1.000
B57	SKC	224-PCXR3	510798	06/01/2023	1,000	1,500	2,000	997	1,492	1,998	1.000x - 2.680	1.000
B58	SKC	224-PCXR3	509852	06/01/2023	1,000	1,500	2,000	1,000	1,498	1,999	1.007x - 18.953	0.999
B59	SKC	224-PCXR3	509862	06/01/2023	1,000	1,500	2,000	996	1,503	1,994	0.997x + 3.235	1.000
B60	SKC	224-PCXR3	512655	06/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.006x - 11.407	1.000
B61	SKC	224-PCXR3	503915	06/01/2023	1,000	1,500	2,000	994	1,489	1,998	1.004x - 12.623	1.000
B62	SKC	224-PCXR3	505975	06/01/2023	1,000	1,500	2,000	999	1,494	1,996	0.997x + 0.343	1.000
B63	SKC	224-PCXR3	511432	03/01/2023	1,000	1,500	2,000	991	1,501	1,999	1.016x - 34.624	0.999
B64	SKC	224-PCXR3	508302	03/01/2023	1,000	1,500	2,000	997	1,492	1,989	0.992x + 6.226	1.000
B65	SKC	224-PCXR3	508310	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.007x - 13.936	1.000
B66	SKC	224-PCXR3	509861	03/01/2023	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.183	1.000
B67	SKC	224-PCXR3	506295	04/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.009x - 15.555	1.000
B68	SKC	224-PCXR3	505872	04/01/2023	1,000	1,500	2,000	1,002	1,490	1,997	0.995x + 3.841	1.000
B69	SKC	224-PCXR3	508375	04/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.772	0.999
B70	SKC	224-PCXR3	510623	05/01/2023	1,000	1,500	2,000	992	1,503	1,997	1.002x - 5.855	1.000
B71	SKC	224-PCXR3	508367	05/01/2023	1,000	1,500	2,000	992	1,506	2,002	1.017x - 34.791	0.999
B72	SKC	224-PCXR3	505977	05/01/2023	1,000	1,500	2,000	1,001	1,498	1,993	0.991x + 8.962	1.000
B73	SKC	224-PCXR3	512606	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,005	1.009x - 14.785	1.000
B74	SKC	224-PCXR3	505993	05/01/2023	1,000	1,500	2,000	996	1,495	1,994	1.000x - 6.916	1.000
B75	SKC	224-PCXR3	509820	04/01/2023	1,000	1,500	2,000	995	1,498	1,990	0.996x + 1.791	1.000
B76	SKC	224-PCXR3	509811	04/01/2023	1,000	1,500	2,000	993	1,498	1,998	1.006x - 14.322	1.000
B77	SKC	224-PCXR3	508301	04/01/2023	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.603	0.999
B78	SKC	224-PCXR3	510677	04/01/2023	1,000	1,500	2,000	995	1,503	1,999	1.013x - 28.158	0.999
B79	SKC	224-PCXR3	510920	03/01/2023	1,000	1,500	2,000	994	1,493	1,994	0.999x - 4.184	1.000

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
H-B01	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	506.1	989.5	1973.5	0.990x + 8.311	1.000
H-B02	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	494.9	998.2	1995.3	0.993x + 4.772	1.000
H-B03	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	498.3	987.5	2010.6	1.005x - 15.690	0.999
H-B04	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	500.4	999.5	2008.7	0.998x - 2.369	1.000
H-B05	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	499.0	997.8	1972.3	0.981x + 20.957	0.999
H-B06	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	503.6	995.0	1981.4	1.005x - 8.788	0.999
H-B07	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	504.1	989.0	2018.7	1.002x - 2.144	1.000
H-B08	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	499.8	999.2	1975.8	0.996x + 3.270	0.999
H-B09	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	503.7	1006.6	2014.3	0.994x + 14.202	1.000
H-B10	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	496.1	998.6	2012.4	0.997x + 2.443	1.000

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)





CERTIFICATE No : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY :   
PONGSAK J.

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22





CERTIFICATE No : 22M2567

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS 105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA 05/50 RECEIVED DATE : 11-Mar-22  
AIR PRESSURE : 1008mbar  $\pm$  1mbar CALIBRATION DATE : 11-Mar-22  
AMBIENT TEMPERATURE : 22° C  $\pm$  1° C RELATIVE HUMIDITY : 49 %RH  $\pm$  10 % RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

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

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

**RESULT OF CALIBRATION** :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

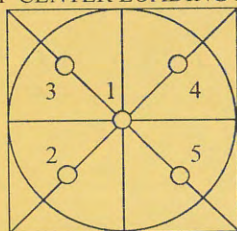
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.0000	0.0000	0.00011
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001

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

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

END OF CALIBRATION REPORT



# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP22018

Pages 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501S14123010  
**ID No.:** SP03/58  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY  
  
**Condition As Found :** GOOD  
  
**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.  
  
**Location :** ORGANIC LABORATORY IV  
  
**Ambient Temperature :** ( 24.4 ± 5 ) °C  
**Relative Humidity :** ( 60.1 ± 25 ) %  
  
**Received Date :** 30 AUGUST 2022  
**Calibration Date :** 30 AUGUST 2022  
**Date of Issue :** 31 AUGUST 2022

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

( Thanakul Petchurai )

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

## Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

Pages : 2 of 3

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC\* = Unit Under Calibration



## Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

Pages : 3 of 3

**Result of calibration : Photometric Accuracy**

(Without adjustment)

Material	Wavelength (nm)	Filter: S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	2.00	

UUC\* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.0001 A

## Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

## Stray Light\*\* UUC\* Reading at 220 nm

Transmission T(%) Absorbance(A)

0.0107

3.9886

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

End of Calibration Certificate

Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name: S.P.S Consulting Service Address: 7 Soi Phahon Yothin 24, Phahon Yotin Rd., Chatujak, A. Chatuchak Bangkok 10900 Customer Tag No.:

## Certificate Details

Number: 2546/21 Date of Issue: 21-Jun-2021 Expiry date: 21-Jun-2023  
Material Details  
Production Order: 90166198 Material Code: 553600-SK-44 Cylinder No.: D636139  
Gas content: 5.52 M<sup>3</sup> Filling pressure: 145.0 bar Valve: CGA 660 SS  
Cylinder Owner: LINDE Cylinder Material: Spectra seal Cylinder Size: 40 L

## Laboratory Report

## Analytical Result

Component	Normal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Nitric Oxide	100 ppm	93.6 ppm	± 1% relative	(6) I-PB-352	14-Jun & 21-Jun-21
Other NOx impurity in Nitrogen		Less than 4.9 ppm			

## Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date
Nitric Oxide in Nitrogen	H17936	100.3 ± 0.8 ppm	24-Jun-2021

## Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-NO	25-May-2021

## Recommend usage condition

Minimum utilization: 5% of actual content or before expiry date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1.  
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.  
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoonorn

Signatory for and on behalf of Linde (Thailand) Co., Ltd

Page 1 of 1

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บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)

เลขที่ใบแจ้งหนี้: 00000000000000000000

วันที่ 15 พฤษภาคม 2563 ถึง 2/3 มิถุนายน 2563 เลขที่ใบแจ้งหนี้: 00000000000000000000

เลขที่ใบแจ้งหนี้: 00000000000000000000 โทร 10540 โทรสาร (66) 2338-6100 โทรสาร (66) 2338-6333

โรงงานผลิต: 105 มิถุนายน 2563 เลขที่ใบแจ้งหนี้: 00000000000000000000

โทรสาร (66) 38-570-479-93

โทรสาร (66) 33-570-323

Linde (Thailand) Public Company Limited

PB-002-P006

SSB 2 14 Apr 2021

P.O. Tagungsraum 11111111111111111111

15 Floor, Bangna Tower A, 2+3 Mo 14, Bangna Trad RM, 6.5 Road, Bangnae

Bangplee, Samutprakarn 10540. Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant 105 Mo 5, T.Bangsamak, A.Bangpakong, Chachoengsao 24180

Thailand. Tel (66) 38-570-479-93

Fax (66) 33-570-323

Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name: S.P.S Consulting Service Address: 7 Soi Phahon Yothin 24,  
Khet Chatuchak, Bangkok 10900 Customer Tag No.:

## Certificate Details

Number:	1138/22	Date of Issue:	19-Apr-2022	Expiry date:	19-Apr-2024
Material Details					
Production Order:	90170869	Material Code:	411800-AL-44	Cylinder No.:	D824400
Gas content:	6.90 M <sup>3</sup>	Filling pressure:	145.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Aluminum	Cylinder Size:	50 L

## Laboratory Report

## Analytical Result

Component	Nominal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Nitric Oxide	200 ppm	201 ppm	± 1% relative	(6) I-PB-352	7-Apr & 19-Apr-22
Other NOx impurity In Nitrogen		Less than 10.0 ppm			

## Reference Standard

Nitric Oxide  
In Nitrogen

## Reference Standard used in Assay

Cylinder number	Concentration	Expiry date:
QA2565	99.4 ± 0.7 ppm	4-Feb-2023

## Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-NO	9-Mar & 8-Apr-22

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1  
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.  
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

### Customer Details

Address:  
7 Soi Phahon Yothin 24, Phahon Yotin Rd.,  
Chatujak, A. Chatuchak Bangkok 10900

Customer Tag No.:

### Certificate Details

Number:	2574/21	Date of Issue:	21-Jun-2021	Expiry date:	21-Jun-2029
Material Details					
Production Order:	90166199	Material Code:	627400-SK-44	Cylinder No.:	A00710SK
Gas content:	5.52 M <sup>3</sup>	Filling pressure:	145.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	40 L

## Laboratory Report

### Analytical Result

Component	Normal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Sulphur Dioxide In Nitrogen	50.0 ppm	50.2 ppm	± 1% relative	(6) I-PB-352	12-Jun & 19-Jun-21

*Reference Standard used in Assay*

Reference Standard	Cylinder number	Concentration	Expiry date:
Sulphur Dioxide In Nitrogen	1331885G	30.50 ± 0.40 ppm	16-Oct-2021

#### Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet i550	FTIR-SO2	7-Jun-2021

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.

3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoontorn  
Signatory for and on behalf of Linde (Thailand) Co. Ltd.

Page 1 of 1

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Linde (Thailand) Public Company Limited 551 2 31 45 252\*

10/22/2022 11:22:22

<sup>15</sup> Floor Bangna Tower A, 2/3 Moo 14, Bangna 7100 KM, S.S. Road, Bangkok

Bangkok: Samutprakarn 10540. Tel: (66) 2332-6100 Fax: (66) 2332-6333

Wellgrow Plant 105 Moo 5, Tambangsek, A.Bangpakong, Chachoengsao 24130

Thailand, Tel (66) 33.570-479-93 Fax (66) 33.570-323

Page (s): 33,573-373

บริษัท ลิบเด้ (ประเทศไทย) จำกัด (มหาชน)

7. 2007/2008 01/07/2007 00/07/2008

3.15 ចំណុចក្នុងកថាខណ្ឌ 2/3 រូប 14 ត្រូវបានកាត់បន្ថយ ឬ 6.5 ដង

ข้อมูลเบื้องต้น : หมายเลข 10540 โทรศัพท์ (66) 2338-6100 โทรสาร (66) 2338-3333

เลขที่ 105 หมู่ 5 ตำบลหนองทราย อำเภอเมืองพิษณุโลก 24133

โทรศัพท์ (66) 33.576-479-93      โทรสาร (66) 33.571-323



Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name:

S.P.S Consulting Service

Address:

7, Soi Phahon Yothin 24, Phahon Yothin Rd.,  
Chatujak, Bangkok, 10900

Customer Tag No.:

## Certificate Details

Number:	2420/19	Date of Issue:	25-Jul-2019	Expiry date:	24-Jul-2027
Material Details					
Production Order:	90154858	Material Code:	636400-SK-44	Cylinder No.:	A00797SK
Gas content:	5.520 M <sup>3</sup>	Filling pressure:	145.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	40 L

## Laboratory Report

## Analytical Result

Component	Nominal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Sulphur Dioxide In Nitrogen	100 ppm	102 ppm	± 1% relative	(6) I-PB-352	17-Jul & 24-Jul-19

## Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date
Sulphur Dioxide In Nitrogen	258005SG	103.1 ± 0.8 ppm	9-Aug-2020

## Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-SO2	24-Jun-2019

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.

Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

- All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1.
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer (6) Other - Specified

Sukanya Parinyasoonporn

Signatory for and on behalf of Linde (Thailand) Co., Ltd

Page 1 of 1

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PB-005 PSC

ISSN 2 of March 2019

บริษัท ลินเด (ประเทศไทย) จำกัด (มหาชน)

เลขที่ใบอนุญาตเลขที่ 01000000000000000000

ชั้น 15 ถนนพหลโยธินเลขที่ 2, 3 หมู่ 1-3 แขวงบางนา-ตราด เขต 5, 5 แขวงบางนา

เลขหมายโทรศัพท์ 02-570-479-93 โทรสาร (66) 2332-6100 โทรสาร (66) 2332-6333

เลขหมายมือถือ 095-4010540 โทรสาร (66) 2332-6100 โทรสาร (66) 2332-6333

เลขหมายมือถือโทร 105 หมู่ 5 แขวงบางนา เขตบางนา กรุงเทพมหานคร 10130

โทรศัพท์ (66) 33-570-479-93

โทรสาร (66) 33-570-323

Linde (Thailand) Public Company Limited

เลขที่ใบอนุญาตเลขที่ 01000000000000000000

5 Floor, Bangna Tower A-2, 3 Mo0 1-4, Bangna Road KM. 8 5 Road Bangkok

Bangkok Samutprakarn 10540, Tel (66) 2332-6100 Fax (66) 2332-6333

Wellgrow Plant: 105 Mo0 5 1 Bangsamak, A.Bangkokong, Chachabongsoo 24130

Thailand, Tel (66) 33-570-479-93

Fax (66) 33-570-323

Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name: S.P.S Consulting Service  
Address: 7 Soi Phahon Yothin 24, Phahon Yotin Rd.,  
Khet Chatuchak Bangkok 10900  
Customer Tag No.:

## Certificate Details

Number:	2256/20	Date of Issue:	22-May-2020	Expiry date:	21-May-2028
Material Details					
Production Order:	90160385	Material Code:	590800-J-44	Cylinder No.:	5858
Gas content:	6.56 M <sup>3</sup>	Filling pressure:	145.0 bar	Valve:	CGA 590 BRASS
Cylinder Owner:	LINDE	Cylinder Material:	STEEL	Cylinder Size:	47 L

## Laboratory Report

## Analytical Result

Component	Normal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Oxygen In Nitrogen	15.0%	14.9%	± 1% relative	(6) I-PB-352	22-May-2020

## Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date:
Oxygen In Nitrogen	53281	9.98 ± 0.05%	13-Sep-2021

## Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Servomex 4100 O2 analyser	Paramagnetic	21-May-2020

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

- All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoonorn

Signatory for and on behalf of Linde (Thailand) Co., Ltd.

PB-002/F006



บริษัท ยูไนด์อินดัสเตรียลแก๊ส จำกัด (สำนักงานใหญ่)  
聯育股份有限公司  
UNITED INDUSTRIAL GASES CO., LTD. (Head Office)

29/3 หมู่ที่ 5 ถนนบางนา-ตราด ตำบลบางเสาธง อำเภอบางเสาธง จังหวัดสมุทรปราการ 10570

29/3 MOO 5 BANGNA-TRAD ROAD, TAMBOL BANGSAOTONG, AMPHUR BANGSAOTONG, SAMUTPRAKARN 10570

TEL: 0-2338-1460-1, 0-2708-4148-9 FAX: 0-2338-1548, 0-2708-3873 E-mail: uig@gases.com, uig@gases.com Web: http://www.uiggases.com

เลขประจำตัวผู้เสียภาษี : 0115528000610

Certificate of Analysis

Page : 1/1

Certificate No: QA22090054

Client Name : บริษัท เอส.พี.เอส.คอนซัลติ้ง เซอร์วิส จำกัด  
Address : เลขที่ 7 ซ.พหลโยธิน ก.พหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพมหานคร 10900  
Telephone : Fax :  
Contact Name : - Contact Email : -

Sample Description

Sample Name : Nitrogen 99.999% Ultra High Purity Grade Shelf Life : 3 Years  
Sampling Condition : Cylinder 7 M3 Pressure 2000 psig Valve Type : CGA 580  
Lot No. : Test Date : 06/09/2022

รายการทดสอบ (Test Item)	วิธีทดสอบ (Test Method)	หน่วย (Unit)	เกณฑ์กำหนด (Specification)	ผลการทดสอบ (Results)
1. Moisture (H <sub>2</sub> O)	LT-UIG-01 (Shaw Moisture Meter)	ppm	≤ 3.0	< 3.0
2. Oxygen (O <sub>2</sub> )	LT-UIG-03 (Oxygen Analyzer)	ppm	≤ 2.0	< 3.0
3. Carbon Dioxide (CO <sub>2</sub> )	In-house method : LT-UIG-05 (Gas Chromatography)	ppm	≤ 1.0	< 1.0
4. Carbon Monoxide (CO)	In-house method : LT-UIG-05 (Gas Chromatography)	ppm	≤ 1.0	< 1.0
5. THC as CH <sub>4</sub>	In-house method : LT-UIG-06 (Gas Chromatography)	ppm	≤ 1.0	< 1.0

Note: CYLINDER No. : N78077, N75075



Approved By :

( Miss Sunisa Sonthipakdee )  
Quality Control

Date: 06 / 09 / 2022

FM-LB-012

Rev.00

Date : 01 / 02 / 2018

ระดับเสียงในบรรยากาศ





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0358

MTC No. EEL. BP. 22/0366

## 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 : Cirrus

Model : CR:515

Serial No. : 92002

### Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T06500001.

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

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 3 Mar. 2023

Date of Calibration : 13 Mar. 2023

1 / 2

*N. N. K. P. S.*

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

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

### Head Office

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

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

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

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

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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. 21-66/0358

MTC No. EEL. BP. 22/0366

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

Nominal Output of Unit Under Test = 94 dB re 20 $\mu$ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.99	-0.01	$\pm 0.10$	$\pm 0.40$ dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.39	$\pm 0.50$	$\pm 3.0\%$

- Note :
1. No adjustment.
  2. The calibrator pressure correction was not included.
  3. The microphone volume correction was not included.

Calibrated by :



(Mr. Nuttapong Niljrusvanit)

Approved by :



(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13 Mar. 2023

Date of Issue : 14 Mar. 2023

Ref : 2011266030300928001

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End of Certificate

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

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FM.BL.MTC.002 Rev.4

Head Office

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

Noise B\_034\_1/23

## 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	19 March 2022
		Due Date	19 March 2023

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B03	Cirrus	CR161B	G301155	04 February 2023	94.0	94.0
CR-B05	Cirrus	CR161B	G301134	04 February 2023	94.0	94.0
CR-B06	Cirrus	CR161B	G301151	04 February 2023	94.0	94.0
CR-B09	Cirrus	CR161B	G301401	04 February 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.99 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)

คุณภาพน้ำ



## Certificate of Calibration

**Certificate No. :** 65-400210-1

**Page : 1 of 2**

**Submitted by :** S. P. S Consulting Service Co.,Ltd.  
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

**Equipment :** Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

**Environment :** Ambient Temperature :  $(23 \pm 2)$  °C

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

Line Voltage :  $(220 \pm 22)$  VAC

**Date of Received :** 19 April 2022

**Date of Calibration :** 23 April 2022

**Date of Issue :** 23 April 2022

**Calibrated by :** Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by

( Bunjerd Masri )

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 65-400210-1

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

Ice point check : UUC\* reading 0 °C Standard reading 0.6439 °C

Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
20.6690	20	0.7	0.31

### Remark

UUC : Unit Under Calibration

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

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

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## Certificate of Calibration

**Certificate No. :** 66-400065-2

**Page : 1 of 2**

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

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

**Equipment :** Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

**Environment :** Ambient Temperature :  $(23 \pm 2)$  °C

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

Line Voltage :  $(220 \pm 22)$  VAC

**Date of Received :** 01 February 2023

**Date of Calibration :** 06 February 2023

**Date of Issue :** 06 February 2023

**Calibrated by :** Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

( Bunjerd Masri )

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 66-400065-2

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

Ice point check : UUC\* reading 0 ° C Standard reading 0.3606 ° C

Standard Reading ( ° C )	UUC Reading ( ° C )	Correction ( ° C )	Uncertainty ( ± ° C )
20.3607	20	0.4	0.31

### Remark

UUC : Unit Under Calibration

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

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

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



Cert.No.: 22CH140

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** Conductivity Meter  
**Manufacturer :** Mettler Toledo  
**Model :** SevenCompact  
**Serial No. :** C141708983  
**ID No. :** -  
**Condition As-Received:** Used Item  
**Received Date :** 31 January 2022  
**Calibration Date :** 02 February 2022  
**Reference :** 2201-0954WSC-1  
**Submitted by :** S.P.S. Consulting Service Co.,Ltd.  
7 Soi Phahonyothin 24, Phahonyothin Rd.,  
Chom Phon, Chatuchak, Bangkok 10900  
**Ambient Temperature :**  $(25 \pm 2.5) ^\circ\text{C}$   
**Relative Humidity :**  $(50 \pm 15) \%$   
**Calibration Procedure:** In -house method :  
- CP-CH6 : based on direct measurement by  
using certified reference material (CRM)

**Calibrated by :** Warakorn Lerngagtrakul

**Approved by :**

Approved Signatory

- ( ✓ ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagtrakul

**Issue Date :** 10 February 2022

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

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

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Cert.No.: 22CH140

Page.: 2 of 2

**Condition of this result of calibration**

## 1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	1963878	130RC095	21I977	17 Sep 2022

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

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

## 2. Certified Reference Materials :-

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

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
147.0 $\mu\text{S/cm}$	CPA Chem	761020	02 Aug 2022
1413.0 $\mu\text{S/cm}$	CPA Chem	761021	02 Aug 2022
12.880 $\text{mS/cm}$	CPA Chem	761022	02 Aug 2022
111.3 $\text{mS/cm}$	CPA Chem	768164	12 Sep 2022

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ )  $^{\circ}\text{C}$

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

**Calibration results****Function : Conductivity Measurement**(\*) After Adjustment at 0.147, 1.413, 12.880, 111.3  $\text{mS/cm}$ 

Conductivity Electrode Serial No.: 5821320179

<b>Standard Conductivity Solution</b>	<b>Before Adjustment UUC* Reading</b>	<b>After Adjustment UUC* Reading</b>	<b>Uncertainty of Measurement (<math>\pm</math>)</b>	<b>Coverage factor k</b>
147.0 $\mu\text{S/cm}$	148.1 $\mu\text{S/cm}$	147.0 $\mu\text{S/cm}$	0.99 $\mu\text{S/cm}$	2.00
1413.0 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00
12.880 $\text{mS/cm}$	12.61 $\text{mS/cm}$	12.88 $\text{mS/cm}$	0.086 $\text{mS/cm}$	2.00
111.3 $\text{mS/cm}$	105.7 $\text{mS/cm}$	111.4 $\text{mS/cm}$	0.76 $\text{mS/cm}$	2.00

**Remark**

- UUC\* = Unit Under Calibration

- 147.0  $\mu\text{S/cm}$  Adjustment Cell constant =  $0.550585 \text{ cm}^{-1}$ - 1413.0  $\mu\text{S/cm}$  Adjustment Cell constant =  $0.554585 \text{ cm}^{-1}$ - 12.880  $\text{mS/cm}$  Adjustment Cell constant =  $0.562585 \text{ cm}^{-1}$ - 111.3  $\text{mS/cm}$  Adjustment Cell constant =  $0.578585 \text{ cm}^{-1}$ 

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

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## 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. : 230211016445

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

DATE OF RECEIVED : 11 February 2023

DATE OF ISSUED : 15 February 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Seehanart  
Calibration Engineer



Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
15 February 2023



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. Q23016445

F3-011-04/01-12

page 1 of 4



@clccalibration

## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : CONDUCTIVITY METER  
MANUFACTURER : METTLER TOLEDO  
MODEL / TYPE : SEVEN COMPACT S230  
SERIAL NO. : C141708983/5821320179  
DATE OF CALIBRATION : 13 February 2023

#### 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. Potassium Chloride Solution ( nominal 1.41 mS/cm , nominal 12.8 mS/cm )
2. Conductivity Solution , Hanna Product Code HI 7033L Lot Number 6436.
3. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F250 S/N. 1334023800.
5. IPRT, ASL Model T100-250-1D S/N. L0193A-1-1.





## TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Merck Co., Ltd.

Certificate No. HC02139203 , HC04515254. Due Date 30 June 2023 , 30 November 2023.

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

Certificate No. 12E12 , Due Date May 2024 .

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

Certificate No. Q22130792, Due Date 05 January 2024.

4. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0823/65, Due Date 22 August 2023.

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

Certificate No. TT-0166-22, Due Date 01 December 2023.

## UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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





## CONDITION OF CALIBRATION ITEM : GOOD

## 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	k Factor
*84.00 µS/cm	84.04 µS/cm [Cell Constant 0.548589]	± 1.00 µS/cm	2,00
1412.0 µS/cm	1413 µS/cm [Cell Constant 0.548589]	± 21.0 µS/cm	2,00
12.85 mS/cm	12.88 mS/cm [Cell Constant 0.573538]	± 0.19 mS/cm	2,00

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 01 Page 138 of 138

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

Immersion depth (mm)	Actual Temperature ( °C )	DUC Reading ( °C )	Correction ( °C )	Uncertainty ± ( °C )
100	25.00	25.0	0.00	0.07

Note. The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of  $k = 2,00$ .

\* 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 ###**





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

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

TEL. 0-2717-3000-24 FAX. 0-2719-9484

Cert.No.: 22CH578

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** Turbidity Meter  
**Manufacturer :** Eutech  
**Model :** Cyberscan WL TB1000  
**Serial No. :** 201802206  
**ID. No. :** TB 03/61  
**Condition As-Received:** Used Item  
**Received Date :** 25 April 2022  
**Calibration Date :** 27 April 2022  
**Reference :** 2204-0619WN-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 :**

Approved Signatory

- (✓) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagtrakul

**Issue Date :** 3 May 2022

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

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Cert.No. : 22CH578

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).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermo-Hygrograph	1102794	130EC009	21H2601	8 Dec 2022
2) Electronic Balance	N03679	140RC001	21MM429	21 Sep 2022

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

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Assay</u>
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

<b>Standard Formazine suspension ( NTU )</b>	<b>UUC* Reading ( NTU )</b>	<b>Uncertainty of Measurement ( <math>\pm</math> NTU )</b>	<b>Coverage Factor <i>k</i></b>
20	19.4	0.38	2.00
40	39.3	0.40	2.00
100	98.9	0.73	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 %.

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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

Cert.No.: 23CH432

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** Turbidity Meter  
**Manufacturer :** Eutech  
**Model :** Cyberscan WL TB1000  
**Serial No. :** 201802206  
**ID. No. :** TB 03/61  
**Condition As-Received:** Used Item  
**Received Date :** 29 March 2023  
**Calibration Date :** 30 March 2023  
**Reference :** 2303-1034WN-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 :**

Approved Signatory

- ( ☒ ) Malee Butkruea  
( ☐ ) Saithip Meangmai  
( ☐ ) Warakorn Lerngagtrakul

**Issue Date :**

31 March 2023

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

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approval of the head of Calibration and Testing Equipment Services.

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Cert.No. : 23CH432

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).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermo-Hygrograph	1103328	130EC010	22H1313	12 June 2023
2) Electronic Balance	N03679	140RC001	22MM49	20 Sep 2023

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

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Assay</u>
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 ( $\pm$ NTU )	Coverage Factor <i>k</i>
20	19.3	0.38	2.00
40	39.0	0.40	2.00
100	99.2	0.70	2.00
400	391	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-

Malu

a 1155462



# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP22018

Pages 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501S14123010  
**ID No.:** SP03/58  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY  
  
**Condition As Found :** GOOD  
  
**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.  
  
**Location :** ORGANIC LABORATORY IV  
  
**Ambient Temperature :** ( 24.4  $\pm$  5 ) °C  
**Relative Humidity :** ( 60.1  $\pm$  25 ) %  
  
**Received Date :** 30 AUGUST 2022  
**Calibration Date :** 30 AUGUST 2022  
**Date of Issue :** 31 AUGUST 2022

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

( Thanakul Petchurai )

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



## Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

Pages : 2 of 3

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC\* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP22018  
Job No. : VC65SP0008  
Pages : 3 of 3

**Result of calibration : Photometric Accuracy**

(Without adjustment)

Material	Wavelength (nm)	Filter: S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	2.00	

UUC\* = Unit Under Calibration

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

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

Stray Light** UUC* Reading at 220 nm	
Transimission T(%)	Absorbance(A)
0.0107	3.9886

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

**End of Calibration Certificate**



**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 : 22E9693

REFERENCE No : 66476-1

PAGE : 1 OF 3

**Certificate of Calibration**

**EQUIPMENT** : pH METER

**MANUFACTURER** : HANNA

**MODEL** : HI 3512

**SERIAL No** : TH118035

**ID No** : pH 04/56

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : ATSAWIN Y.

**CALIBRATION DATE** : 15-Sep-22

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

**ISSUED DATE** : 15-Sep-22

**RECEIVED DATE** : 14-Sep-22

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





# QUALITY CALIBRATION CO.,LTD.

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

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

CERTIFICATE No : 22E9693

PAGE : 2 OF 3

## Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
ID No : pH 04/56  
RECEIVED DATE : 14-Sep-22  
AMBIENT TEMPERATURE : 20 ° C ± 1 ° C  
MODEL : HI 3512  
SERIAL NUMBER : TH118035  
CALIBRATION DATE : 15-Sep-22  
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 READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/ LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3



**QUALITY CALIBRATION CO.,LTD.**

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CERTIFICATE No : 22E9693

PAGE : 3 OF 3

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

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

**3. DISPLAY UNIT WITH TEMPERATURE**

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

**4. PERCENT SLOPE 100%**

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT





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


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

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

**Cert.No.:** 22TW98

**Page.:** 1 of 2

## Certificate of Testing

<b>Equipment :</b>	DO Meter
<b>Manufacturer :</b>	YSI
<b>Model :</b>	5000-230V
<b>Serial No. :</b>	15B100751
<b>ID No. :</b>	-
<b>Received Date :</b>	20 April 2022
<b>Test Date :</b>	21 April 2022
<b>Reference :</b>	2204-0429WC-1
<b>Submitted by :</b>	S.P.S. Consulting Service Co.,Ltd. 7 Phaholyothin 24, Phaholyothin Road., Jompol, Chatuchak, Bangkok 10900
<b>Laboratory Condition :</b>	Temperature ( $25 \pm 5$ ) °C Humidity ( $50 \pm 20$ ) %
<b>Test Procedure :</b>	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
<b>Tested by :</b>	Walalak Sirithean 
<b>Approved by :</b>	 Approved Signatory

( ☒ ) Malee Butkruea  
( ☐ ) Saithip Meangmai  
( ☐ ) Warakorn Lerngagtrakul

**Issue Date :** 25 April 2022





Cert.No.: 22TW98

Page.: 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

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

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

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

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

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

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a 1105753

CERT.No.: HS-U017D

Calibration Date : 3 Apr 23  
 Submitted by : S.P.S CONSULTING SERVICE CO.,LTD  
 7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,  
 Chatuchak, Bangkok, Thailand 10900

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

Model : YSI 5000  
 S/N : 15B100751  
 Probe : YSI 5010  
 S/N : 22D100097  
 ID NO. : -  
 Air Temp ref : S/N. E00522  
 Barometric ref : S/N. E00522  
 Water Temp ref : S/N. 11431  
 Technician : Kittipong M.

#### Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.08	(PASS)	-
Mean Measurement	9.08	mg/l	-
Inaccuracy	0.01	mg/l	-
Overall Status	(PASS)		

#### Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature  
 (Kittipong Maekwong)

Laboratory Manager  
 (Natenapha Pisatkunchon)





# 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 : 22T10972

REFERENCE No : 66837-1

PAGE : 1 OF 3

## Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0497

ID No : DRB 04/59

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 : 20-Dec-22

APPROVED BY : [REDACTED]  
PONGSAK J.

ISSUED DATE : 20-Dec-22

RECEIVED DATE : 20-Dec-22

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

F-G010 REV : 02





CERTIFICATE No : 22T10972

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
ID NUMBER : DRB 04/59  
RECEIVED DATE : 20-Dec-22  
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200  
SERIAL NUMBER : 15110C0497  
CALIBRATION DATE : 20-Dec-22  
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

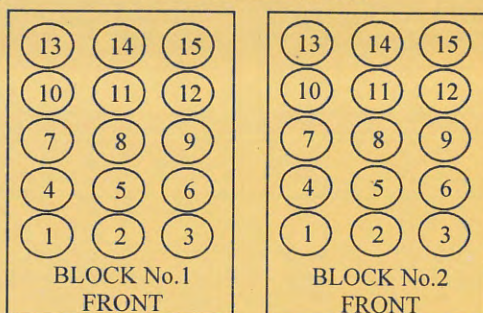
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

### 2. REFERENCE STANDARD INSTRUMENTS :-

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

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

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



### TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	149.8
	2	149.6
	3	149.7
	4	149.8
	5	149.9
	6	149.8
	7	149.8
	8	149.8
	9	149.9
	10	149.8
	11	149.9
	12	149.7
	13	149.9
	14	149.9
	15	149.7
Uncertainty of Measurement(± °C)	0.86	0.86

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

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

END OF CALIBRATION REPORT





CERTIFICATE No : 22M2569

REFERENCE No : 64386-3

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 : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY :   
PONGSAK J.

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22





CERTIFICATE No : 22M2569

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	MODEL	:	BSA224S-CW
MANUFACTURER	:	SARTORIUS	S/N	:	36591843
ID No	:	BA 09/61	RECEIVED DATE	:	11-Mar-22
AIR PRESSURE	:	1008mbar $\pm$ 1mbar	CALIBRATION DATE	:	11-Mar-22
AMBIENT TEMPERATURE	:	22° C $\pm$ 1° C	RELATIVE HUMIDITY	:	51 %RH $\pm$ 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

### 2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

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

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

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

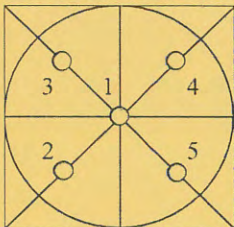
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9999
2	99.9999
3	100.0000
4	99.9999
5	99.9998
OFF-CENTER LOADING	0.0001

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

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

END OF CALIBRATION REPORT





CERTIFICATE No : 23M2442

REFERENCE No : 68471-2

PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : SARTORIUS

**MODEL** : BSA224S-CW

**SERIAL No** : 36591843

**ID No** : BA 09/61

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : ATSAWIN Y.

**CALIBRATION DATE** : 10-Mar-23

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

**ISSUED DATE** : 16-Mar-23

**RECEIVED DATE** : 10-Mar-23





CERTIFICATE No : 23M2442

PAGE : 2 OF 2

## Calibration Report

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

### CONDITION OF THIS RESULTS OF CALIBRATION

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. 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 CENTRAL BUREAU OF WEIGHTS&MEASURES

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

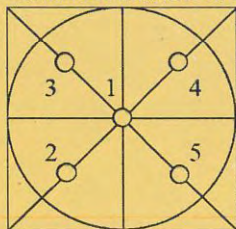
2. TARE FUNCTION : NORMAL

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	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	99.9999
3	99.9998
4	100.0001
5	100.0000
OFF-CENTER LOADING	0.0002

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

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

END OF CALIBRATION REPORT





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

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

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
<b>MODEL</b>	<b>SERIAL NUMBER</b>	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Methods</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>May 30, 2023</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>February 28, 2023</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>August 30, 2023</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2023</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER** 077C7042401**DATE TESTED** January 11, 2023**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

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

☐ OK

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

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER :** 077C7042401
**DATE TESTED :** January 11, 2023

PARAMETER		SPECIFICATION		FINAL VALUE	
<b>Spectral Resolution : UV</b>	<b>As</b> 193.696 nm	$\leq 0.007$		<u>0.00504</u>	
	<b>Ni</b> 231.604 nm	$\leq 0.008$		<u>0.00646</u>	
	<b>Ni</b> 341.476 nm	$\leq 0.012$		<u>0.00768</u>	
<b>Spectral Resolution : VIS</b>	<b>La</b> 408.672 nm	$\leq 0.020$		<u>0.01597</u>	
	<b>Ba</b> 455.403 nm	$\leq 0.025$		<u>0.02185</u>	
<b>Precision</b>					
	<b>As</b> 193.656 nm	% RSD	< 1.0	<u>0.89</u>	%
	<b>Zn</b> 213.856 nm	% RSD	< 1.0	<u>0.77</u>	%
	<b>Mn</b> 257.610 nm	% RSD	< 1.0	<u>0.51</u>	%
	<b>La</b> 379.478 nm	% RSD	< 1.0	<u>0.44</u>	%
	<b>Ba</b> 455.403 nm	% RSD	< 1.0	<u>0.44</u>	%
	<b>Ba</b> 493.408 nm	% RSD	< 1.0	<u>0.46</u>	%
<b>Detection Limits : Axial</b>	<b>Tl</b> 190.080 nm	3(sd)		<u>4.04</u>	ppb
	<b>As</b> 193.696 nm	3(sd)		<u>3.58</u>	ppb
	<b>Pb</b> 220.353 nm	3(sd)		<u>1.90</u>	ppb
<b>Detection Limits : Radial</b>	<b>As</b> 193.696 nm	3(sd)		<u>47.72</u>	ppb
	<b>Zn</b> 213.856 nm	3(sd)		<u>1.02</u>	ppb
	<b>Mn</b> 257.610 nm	3(sd)		<u>0.68</u>	ppb
	<b>La</b> 379.478 nm	3(sd)		<u>1.43</u>	ppb
	<b>Ba</b> 455.403 nm	3(sd)		<u>0.10</u>	ppb
	<b>Ba</b> 493.408 nm	3(sd)		<u>0.36</u>	ppb
<b>BEC : Axial (IB X 500)/(IS-IB)</b>	<b>Cd</b> 226.502 nm	$\leq 150$ ppb		<u>58.36</u>	
<b>BEC : Radial (IB X 1000)/(IS-IB)</b>	<b>Mn</b> 257.610 nm	$\leq 45$ ppb		<u>104142.80</u>	



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER** 077C7042401**DATE TESTED** January 11, 2023**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

**Service Department PerkinElmer Ltd.**

**Authorized Representative:**


( Mr. Wiphan Promlumda )

Service Engineer



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

<b>Company Name:</b>	SPS CONSULTING SERVICE CO.,LTD.		
<b>Address (Instrument Location):</b>	7 SOI PHAHOLYOTHIN 24,PHAHOLYOTHIN RD. JOMPOL,CHATUCHAK, BANGKOK		
<b>Serial Number:</b>	PTCS14111103	<b>PM Number:</b>	1-2
<b>Customer Name (if applicable):</b>	K. PHENPHA	<b>Telephone Number:</b>	083-926-9252
<b>Customer Support Engineer Name:</b>	K. DUANG	<b>Service Order Number:</b>	WO-02044564
<b>Date PM Performed: (DD-MMM-YYYY)</b>	06-Jan-2023	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	06-Jul-2023
<b>Standard Labor Hours to Complete PM :</b>		<b>5 hours</b>	

Part Number	Release	Publication Date	
09370143 Rev.9	A	January 2018	

### **Scope**

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

The customer should save their method before the PM begins.

### **General Instructions:**

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

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## Component List

Component / Specific Model	Serial #	Configuration Notes
AS900	AS9S14B1002	WINLAB 32

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A
N3160156	O-Ring Kits for Sampling Introduction ( Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction ( Plastic Nebulizer)	2
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	2

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	56-021CRY1	30-Jun-2023

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



Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

# Procedure Checklist

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

## 1. General:

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

## 2. PC Instrument Software:

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

## 3. Mechanical:

- ✓ Inspect and clean all fans and filters. Replace filters if necessary
- ✓ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ✓ Clean exterior of the instrument.

### 3.1 Flame Technique

- ✓ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ✓ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ✓ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ✓ Check the drain system for signs of wear. Replace worn or damaged parts.
- ✓ Visually check for proper flame conditions when igniting the Air-C<sub>2</sub>H<sub>2</sub> and N<sub>2</sub>O-C<sub>2</sub>H<sub>2</sub> flames (if applicable).

### 3.2 THGA Technique

- ✓ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ✓ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ✓ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ✓ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ✓ Check furnace open/close function.
- ✓ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ✓ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ✓ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ✓ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN



- ✓ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ✓ Check auto sampler operation.
- ✓ Perform an auto sampler check valve test as described in the Service Manual.
- ✓ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ✓ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.

#### 4. Electrical:

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

#### 5. Optics:

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

#### 6. Gasses:

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

#### 7. Flame Interlock Check:

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

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

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

### 8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.1982	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.9942	Passed

### 8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0014	Passed

### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

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

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0083	Passed

### 8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0002	Passed



### 8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	$\leq 0.005$	0.0021	Passed

### 8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	$> 0.250$ Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	$> 0.250$ Abs.	0.3281	Passed

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

### 9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

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

### 9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	$\leq 0.005$ Abs.	0.0000	Passed
Standard Deviation	$\leq 0.005$	0.0002	Passed

### 9.3 Chromium Characteristic Mass and Precision

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

Parameter	Specification	Results	Pass/Fail
Cr $m_0$ Results	$\leq 7.0$ pg/0.0044 A-s	5.7	Passed
Precision	$\leq 2.0$ %	0.74	Passed

#### 9.4 Copper Characteristic Mass and Zeeman Ratio

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

Parameter	Specification	Results	Pass/Fail
Cu m <sub>0</sub> Result	≤ 16.5 pg/0.0044 A-s	12.3	Passed
Zeeman Ratio	0.52 ± 0.04	0.54	Passed

#### 10. Review:

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



## Additional Comments

Additional Comments Regarding the PM	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1855}{0.1855+0.1563}$ $= 0.54$
REPLACE PM KIT	

## Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.</i>		
<i>This PinAAcle 900T Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>		
<b>Review of Preventive Maintenance:</b>		
Authorized PerkinElmer Representative:	<div style="background-color: #808080; width: 100%; height: 100%;"></div>	Date: 06-Jan-2023 <small>(DD-MMM-YYYY)</small>
Authorized Customer Representative:	<div style="background-color: #808080; width: 100%; height: 100%;"></div>	Date: 06-Jan-2023 <small>(DD-MMM-YYYY)</small>

คุณภาพอากาศในบรรยากาศ





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

## High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

### Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	01/02/2023	$y = 1.278x - 5.652$	0.997
B02	B02	02/02/2023	$y = 1.147x + 0.663$	0.999
B03	B03	01/02/2023	$y = 1.123x - 0.622$	0.995
B04	B04	01/02/2023	$y = 1.229x - 4.835$	0.996
B05	B05	02/02/2023	$y = 1.280x - 6.358$	0.997
B06	B06	01/02/2023	$y = 1.251x - 5.438$	0.999
B07	B07	03/02/2023	$y = 1.165x - 3.515$	0.996
B08	B08	03/02/2023	$y = 1.269x - 7.559$	0.997
B09	B09	01/02/2023	$y = 1.198x - 2.843$	0.998
B10	B10	01/02/2023	$y = 1.128x + 0.785$	0.999
B11	B11	02/02/2023	$y = 1.138x - 1.752$	0.999
B12	B12	01/02/2023	$y = 1.195x - 4.080$	0.998
B13	B13	01/02/2023	$y = 1.254x - 5.913$	0.999
B14	B14	03/02/2023	$y = 1.291x - 7.822$	0.999
B15	B15	01/02/2023	$y = 1.149x - 1.829$	0.997
B16	B16	01/02/2023	$y = 1.287x - 7.502$	0.997
B17	B17	02/02/2023	$y = 1.207x - 4.147$	1.000
B18	B18	01/02/2023	$y = 1.277x - 7.238$	0.999
B19	B19	03/02/2023	$y = 1.243x - 6.520$	0.995
B20	B20	01/02/2023	$y = 1.267x - 7.055$	1.000
B21	B21	03/02/2023	$y = 1.141x - 1.101$	0.999
B22	B22	03/02/2023	$y = 1.221x - 5.534$	0.996
B23	B23	02/02/2023	$y = 1.197x - 4.328$	0.995
B24	B24	01/02/2023	$y = 1.159x - 2.269$	0.999
B25	B25	01/02/2023	$y = 1.050x + 2.684$	0.998
B26	B26	03/02/2023	$y = 1.253x - 6.203$	0.997
B27	B27	03/02/2023	$y = 1.220x - 5.822$	0.997
B28	B28	01/02/2023	$y = 1.251x - 6.762$	0.999
B29	B29	01/02/2023	$y = 1.201x - 3.793$	0.998
B30	B30	03/02/2023	$y = 1.242x - 6.540$	0.995
B31	B31	03/02/2023	$y = 1.255x - 6.608$	0.999
B32	B32	02/02/2023	$y = 1.249x - 6.292$	0.997
B33	B33	02/02/2023	$y = 1.260x - 5.168$	0.997
B34	B34	01/02/2023	$y = 1.272x - 7.454$	1.000

Calibrated by :

(Mr. Adul Dangklom)

(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>
B01	B01	02/02/2023	$y = 1.210x - 0.261$	0.997
B02	B02	02/02/2023	$y = 1.046x + 2.414$	0.998
B03	B03	02/02/2023	$y = 1.199x - 4.047$	0.996
B04	B04	02/02/2023	$y = 1.288x - 7.602$	0.997
B05	B05	01/02/2023	$y = 1.222x - 4.886$	1.000
B06	B06	01/02/2023	$y = 1.210x - 3.612$	0.996
B07	B07	03/02/2023	$y = 1.270x - 6.088$	0.999
B08	B08	01/02/2023	$y = 1.277x - 5.288$	0.998
B09	B09	03/02/2023	$y = 1.289x - 6.478$	0.999
B10	B10	03/02/2023	$y = 1.266x - 8.106$	0.997
B11	B11	01/02/2023	$y = 1.258x - 6.917$	0.995
B12	B12	02/02/2023	$y = 1.192x - 3.640$	0.998
B13	B13	02/02/2023	$y = 1.289x - 7.913$	0.998
B14	B14	02/02/2023	$y = 1.250x - 4.233$	0.999
B15	B15	01/02/2023	$y = 1.118x + 0.802$	0.999
B16	B16	03/02/2023	$y = 1.297x - 3.106$	0.998
B17	B17	01/02/2023	$y = 1.204x - 4.477$	0.996
B18	B18	02/02/2023	$y = 1.176x - 1.624$	0.998
B19	B19	02/02/2023	$y = 1.097x + 1.230$	0.999
B20	B20	03/02/2023	$y = 1.188x - 4.372$	0.999
B21	B21	03/02/2023	$y = 1.156x - 0.146$	0.996
B22	B22	03/02/2023	$y = 1.269x - 6.647$	0.998
B23	B23	02/02/2023	$y = 1.197x - 2.685$	1.000
B24	B24	02/02/2023	$y = 1.251x - 6.437$	0.995
B25	B25	01/02/2023	$y = 1.144x - 2.851$	0.997
B26	B26	01/02/2023	$y = 1.249x - 5.704$	0.996
B27	B27	01/02/2023	$y = 1.241x - 5.428$	0.997
B28	B28	01/02/2023	$y = 1.198x - 4.626$	0.998
B29	B29	02/02/2023	$y = 1.244x - 7.658$	0.997
B30	B30	02/02/2023	$y = 1.246x - 7.229$	0.997
B31	B31	02/02/2023	$y = 1.178x - 0.243$	0.995
B32	B32	03/02/2023	$y = 1.201x - 2.954$	0.998
B33	B33	03/02/2023	$y = 1.168x - 1.341$	0.997
B34	B34	01/02/2023	$y = 1.237x - 2.684$	0.995

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)





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# CALIBRATION REPORT

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

DATE : 04 February 2023

BRAND : API

MODEL : 100E

NO. SO<sub>2</sub>-B04

SERIAL NO. 3159

### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

### Reference Standard Gas

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

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 50.0 ppm

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO <sub>2</sub> Span	400.0	400.3	0.075	400.0	1.017

### 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	662	cc/min	650 ± 10%
PMT	103.4	mV	-20-150 with Zero Air
UV LAMP	3049.7	mV	1000-4900
STR. LGT	61.9	PPB	<100
DRK PMT	63.5	mV	-50 - 200
DRK LMP	58.2	mV	-50 - 200
HVPS	675	V	550-900 constant
DCPS	2522	mV	2500 ± 200
RCELL TEMP	50.5	°C	50 ± 1
BOX TEMP	29.3	°C	5-40
PMT TEMP	7.2	°C	7 ± 2.0
SO <sub>2</sub> Span Conc	400	PPB	20-20,000
SO <sub>2</sub> Slope	1.017	-	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)

(Mr.Peera Detudom)





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### CALIBRATION REPORT

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

DATE : 04 February 2023

BRAND : API

MODEL : 100E

NO. SO<sub>2</sub>-B05

SERIAL NO. 3270

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

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

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 50.0 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.7	-0.075	400.0	1.006

#### 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	103.1	mV	-20-150 with Zero Air
UV LAMP	3025.6	mV	1000-4900
STR. LGT	61.7	PPB	<100
DRK PMT	63.1	mV	-50 - 200
DRK LMP	57.9	mV	-50 - 200
HVPS	670	V	550-900 constant
DCPS	2527	mV	2500 ± 200
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.5	°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	1.006	-	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)

(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	04 February 2023	BRAND :	API	MODEL :	100E
NO.	SO <sub>2</sub> -B06			SERIAL NO.	3430
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 04 August 2022			Serial No.	: 911
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
				% RH	49
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO <sub>2</sub> Span	400.0	400.2	0.050	400.0	1.014
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	656	cc/min	650 ± 10%		
PMT	102.9	mV	-20-150 with Zero Air		
UV LAMP	3006.5	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.7	mV	-50 - 200		
HVPS	669	V	550-900 constant		
DCPS	2516	mV	2500 ± 200		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.2	°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	1.014	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	22.1	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

(Mr.Peera Detudom)





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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	04 February 2023	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO <sub>2</sub> -B11			SERIAL NO.	SO2187
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 04 August 2022			Serial No.	: 911
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO <sub>2</sub> Span	400.0	400.1	0.025	400.0	1.010
API Model TML-50 SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.6	in-Hg	25-35		
SAMPLE FLOW	653	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3015.4	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	63.2	mV	-50 - 200		
DRK LMP	58.0	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2520	mV	2500 ± 200		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.1	°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	1.010	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	21.7	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

(Mr.Peera Detudom)



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### CALIBRATION REPORT

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 04 February 2023

BRAND : API

MODEL : 200E

NO. NOX-B07

SERIAL NO. 4338

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.2	0.050	400.0	1.010
NO <sub>x</sub> Span	400	400.3	0.075	400.0	1.015

#### 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	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	675	V	420 - 900 constant
RCELL TEMP	50.5	°C	50 ± 1
BOX TEMP	29.2	°C	8 - 48
PMT TEMP	7.4	°C	7 ± 2
MOLY TEMP	315.2	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.010	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.015	-	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)

(Mr.Peera Detudom)



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### CALIBRATION REPORT

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 04 February 2023

BRAND : API

MODEL : 200E

NO. NOX-B08

SERIAL NO. 4336

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.003
NO <sub>x</sub> Span	400	399.8	-0.050	400.0	1.006

#### 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	509	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.4	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	0.999	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.004	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO <sub>x</sub> Offset	0.7	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

(Mr.Adul Dangklom)

(Mr.Peera Detudom)





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

### CALIBRATION REPORT

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 04 February 2023

BRAND : API

MODEL : 200E

NO. NOX-B16

SERIAL NO. 249

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.008
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.011

#### 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	507	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.5	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	671	V	420 - 900 constant
RCELL TEMP	50.3	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	314.7	°C	315 ± 5
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.008	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.011	-	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 :

Adul

(Mr.Adul Dangklom)

(Mr.Peera Detudom)



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### CALIBRATION REPORT

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 04 February 2023

BRAND : API

MODEL : TML-41M

NO. NOX-B20

SERIAL NO. N02782

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 04 August 2022

Serial No. : 911

#### Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : D636192

Certified Date : 20 April 2022

Expired Date : 20 April 2024

Cylinder Conc. : 49.1 ppm

#### CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.5 °C

% RH 49

#### CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.005
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.009

#### API Model TML-41M NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	507	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.0	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	315.4	°C	315 ± 5
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000
NO Slope	1.005	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.009	-	1.0 ± 0.3
NO Offset	1.2	mV	-20 to +150
NO <sub>x</sub> Offset	0.8	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

(Mr.Adul Dangtorn)

(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 : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS 105DU

**SERIAL No** : 1126422905

**ID No** : BA 05/50

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : TETNITHI W.

**CALIBRATION DATE** : 11-Mar-22

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

**ISSUED DATE** : 17-Mar-22

**RECEIVED DATE** : 11-Mar-22

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





CERTIFICATE No : 22M2567

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS 105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA 05/50 RECEIVED DATE : 11-Mar-22  
AIR PRESSURE : 1008mbar  $\pm$  1mbar CALIBRATION DATE : 11-Mar-22  
AMBIENT TEMPERATURE : 22° C  $\pm$  1° C RELATIVE HUMIDITY : 49 %RH  $\pm$  10 % RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

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

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

**RESULT OF CALIBRATION** :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

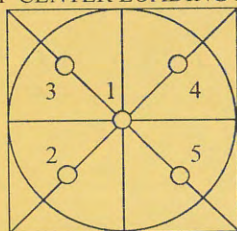
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0000
OFF-CENTER LOADING	0.00001	0.0001

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

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

END OF CALIBRATION REPORT

คุณภาพอากาศจากปล่องระบาย





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

## Console Calibration Report

Calibration Method

Critical Orifices

### Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{@}$ (mmH <sub>2</sub> O)
B01	1563	01/12/2022	1.007	49.94
B02	8002514	02/12/2022	1.002	49.41
B03	1503016	05/12/2022	1.004	50.46
B04	00006659	01/12/2022	1.007	49.43
B05	00007428	01/12/2022	0.998	49.80
R01	1561	01/12/2022	1.004	49.52
R02	8002513	01/12/2022	1.003	49.77
R03	1570	05/12/2022	1.008	49.68
R04	8002519	05/12/2022	0.997	50.12
R05	1503015	01/12/2022	1.003	50.08

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

Accept Value of  $\Delta H_{@}$  (test) is  $46.7 \pm 6.4$  (mmH<sub>2</sub>O)

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)





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## Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	02/02/2023	0.84	0.84
B04	S	0.99	01/02/2023	0.84	0.83
B05	S	0.99	02/02/2023	0.84	0.85
B07	S	0.99	02/02/2023	0.85	0.84
B08	S	0.99	01/02/2023	0.83	0.84
B09	S	0.99	01/02/2023	0.84	0.84
B11	S	0.99	01/02/2023	0.84	0.84
B16	S	0.99	01/02/2023	0.84	0.83
B18	S	0.99	02/02/2023	0.84	0.84
B19	S	0.99	02/02/2023	0.85	0.84
B21	S	0.99	03/02/2023	0.84	0.84
B24	S	0.99	03/02/2023	0.84	0.83
B27	S	0.99	02/02/2023	0.84	0.84
B30	S	0.99	01/02/2023	0.83	0.84
B31	S	0.99	02/02/2023	0.84	0.85
B33	S	0.99	03/02/2023	0.84	0.84
B35	S	0.99	02/02/2023	0.84	0.85

Remark : Accept value of Cp (test) is  $0.84 \pm 0.01$

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)

## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220066-1]  
CLID. NO. : 212201112  
JOB CONTROL NO. : 220720073201

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

DATE OF RECEIVED : 20 July 2022

DATE OF ISSUED : 22 July 2022

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sittipong Pimdee  
Calibration Engineer



Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
22 July 2022

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. Q22073201

F3-011-04/01-12

page 1 of 3



@clccalibration

## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220066-1]  
DATE OF CALIBRATION : 21 July 2022

---

#### ENVIRONMENT CONDITIONS :

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

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

#### PROCEDURE USED :

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

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

#### REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 744 S/N. 9226007 with Pressure Module Model 700PV4 S/N. 19298401.

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).  
Certificate No. MP-0196-21, Due Date 17 November 2022.

#### UNCERTAINTY :

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

Certificate No. **Q22073201**

F3-011-04/01-12

page 2 of 3



@clccalibration



## CONDITION OF CALIBRATION ITEM : GOOD

## MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment

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

### CALIBRATION DATA

#### CORRECTION OF PRESSURE

DUC Test point ( inHg )	STD Reading ( inHg )		Correction ( inHg )	
	Up	Down	Up	Down
0	0.0	0.0	0.0	0.0
-5	-4.6	-4.7	+0.4	+0.3
-10	-9.5	-9.6	+0.5	+0.4
-15	-14.4	-14.5	+0.6	+0.5
-20	-19.4	-19.5	+0.6	+0.5
-25	-24.5	-24.5	+0.5	+0.5
-30	-29.5	-29.5	+0.5	+0.5

Uncertainty of measurement  $\pm 0.2$  inHg

Transmitting fluid : Air.

Technical Note. k factor 1 kPa = 0.2952998 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 36 of 54

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

### End of Certificate ###

Certificate No. Q22073201

F3-011-04/01-12

page 3 of 3



@clccalibration



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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  $\pm$  3  $^{\circ}$ C  
Pressure : 1010  $\pm$  15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B01	SKC	224-PCXR4	262101	03/01/2023	1,000	1,500	2,000	993	1,497	1,998	1.003x - 5.584	1.000
B02	SKC	224-PCXR4	626166	03/01/2023	1,000	1,500	2,000	1,003	1,505	2,001	1.009x - 19.667	0.999
B03	SKC	224-PCXR4	612968	03/01/2023	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.109	1.000
B04	SKC	224-PCXR4	602804	04/01/2023	1,000	1,500	2,000	1,000	1,502	1,995	1.000x - 0.893	1.000
B05	SKC	224-PCXR4	612693	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 22.224	0.999
B06	SKC	224-PCXR4	262188	03/01/2023	1,000	1,500	2,000	995	1,508	2,005	1.011x - 20.273	1.000
B07	SKC	224-PCXR4	626262	03/01/2023	1,000	1,500	2,000	998	1,492	1,995	0.993x + 6.086	1.000
B08	SKC	224-PCXR4	626100	03/01/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 23.308	0.999
B09	SKC	224-PCXR4	626479	03/01/2023	1,000	1,500	2,000	996	1,490	1,994	0.995x + 1.117	1.000
B10	SKC	224-PCXR4	091950	03/01/2023	1,000	1,500	2,000	992	1,503	2,001	1.018x - 36.582	0.999
B11	SKC	224-PCXR8	564315	05/01/2023	1,000	1,500	2,000	996	1,490	1,999	1.003x - 8.256	1.000
B12	SKC	224-PCXR4	034656	05/01/2023	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.324	0.999
B13	SKC	224-PCXR4	602073	05/01/2023	1,000	1,500	2,000	995	1,500	1,998	1.001x - 3.474	1.000
B14	SKC	224-PCXR4	626313	04/01/2023	1,000	1,500	2,000	999	1,491	1,988	0.992x + 6.844	1.000
B15	SKC	224-PCXR4	626474	04/01/2023	1,000	1,500	2,000	1,001	1,502	2,005	1.014x - 25.558	0.999
B16	SKC	224-PCXR4	626477	04/01/2023	1,000	1,500	2,000	994	1,504	2,001	1.015x - 31.345	0.999
B17	SKC	224-PCXR4	626860	04/01/2023	1,000	1,500	2,000	997	1,494	1,991	0.997x - 0.359	1.000
B18	SKC	224-PCXR4	691484	04/01/2023	1,000	1,500	2,000	1,003	1,500	2,001	1.008x - 17.589	0.999
B19	SKC	224-PCXR4	691599	03/01/2023	1,000	1,500	2,000	993	1,503	1,999	1.007x - 11.574	1.000
B20	SKC	224-PCXR4	691587	03/01/2023	1,000	1,500	2,000	992	1,504	1,999	1.015x - 32.235	0.999
B21	SKC	224-PCXR4	691531	03/01/2023	1,000	1,500	2,000	993	1,499	1,994	1.001x - 7.107	1.000
B22	SKC	224-PCXR4	691654	05/01/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 21.107	0.999
B23	SKC	224-PCXR4	798393	05/01/2023	1,000	1,500	2,000	992	1,507	2,002	1.018x - 34.883	0.999
B24	SKC	224-PCXR4	626363	05/01/2023	1,000	1,500	2,000	1,000	1,502	2,000	1.011x - 22.387	0.999
B25	SKC	224-PCXR4	798489	05/01/2023	1,000	1,500	2,000	1,001	1,492	2,001	0.998x + 1.101	1.000
B26	SKC	224-PCXR4	798479	05/01/2023	1,000	1,500	2,000	999	1,500	1,993	0.996x + 4.008	1.000
B27	SKC	224-PCXR4	691673	04/01/2023	1,000	1,500	2,000	994	1,503	2,002	1.016x - 32.071	0.999
B28	SKC	224-PCXR4	691570	04/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.012x - 22.515	0.999
B29	SKC	224-PCXR4	626472	04/01/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.001x - 4.942	1.000
B30	SKC	224-PCXR4	691489	03/01/2023	1,000	1,500	2,000	1,004	1,510	2,004	1.008x - 12.460	0.999
B31	SKC	224-PCXR4	691509	03/01/2023	1,000	1,500	2,000	992	1,497	1,998	1.006x - 12.711	1.000
B32	SKC	224-PCXR4	091567	05/01/2023	1,000	1,500	2,000	991	1,504	2,001	1.016x - 32.322	0.999
B33	SKC	224-PCXR4	091756	05/01/2023	1,000	1,500	2,000	993	1,497	1,991	0.997x - 0.004	1.000
B34	SKC	224-PCXR4	612962	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,002	1.007x - 14.195	1.000
B35	SKC	224-PCXR4	602682	05/01/2023	1,000	1,500	2,000	993	1,498	1,995	1.002x - 8.448	1.000
B36	SKC	224-PCXR4	626164	03/01/2023	1,000	1,500	2,000	999	1,496	1,999	1.001x - 5.424	1.000
B37	SKC	224-PCXR4	626256	03/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.013x - 27.815	0.999
B38	SKC	224-PCXR4	626167	03/01/2023	1,000	1,500	2,000	997	1,496	1,996	0.999x - 0.997	1.000
B39	SKC	224-PCXR4	034637	03/01/2023	1,000	1,500	2,000	1,005	1,501	2,001	1.010x - 18.618	0.999
B40	SKC	224-PCXR4	798349	05/01/2023	1,000	1,500	2,000	994	1,506	1,999	1.014x - 29.602	0.999

Calibrated 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

### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

Temperature : 25  $\pm$  3 °C  
Pressure : 1010  $\pm$  15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R <sup>2</sup>
B41	SKC	224-PCXR4	612669	05/01/2023	1,000	1,500	2,000	998	1,497	1,990	0.997x + 0.718	1.000
B42	SKC	224-PCXR4	626041	05/01/2023	1,000	1,500	2,000	1,004	1,498	1,991	0.986x + 18.291	1.000
B43	SKC	224-PCXR4	034636	05/01/2023	1,000	1,500	2,000	1,000	1,501	1,992	0.991x + 11.882	1.000
B44	SKC	224-PCXR8	529341	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,002	1.005x - 9.213	1.000
B45	SKC	224-PCXR8	529594	06/01/2023	1,000	1,500	2,000	999	1,501	1,989	0.991x + 11.184	1.000
B46	SKC	224-PCXR8	566743	06/01/2023	1,000	1,500	2,000	995	1,504	2,002	1.014x - 30.571	0.999
B47	SKC	224-PCXR8	566747	06/01/2023	1,000	1,500	2,000	1,002	1,502	2,004	1.013x - 24.601	0.999
B48	SKC	224-PCXR8	566753	04/01/2023	1,000	1,500	2,000	1,000	1,494	1,998	0.998x + 0.319	1.000
B49	SKC	224-PCXR8	566780	04/01/2023	1,000	1,500	2,000	1,003	1,502	2,006	1.013x - 23.982	0.999
B50	SKC	224-PCXR8	500400	04/01/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.001x - 3.538	1.000
B51	SKC	224-PCXR8	500363	04/01/2023	1,000	1,500	2,000	996	1,504	1,999	1.011x - 25.031	0.999
B52	SKC	224-PCXR8	093186	04/01/2023	1,000	1,500	2,000	995	1,496	1,994	0.997x - 0.602	1.000
B53	SKC	224-PCXR8	707670	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.008x - 15.403	0.999
B54	SKC	224-PCXR3	509821	03/01/2023	1,000	1,500	2,000	993	1,502	2,001	1.017x - 34.237	0.999
B55	SKC	224-PCXR3	510710	03/01/2023	1,000	1,500	2,000	999	1,494	1,994	0.997x - 0.989	1.000
B56	SKC	224-PCXR3	511450	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,001	1.004x - 8.081	1.000
B57	SKC	224-PCXR3	510798	06/01/2023	1,000	1,500	2,000	997	1,492	1,998	1.000x - 2.680	1.000
B58	SKC	224-PCXR3	509852	06/01/2023	1,000	1,500	2,000	1,000	1,498	1,999	1.007x - 18.953	0.999
B59	SKC	224-PCXR3	509862	06/01/2023	1,000	1,500	2,000	996	1,503	1,994	0.997x + 3.235	1.000
B60	SKC	224-PCXR3	512655	06/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.006x - 11.407	1.000
B61	SKC	224-PCXR3	503915	06/01/2023	1,000	1,500	2,000	994	1,489	1,998	1.004x - 12.623	1.000
B62	SKC	224-PCXR3	505975	06/01/2023	1,000	1,500	2,000	999	1,494	1,996	0.997x + 0.343	1.000
B63	SKC	224-PCXR3	511432	03/01/2023	1,000	1,500	2,000	991	1,501	1,999	1.016x - 34.624	0.999
B64	SKC	224-PCXR3	508302	03/01/2023	1,000	1,500	2,000	997	1,492	1,989	0.992x + 6.226	1.000
B65	SKC	224-PCXR3	508310	03/01/2023	1,000	1,500	2,000	1,002	1,500	2,003	1.007x - 13.936	1.000
B66	SKC	224-PCXR3	509861	03/01/2023	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.183	1.000
B67	SKC	224-PCXR3	506295	04/01/2023	1,000	1,500	2,000	993	1,508	2,004	1.009x - 15.555	1.000
B68	SKC	224-PCXR3	505872	04/01/2023	1,000	1,500	2,000	1,002	1,490	1,997	0.995x + 3.841	1.000
B69	SKC	224-PCXR3	508375	04/01/2023	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.772	0.999
B70	SKC	224-PCXR3	510623	05/01/2023	1,000	1,500	2,000	992	1,503	1,997	1.002x - 5.855	1.000
B71	SKC	224-PCXR3	508367	05/01/2023	1,000	1,500	2,000	992	1,506	2,002	1.017x - 34.791	0.999
B72	SKC	224-PCXR3	505977	05/01/2023	1,000	1,500	2,000	1,001	1,498	1,993	0.991x + 8.962	1.000
B73	SKC	224-PCXR3	512606	05/01/2023	1,000	1,500	2,000	1,002	1,501	2,005	1.009x - 14.785	1.000
B74	SKC	224-PCXR3	505993	05/01/2023	1,000	1,500	2,000	996	1,495	1,994	1.000x - 6.916	1.000
B75	SKC	224-PCXR3	509820	04/01/2023	1,000	1,500	2,000	995	1,498	1,990	0.996x + 1.791	1.000
B76	SKC	224-PCXR3	509811	04/01/2023	1,000	1,500	2,000	993	1,498	1,998	1.006x - 14.322	1.000
B77	SKC	224-PCXR3	508301	04/01/2023	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.603	0.999
B78	SKC	224-PCXR3	510677	04/01/2023	1,000	1,500	2,000	995	1,503	1,999	1.013x - 28.158	0.999
B79	SKC	224-PCXR3	510920	03/01/2023	1,000	1,500	2,000	994	1,493	1,994	0.999x - 4.184	1.000

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)





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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
H-B01	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	506.1	989.5	1973.5	0.990x + 8.311	1.000
H-B02	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	494.9	998.2	1995.3	0.993x + 4.772	1.000
H-B03	Dwyer	VFB-65	05/01/2023	500	1,000	2,000	498.3	987.5	2010.6	1.005x - 15.690	0.999
H-B04	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	500.4	999.5	2008.7	0.998x - 2.369	1.000
H-B05	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	499.0	997.8	1972.3	0.981x + 20.957	0.999
H-B06	Dwyer	VFB-65	03/01/2023	500	1,000	2,000	503.6	995.0	1981.4	1.005x - 8.788	0.999
H-B07	Dwyer	VFB-65	04/01/2023	500	1,000	2,000	504.1	989.0	2018.7	1.002x - 2.144	1.000
H-B08	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	499.8	999.2	1975.8	0.996x + 3.270	0.999
H-B09	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	503.7	1006.6	2014.3	0.994x + 14.202	1.000
H-B10	Dwyer	VFB-65	06/01/2023	500	1,000	2,000	496.1	998.6	2012.4	0.997x + 2.443	1.000

Calibrated by :

(Mr. Adul Dangklom)

(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 : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : METTLER TOLEDO

**MODEL** : XS 105DU

**SERIAL No** : 1126422905

**ID No** : BA 05/50

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : TETNITHI W.

**CALIBRATION DATE** : 11-Mar-22

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

**ISSUED DATE** : 17-Mar-22

**RECEIVED DATE** : 11-Mar-22

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





CERTIFICATE No : 22M2567

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS 105DU  
MANUFACTURER : METTLER TOLEDO S/N : 1126422905  
ID No : BA 05/50 RECEIVED DATE : 11-Mar-22  
AIR PRESSURE : 1008mbar  $\pm$  1mbar CALIBRATION DATE : 11-Mar-22  
AMBIENT TEMPERATURE : 22° C  $\pm$  1° C RELATIVE HUMIDITY : 49 %RH  $\pm$  10 % RH

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

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

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

**RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT**

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

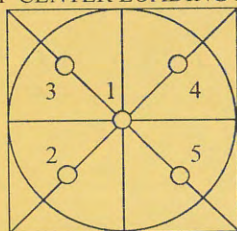
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

4. REPEATABILITY OF READING AT 100 g WAS 0.000048 g

5. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY ( $\pm$ g)
0.00	0.00000	0.00000	0.000058
0.02	0.01999	0.00001	0.000058
0.10	0.09999	0.00001	0.000059
0.20	0.19999	0.00001	0.000059
0.50	0.50001	-0.00001	0.000058
1.00	1.00001	-0.00001	0.000059
2.00	2.00000	0.00000	0.000059
5.00	5.00001	-0.00001	0.000061
10.00	10.00005	-0.00005	0.000063
20.00	20.00006	-0.00006	0.000069
50.00	50.0000	0.0000	0.00011
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001

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

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

END OF CALIBRATION REPORT



# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP22018

Pages 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501S14123010  
**ID No.:** SP03/58  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY  
  
**Condition As Found :** GOOD  
  
**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.  
  
**Location :** ORGANIC LABORATORY IV  
  
**Ambient Temperature :** ( 24.4 ± 5 ) °C  
**Relative Humidity :** ( 60.1 ± 25 ) %  
  
**Received Date :** 30 AUGUST 2022  
**Calibration Date :** 30 AUGUST 2022  
**Date of Issue :** 31 AUGUST 2022

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

( Thanakul Petchurai )

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



## Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

Pages : 2 of 3

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC\* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP22018  
Job No. : VC65SP0008  
Pages : 3 of 3

**Result of calibration : Photometric Accuracy**

(Without adjustment)

Material	Wavelength (nm)	Filter: S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	2.00	

UUC\* = Unit Under Calibration

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

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

Stray Light** UUC* Reading at 220 nm	
Transimission T(%)	Absorbance(A)
0.0107	3.9886

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

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

**End of Calibration Certificate**



Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name: S.P.S Consulting Service Address: 7 Soi Phahon Yothin 24, Phahon Yotin Rd., Chatujak, A. Chatuchak Bangkok 10900 Customer Tag No.:

## Certificate Details

Number: 2546/21 Date of Issue: 21-Jun-2021 Expiry date: 21-Jun-2023  
Material Details  
Production Order: 90166198 Material Code: 553600-SK-44 Cylinder No.: D636139  
Gas content: 5.52 M<sup>3</sup> Filling pressure: 145.0 bar Valve: CGA 660 SS  
Cylinder Owner: LINDE Cylinder Material: Spectra seal Cylinder Size: 40 L

## Laboratory Report

## Analytical Result

Component	Normal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Nitric Oxide	100 ppm	93.6 ppm	± 1% relative	(6) I-PB-352	14-Jun & 21-Jun-21
Other NOx impurity in Nitrogen		Less than 4.9 ppm			

## Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date
Nitric Oxide in Nitrogen	H17936	100.3 ± 0.8 ppm	24-Jun-2021

## Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-NO	25-May-2021

## Recommend usage condition

Minimum utilization: 5% of actual content or before expiry date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1.  
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.  
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoontorn

Signatory for and on behalf of Linde (Thailand) Co., Ltd

Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name: S.P.S Consulting Service Address: 7 Soi Phahon Yothin 24, Khet Chatuchak, Bangkok 10900 Customer Tag No.:

## Certificate Details

Number:	1138/22	Date of Issue:	19-Apr-2022	Expiry date:	19-Apr-2024
Material Details					
Production Order:	90170869	Material Code:	411800-AL-44	Cylinder No.:	D824400
Gas content:	6.90 M <sup>3</sup>	Filling pressure:	145.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Aluminum	Cylinder Size:	50 L

## Laboratory Report

## Analytical Result

Component	Normal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Nitric Oxide	200 ppm	201 ppm	± 1% relative	(6) I-PB-352	7-Apr & 19-Apr-22
Other NOx impurity In Nitrogen		Less than 10.0 ppm			

## Reference Standard

Nitric Oxide  
In Nitrogen

## Reference Standard used in Assay

Cylinder number	Concentration	Expiry date:
QA2565	99.4 ± 0.7 ppm	4-Feb-2023

Instrument/Make/Model  
FTIR Spectrometers Nicolet iS50

## Analytical Instruments used in Assay

Analytical Principle  
FTIR-NO

Last Multipoint Calibration  
9-Mar & 8-Apr-22

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1  
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.  
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer  
(5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoontorn  
Signatory for and on behalf of Linde (Thailand) Co., Ltd.

PB-002/F006

บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)

เลขที่ใบอนุญาตเลขที่ 0107531000785

ชั้น 15 ถนนพหลโยธินเลขที่ 2/3 หมู่ 14 ถนนบางนา-ตราด กม. 6.5 แขวงบางนา

อ.บางพลี อ.สมุทรปราการ 10540 โทรศัพท์ (66) 2338-6100 โทรสาร (66) 2338-6333

โรงงานเวลโกรว์ 105 หมู่ 5 อ.บางพลี อ.บางปะกง จ.สมุทรสาคร 24180

โทรศัพท์ (66) 38.570-479-93

โทรสาร (66) 38.570-323

Linde (Thailand) Public Company Limited

Iss: K/2, 15 Oct 2021

PKC Registration no. 0107531000785

15<sup>th</sup> Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trd KM. 6.5 Road, Bangkaew

Bangplee, Samutprakarn 10540, Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant : 105 Moo 5, T.Bangsamak, A.Bangpakong, Chachoengsao 24180

Thailand, Tel (66) 38.570-479-93

Fax (66) 38.570-323



### Customer Details

Address:  
7 Soi Phahon Yothin 24, Phahon Yotin Rd.,  
Chatujak, A. Chatuchak Bangkok 10900

Customer Tag No.:

Number:	2574/21	Date of Issue:	21-Jun-2021	Expiry date:	21-Jun-2029
Material Details					
Production Order:	90166199	Material Code:	627400-SK-44	Cylinder No.:	A00710SK
Gas content:	5.52 M <sup>3</sup>	Filling pressure:	145.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	40 L

### Analytical Result

Component	Normal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Sulphur Dioxide In Nitrogen	50.0 ppm	50.2 ppm	± 1% relative	(6) I-PB-352	12-Jun & 19-Jun-21

*Reference Standard used in Assay*

Reference Standard	Cylinder number	Concentration	Expiry date:
Sulphur Dioxide In Nitrogen	1331885G	30.50 ± 0.40 ppm	16-Oct-2021

#### Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet i550	FTIR-SQ2	7-Jun-2021

Minimum utilization: 5% of actual content or before expire date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

When reordering, please quote the material number

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-800/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure 51  
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.  
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer  
5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoontorn  
Signatory for and on behalf of Linde (Thailand) Co. Ltd.

Linde (Thailand) Public Company Limited 551 2 31 45 252\*

10/22/2022 11:22:22

15 Floor, Bangna Tower A, 2/3 Moo 14, Bangna-Trad KM. 3.5 Road, Bangnaeaw  
Bangkok 10540, Tel (66) 2332-8100 Fax (66) 2332-8332

Wellgrow Plant 105 Moo 5, Tambangsek, A.Bangpakong, Chachoengsao 24130

Thailand, Tel (66) 33.570-479-93 Fax (66) 33.570-323

### Customer Details

Address:  
7, Soi Phahon Yothin 24, Phahon Yothin Rd.,  
Chatujak, Bangkok, 10900

Customer Tag No.:

### Certificate Details

Number:	2420/19	Date of Issue:	25-Jul-2019	Expiry date:	24-Jul-2027
Material Details					
Production Order:	90154858	Material Code:	636400-SK-44	Cylinder No.:	A00797SK
Gas content:	5.520 M <sup>3</sup>	Filling pressure:	145.0 bar	Valve:	CGA 660 SS
Cylinder Owner:	LINDE	Cylinder Material:	Spectra seal	Cylinder Size:	40 L

## Laboratory Report

### Analytical Result

Component	Normal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Sulphur Dioxide In Nitrogen	100 ppm	102 ppm	= 1% relative	(6) I-PB-352	17-Jul & 24-Jul-19

#### Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date
Sulphur Dioxide in Nitrogen	2580055G	103.1 ± 0.8 ppm	9-Aug-2020

#### Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
FTIR Spectrometers Nicolet iS50	FTIR-SO2	24-Jun-2019

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G<sup>+</sup>.  
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.  
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoonporn  
 Signatory for and on behalf of Linde (Thailand) Co., Ltd.



Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name: S.P.S Consulting Service Address: 7 Soi Phahon Yothin 24, Phahon Yotin Rd., Khet Chatuchak Bangkok 10900 Customer Tag No.:

## Certificate Details

Number: 2256/20 Date of Issue: 22-May-2020 Expiry date: 21-May-2028  
Material Details  
Production Order: 90160385 Material Code: 590800-J-44 Cylinder No.: 5858  
Gas content: 6.56 M<sup>3</sup> Filling pressure: 145.0 bar Valve: CGA 590 BRASS  
Cylinder Owner: LINDE Cylinder Material: STEEL Cylinder Size: 47 L

## Laboratory Report

## Analytical Result

Component	Normal Concentration	Analysis Result <sup>1</sup>	Uncertainty <sup>2</sup>	Method of Analysis <sup>3</sup>	Assay Date
Oxygen In Nitrogen	15.0%	14.9%	± 1% relative	(6) I-PB-352	22-May-2020

## Reference Standard used in Assay

Reference Standard	Cylinder number	Concentration	Expiry date:
Oxygen In Nitrogen	53281	9.98 ± 0.05%	13-Sep-2021

## Analytical Instruments used in Assay

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Servomex 4100 O2 analyser	Paramagnetic	21-May-2020

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

- All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
- The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
- (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoonorn  
Signatory for and on behalf of Linde (Thailand) Co., Ltd.

PB-002/F006



บริษัท ยูไนด์อินดัสเตรียลแก๊ส จำกัด (สำนักงานใหญ่)  
聯育股份有限公司  
UNITED INDUSTRIAL GASES CO., LTD. (Head Office)

29/3 หมู่ที่ 5 ถนนบางนา-ตราด ตำบลบางเสาธง อำเภอบางเสาธง จังหวัดสมุทรปราการ 10570

29/3 MOO 5 BANGNA-TRAD ROAD, TAMBOL BANGSAOTONG, AMPHUR BANGSAOTONG, SAMUTPRAKARN 10570

TEL: 0-2338-1460-1, 0-2708-4148-9 FAX: 0-2338-1548, 0-2708-3873 E-mail: uig@gases@uig.com, uig@gases@uig.com Web: http://www.uiggases.com

เลขประจำตัวผู้เสียภาษี : 0115528000610

Certificate of Analysis

Page : 1/1

Certificate No: QA22090054

Client Name : บริษัท เอส.พี.เอส.คอนเนคติ้ง เซอร์วิส จำกัด  
Address : เลขที่ 7 ซ.พหลโยธิน ก.พหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพมหานคร 10900  
Telephone : Fax :  
Contact Name : Contact Email : -

Sample Description

Sample Name : Nitrogen 99.999% Ultra High Purity Grade Shelf Life : 3 Years  
Sampling Condition : Cylinder 7 M3 Pressure 2000 psig Valve Type : CGA 580  
Lot No. : Test Date : 06/09/2022

รายการทดสอบ (Test Item)	วิธีทดสอบ (Test Method)	หน่วย (Unit)	เกณฑ์กำหนด (Specification)	ผลการทดสอบ (Results)
1. Moisture (H <sub>2</sub> O)	LT-UIG-01 (Shaw Moisture Meter)	ppm	≤ 3.0	< 3.0
2. Oxygen (O <sub>2</sub> )	LT-UIG-03 (Oxygen Analyzer)	ppm	≤ 2.0	< 3.0
3. Carbon Dioxide (CO <sub>2</sub> )	In-house method : LT-UIG-05 (Gas Chromatography)	ppm	≤ 1.0	< 1.0
4. Carbon Monoxide (CO)	In-house method : LT-UIG-05 (Gas Chromatography)	ppm	≤ 1.0	< 1.0
5. THC as CH <sub>4</sub>	In-house method : LT-UIG-06 (Gas Chromatography)	ppm	≤ 1.0	< 1.0

Note: CYLINDER No. : N78077, N75075



Approved By :

( Miss Sunisa Sonthipakdee )  
Quality Control

Date: 06 / 09 / 2022

FM-LB-012

Rev.00

Date : 01 / 02 / 2018



ระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

**Request No.** 21-66/0358

**MTC No.** EEL. BP. 22/0366

## 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 : Cirrus

Model : CR:515

Serial No. : 92002

**Ambient Environment**

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

**Calibration Procedure:** CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

**Date of Receipt** : 3 Mar. 2023

**Date of Calibration** : 13 Mar. 2023

1 / 2

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

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

**Head Office**

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

**Office/Laboratory**

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

**Office**

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

FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0358

MTC No. EEL. BP. 22/0366

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

Nominal Output of Unit Under Test = 94 dB re 20 $\mu$ Pa at 1000 Hz

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.99	-0.01	$\pm 0.10$	$\pm 0.40$ dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.39	$\pm 0.50$	$\pm 3.0\%$

- Note :
1. No adjustment.
  2. The calibrator pressure correction was not included.
  3. The microphone volume correction was not included.

Calibrated by :



(Mr. Nuttapong Niljrusvanit)

Approved by :



(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13 Mar. 2023

Date of Issue : 14 Mar. 2023

Ref : 2011266030300928001

2 / 2

End of Certificate

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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Tel. (66) 0 2323 1672-80 ext. 115, 116  
Fax. (66) 0 2323 9165  
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Office

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



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

Noise B\_034\_1/23

### 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	19 March 2022
		Due Date	19 March 2023

#### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B03	Cirrus	CR161B	G301155	04 February 2023	94.0	94.0
CR-B05	Cirrus	CR161B	G301134	04 February 2023	94.0	94.0
CR-B06	Cirrus	CR161B	G301151	04 February 2023	94.0	94.0
CR-B09	Cirrus	CR161B	G301401	04 February 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.99 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

(Mr. Peera Detudom)

คุณภาพน้ำ



## Certificate of Calibration

**Certificate No. :** 65-400210-1

**Page : 1 of 2**

**Submitted by :** S. P. S Consulting Service Co.,Ltd.  
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

**Equipment :** Liquid in Glass Thermometer  
**Manufacturer :** SK **Model :** N/A  
**Range :** 0 °C to 100 °C **Resolution :** 1 °C  
**Serial No. :** N/A **Immersion :** Total  
**ID No. :** TM21/59

**Environment :** Ambient Temperature : (23 ± 2) °C  
 Relative Humidity : (50 ± 15) %  
 Line Voltage : (220 ± 22) VAC

**Date of Received :** 19 April 2022

**Date of Calibration :** 23 April 2022

**Date of Issue :** 23 April 2022

**Calibrated by :** Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

( Bunjerd Masri )

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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www.calibratech.co.th

## Certificate of Calibration

**Certificate No. :** 65-400210-1

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

Ice point check : UUC\* reading 0 °C Standard reading 0.6439 °C

Standard Reading ( °C )	UUC Reading ( °C )	Correction ( °C )	Uncertainty ( ± °C )
20.6690	20	0.7	0.31

### Remark

UUC : Unit Under Calibration

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

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

- o0o -





## Certificate of Calibration

**Certificate No. :** 66-400065-2

**Page : 1 of 2**

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

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

**Equipment :** Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

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

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

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

**Date of Received :** 01 February 2023

**Date of Calibration :** 06 February 2023

**Date of Issue :** 06 February 2023

**Calibrated by :** Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

( Bunjerd Masri )

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 66-400065-2

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

Ice point check : UUC\* reading 0 ° C Standard reading 0.3606 ° C

Standard Reading ( ° C )	UUC Reading ( ° C )	Correction ( ° C )	Uncertainty ( ± ° C )
20.3607	20	0.4	0.31

### Remark

UUC : Unit Under Calibration

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

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

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



Cert.No.: 22CH140

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** Conductivity Meter  
**Manufacturer :** Mettler Toledo  
**Model :** SevenCompact  
**Serial No. :** C141708983  
**ID No. :** -  
**Condition As-Received:** Used Item  
**Received Date :** 31 January 2022  
**Calibration Date :** 02 February 2022  
**Reference :** 2201-0954WSC-1  
**Submitted by :** S.P.S. Consulting Service Co.,Ltd.  
7 Soi Phahonyothin 24, Phahonyothin Rd.,  
Chom Phon, Chatuchak, Bangkok 10900  
**Ambient Temperature :**  $(25 \pm 2.5) ^\circ\text{C}$   
**Relative Humidity :**  $(50 \pm 15) \%$   
**Calibration Procedure:** In -house method :  
- CP-CH6 : based on direct measurement by  
using certified reference material (CRM)

**Calibrated by :** Warakorn Lerngagtrakul

**Approved by :**

Approved Signatory

- ( ✓ ) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagtrakul

**Issue Date :** 10 February 2022

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

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

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Cert.No.: 22CH140

Page.: 2 of 2

**Condition of this result of calibration**

## 1. Reference Standard Instrument :-

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermometer	1963878	130RC095	21I977	17 Sep 2022

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

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

## 2. Certified Reference Materials :-

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

<u>Conductivity Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
147.0 $\mu\text{S/cm}$	CPA Chem	761020	02 Aug 2022
1413.0 $\mu\text{S/cm}$	CPA Chem	761021	02 Aug 2022
12.880 $\text{mS/cm}$	CPA Chem	761022	02 Aug 2022
111.3 $\text{mS/cm}$	CPA Chem	768164	12 Sep 2022

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ )  $^{\circ}\text{C}$

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

**Calibration results****Function : Conductivity Measurement**(\*) After Adjustment at 0.147, 1.413, 12.880, 111.3  $\text{mS/cm}$ 

Conductivity Electrode Serial No.: 5821320179

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement ( $\pm$ )	Coverage factor k
147.0 $\mu\text{S/cm}$	148.1 $\mu\text{S/cm}$	147.0 $\mu\text{S/cm}$	0.99 $\mu\text{S/cm}$	2.00
1413.0 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	9.2 $\mu\text{S/cm}$	2.00
12.880 $\text{mS/cm}$	12.61 $\text{mS/cm}$	12.88 $\text{mS/cm}$	0.086 $\text{mS/cm}$	2.00
111.3 $\text{mS/cm}$	105.7 $\text{mS/cm}$	111.4 $\text{mS/cm}$	0.76 $\text{mS/cm}$	2.00

**Remark**

- UUC\* = Unit Under Calibration

- 147.0  $\mu\text{S/cm}$  Adjustment Cell constant =  $0.550585 \text{ cm}^{-1}$ - 1413.0  $\mu\text{S/cm}$  Adjustment Cell constant =  $0.554585 \text{ cm}^{-1}$ - 12.880  $\text{mS/cm}$  Adjustment Cell constant =  $0.562585 \text{ cm}^{-1}$ - 111.3  $\text{mS/cm}$  Adjustment Cell constant =  $0.578585 \text{ cm}^{-1}$ 

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

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## 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. : 230211016445

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

DATE OF RECEIVED : 11 February 2023

DATE OF ISSUED : 15 February 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Sukgasem Seehanart  
Calibration Engineer

Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
15 February 2023



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. Q23016445

F3-011-04/01-12

page 1 of 4



@clccalibration

## REPORT OF CALIBRATION

### FOR

NOMENCLATURE	:	CONDUCTIVITY METER
MANUFACTURER	:	METTLER TOLEDO
MODEL / TYPE	:	SEVEN COMPACT S230
SERIAL NO.	:	C141708983/5821320179
DATE OF CALIBRATION	:	13 February 2023

#### 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. Potassium Chloride Solution ( nominal 1.41 mS/cm , nominal 12.8 mS/cm )
2. Conductivity Solution , Hanna Product Code HI 7033L Lot Number 6436.
3. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F250 S/N. 1334023800.
5. IPRT, ASL Model T100-250-1D S/N. L0193A-1-1.





## TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Merck Co., Ltd.

Certificate No. HC02139203 , HC04515254. Due Date 30 June 2023 , 30 November 2023.

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

Certificate No. 12E12 , Due Date May 2024 .

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

Certificate No. Q22130792, Due Date 05 January 2024.

4. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0823/65, Due Date 22 August 2023.

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

Certificate No. TT-0166-22, Due Date 01 December 2023.

## UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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





## CONDITION OF CALIBRATION ITEM : GOOD

## 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	k Factor
*84.00 µS/cm	84.04 µS/cm [Cell Constant 0.548589]	± 1.00 µS/cm	2,00
1412.0 µS/cm	1413 µS/cm [Cell Constant 0.548589]	± 21.0 µS/cm	2,00
12.85 mS/cm	12.88 mS/cm [Cell Constant 0.573538]	± 0.19 mS/cm	2,00

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 01 Page 138 of 138

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

Immersion depth (mm)	Actual Temperature ( °C )	DUC Reading ( °C )	Correction ( °C )	Uncertainty ± ( °C )
100	25.00	25.0	0.00	0.07

Note. The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of  $k = 2,00$ .

\* 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 ###**





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

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

TEL. 0-2717-3000-24 FAX. 0-2719-9484

Cert.No.: 22CH578

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** Turbidity Meter  
**Manufacturer :** Eutech  
**Model :** Cyberscan WL TB1000  
**Serial No. :** 201802206  
**ID. No. :** TB 03/61  
**Condition As-Received:** Used Item  
**Received Date :** 25 April 2022  
**Calibration Date :** 27 April 2022  
**Reference :** 2204-0619WN-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 :**

Approved Signatory

- (✓) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lerngagtrakul

**Issue Date :** 3 May 2022

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

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A 0008721





Cert.No. : 22CH578

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).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermo-Hygrograph	1102794	130EC009	21H2601	8 Dec 2022
2) Electronic Balance	N03679	140RC001	21MM429	21 Sep 2022

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

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Assay</u>
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

<b>Standard Formazine suspension ( NTU )</b>	<b>UUC* Reading ( NTU )</b>	<b>Uncertainty of Measurement ( <math>\pm</math> NTU )</b>	<b>Coverage Factor <i>k</i></b>
20	19.4	0.38	2.00
40	39.3	0.40	2.00
100	98.9	0.73	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 %.

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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

Cert.No.: 23CH432

Page.: 1 of 2

## Certificate of Calibration

**Equipment :** Turbidity Meter  
**Manufacturer :** Eutech  
**Model :** Cyberscan WL TB1000  
**Serial No. :** 201802206  
**ID. No. :** TB 03/61  
**Condition As-Received:** Used Item  
**Received Date :** 29 March 2023  
**Calibration Date :** 30 March 2023  
**Reference :** 2303-1034WN-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 :**

Approved Signatory

- ( ☒ ) Malee Butkruea  
( ☐ ) Saithip Meangmai  
( ☐ ) Warakorn Lerngagtrakul

**Issue Date :**

31 March 2023

**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.

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Cert.No. : 23CH432

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).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1) Thermo-Hygrograph	1103328	130EC010	22H1313	12 June 2023
2) Electronic Balance	N03679	140RC001	22MM49	20 Sep 2023

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

<u>Material</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Assay</u>
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 ( $\pm$ NTU )	Coverage Factor <i>k</i>
20	19.3	0.38	2.00
40	39.0	0.40	2.00
100	99.2	0.70	2.00
400	391	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 %.

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# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



451-451/1 Sirinthorn Rd.,Bangbumru, Bangplud Bangkok 10700 THAILAND.  
Tel.0-2435-8800 Fax.0-2433-1679 e-mail:cal-center@sithiphorn.com http://www.sithiphorn.com

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP22018

Pages 1 of 3

## Calibration Certificate

**Equipment :** UV-VIS SPECTROPHOTOMETER  
**Manufacturer :** PERKINELMER  
**Model :** LAMBDA 25  
**Serial No.:** 501S14123010  
**ID No.:** SP03/58  
**Calibration Mode :** WAVELENGTH ACCURACY  
PHOTOMETRIC ACCURACY  
  
**Condition As Found :** GOOD  
  
**Customer :** S.P.S. CONSULTING SERVICE CO., LTD.  
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,  
CHOMPHON, CHATUCHAK,  
BANGKOK 10900, THAILAND.  
  
**Location :** ORGANIC LABORATORY IV  
  
**Ambient Temperature :** ( 24.4 ± 5 ) °C  
**Relative Humidity :** ( 60.1 ± 25 ) %  
  
**Received Date :** 30 AUGUST 2022  
**Calibration Date :** 30 AUGUST 2022  
**Date of Issue :** 31 AUGUST 2022

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

( Thanakul Petchurai )

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



## Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

Pages : 2 of 3

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	87569	13/10/2022
Didymium liquid	RM-DL	28912	87588	15/10/2022
Neutral density filter	RM-1N2N3N	13877	87600	15/10/2022
Potassium dichromate solutions	RM-0204060810	14204	87614	16/10/2022
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.4	0.15	0.16	2.00
	467.82	467.8	-0.02	0.16	2.00
	536.56	536.5	-0.06	0.16	2.00
	640.50	640.5	0.00	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.2	0.26	0.16	2.00

UUC\* = Unit Under Calibration

## Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

Pages : 3 of 3

**Result of calibration : Photometric Accuracy**

(Without adjustment)

Material	Wavelength (nm)	Filter: S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2436	0.2419	-0.0017	0.0101	2.00	
		40	0.4905	0.4855	-0.0050	0.0115	2.00	
		60	0.7453	0.7388	-0.0065	0.0067	2.00	
		80	0.9920	0.9839	-0.0081	0.0071	2.00	
		100	1.2487	1.2414	-0.0073	0.0073	2.00	

UUC\* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.0001 A

## Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

**Stray Light\*\* UUC\* Reading at 220 nm**

Transmission T(%) Absorbance(A)

0.0107

3.9886

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

**End of Calibration Certificate**



**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 : 22E9693

REFERENCE No : 66476-1

PAGE : 1 OF 3

**Certificate of Calibration**

**EQUIPMENT** : pH METER

**MANUFACTURER** : HANNA

**MODEL** : HI 3512

**SERIAL No** : TH118035


**ID No** : pH 04/56

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : ATSAWIN Y.

**CALIBRATION DATE** : 15-Sep-22

**APPROVED BY** :   
PONGSAK J.

**ISSUED DATE** : 15-Sep-22

**RECEIVED DATE** : 14-Sep-22

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





# QUALITY CALIBRATION CO.,LTD.

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

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CERTIFICATE No : 22E9693

PAGE : 2 OF 3

## Calibration Report

EQUIPMENT : pH METER  
MANUFACTURER : HANNA  
ID No : pH 04/56  
RECEIVED DATE : 14-Sep-22  
AMBIENT TEMPERATURE : 20 ° C ± 1 ° C  
MODEL : HI 3512  
SERIAL NUMBER : TH118035  
CALIBRATION DATE : 15-Sep-22  
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 READ THE VALUE COMPARED WITH CALCULATED VALUE. THE DISPLAY AND ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/</u> <u>LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3



**QUALITY CALIBRATION CO.,LTD.**

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CERTIFICATE No : 22E9693

PAGE : 3 OF 3

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

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

**3. DISPLAY UNIT WITH TEMPERATURE**

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

**4. PERCENT SLOPE 100%**

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT





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



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

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

**Cert.No.:** 22TW98

**Page.:** 1 of 2

## Certificate of Testing

**Equipment :** DO Meter  
**Manufacturer :** YSI  
**Model :** 5000-230V  
**Serial No. :** 15B100751  
**ID No. :** -  
**Received Date :** 20 April 2022  
**Test Date :** 21 April 2022  
**Reference :** 2204-0429WC-1  
**Submitted by :** S.P.S. Consulting Service Co.,Ltd.  
7 Phaholyothin 24, Phaholyothin Road.,  
Jompol, Chatuchak, Bangkok 10900  
**Laboratory Condition :** Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
**Tested by :** Walalak Sirithean  
  
**Approved by :**   
Approved Signatory  
☒ Malee Butkruea  
☐ Saithip Meangmai  
☐ Warakorn Lerngagtrakul  
**Issue Date :** 25 April 2022





Cert.No.: 22TW98

Page.: 2 of 2

**Condition of this result of calibration**

1. Reference Standard Instruments :

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

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

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

**Result :** Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

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

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

-o0o-

a 1105753

CERT.No.: HS-U017D

Calibration Date : 3 Apr 23  
Submitted by : S.P.S CONSULTING SERVICE CO.,LTD  
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,  
Chatuchak, Bangkok, Thailand 10900

Model : YSI 5000  
S/N : 15B100751  
Probe : YSI 5010  
S/N : 22D100097  
ID NO. : -  
Air Temp ref : S/N. E00522  
Barometric ref : S/N. E00522  
Water Temp ref : S/N. 11431  
Technician : Kittipong M.

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

#### 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)	-
<hr/>			
Mean Measurement	9.08	mg/l	-
Inaccuracy	0.01	mg/l	-
<hr/>			
Overall Status	(PASS)		

#### Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature  
(Kittipong Maekwong)

Laboratory Manager  
(Natenapha Pisatkunchon)





# 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 : 22T10972  
REFERENCE No : 66837-1

PAGE : 1 OF 3

## Certificate of Calibration

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
MODEL : DRB 200  
SERIAL No : 15110C0497  
ID No : DRB 04/59  
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 : 20-Dec-22

APPROVED BY : [REDACTED]  
PONGSAK J.

ISSUED DATE : 20-Dec-22

RECEIVED DATE : 20-Dec-22

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

F-G010 REV : 02





CERTIFICATE No : 22T10972

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
ID NUMBER : DRB 04/59  
RECEIVED DATE : 20-Dec-22  
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200  
SERIAL NUMBER : 15110C0497  
CALIBRATION DATE : 20-Dec-22  
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

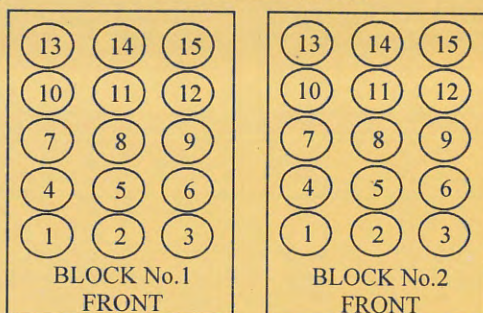
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

### 2. REFERENCE STANDARD INSTRUMENTS :-

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

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

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



### TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	149.8
	2	149.6
	3	149.7
	4	149.8
	5	149.9
	6	149.8
	7	149.8
	8	149.8
	9	149.9
	10	149.8
	11	149.9
	12	149.7
	13	149.9
	14	149.9
	15	149.7
Uncertainty of Measurement(± °C)	0.86	0.86

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

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

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

END OF CALIBRATION REPORT





CERTIFICATE No : 22M2569

REFERENCE No : 64386-3

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 : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY :   
PONGSAK J.

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22





CERTIFICATE No : 22M2569

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	MODEL	:	BSA224S-CW
MANUFACTURER	:	SARTORIUS	S/N	:	36591843
ID No	:	BA 09/61	RECEIVED DATE	:	11-Mar-22
AIR PRESSURE	:	1008mbar $\pm$ 1mbar	CALIBRATION DATE	:	11-Mar-22
AMBIENT TEMPERATURE	:	22° C $\pm$ 1° C	RELATIVE HUMIDITY	:	51 %RH $\pm$ 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY ACCORDING TO UKAS LAB 14 EDITION 6:2019 BY USING KNOWN WEIGHT STANDARD WEIGHT. THE BALANCE WAS ADJUSTED USING WEIGHT OF QUALITY CALIBRATION TO ADJUST. THE BALANCE HAS NO ZERO TRACKING FUNCTION. REPEATABILITY WAS MEASURED BY USING 10 REPEATED MEASUREMENTS. LINEARITY WAS MEASURED COVERING 10 POINTS, EVENLY SPREAD OVER THE RANGE. THE INSTRUMENT WAS SET ZERO BEFORE PERFORMING THE LINEARITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.

### 2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23

3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.

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

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

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

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

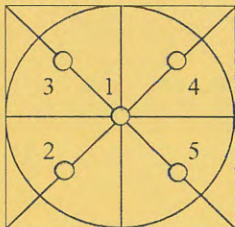
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	99.9999
2	99.9999
3	100.0000
4	99.9999
5	99.9998
OFF-CENTER LOADING	0.0001

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

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

END OF CALIBRATION REPORT





CERTIFICATE No : 23M2442

REFERENCE No : 68471-2

PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : DIGITAL BALANCE

**MANUFACTURER** : SARTORIUS

**MODEL** : BSA224S-CW

**SERIAL No** : 36591843

**ID No** : BA 09/61

**CONDITION AS RECEIVED** : USED ITEM

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

**CALIBRATED BY** : ATSAWIN Y.

**CALIBRATION DATE** : 10-Mar-23

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

**ISSUED DATE** : 16-Mar-23

**RECEIVED DATE** : 10-Mar-23





CERTIFICATE No : 23M2442

PAGE : 2 OF 2

## Calibration Report

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

### CONDITION OF THIS RESULTS OF CALIBRATION

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. 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 CENTRAL BUREAU OF WEIGHTS&MEASURES

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

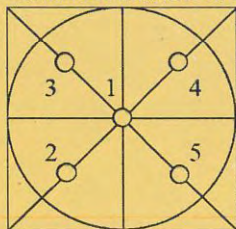
2. TARE FUNCTION : NORMAL

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	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

### 5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	99.9999
3	99.9998
4	100.0001
5	100.0000
OFF-CENTER LOADING	0.0002

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

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

END OF CALIBRATION REPORT





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

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

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
<b>MODEL</b>	<b>SERIAL NUMBER</b>	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Methods</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>May 30, 2023</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>February 28, 2023</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>August 30, 2023</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2023</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER**    077C7042401

**DATE TESTED**    January 11, 2023

#### 1. MECHANICAL CHECKS

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

#### 2. OPTICAL CHECKS

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

#### 3. COOLING SYSTEM CHECKS

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

#### 4. PERFORMANCE CHECKS

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





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

SERIAL NUMBER : 077C7042401DATE TESTED : January 11, 2023

PARAMETER	SPECIFICATION			FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007		<u>0.00504</u>
	Ni 231.604 nm	≤ 0.008		<u>0.00646</u>
	Ni 341.476 nm	≤ 0.012		<u>0.00768</u>
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020		<u>0.01597</u>
	Ba 455.403 nm	≤ 0.025		<u>0.02185</u>
Precision				
	As 193.656 nm	% RSD < 1.0		<u>0.89</u> %
	Zn 213.856 nm	% RSD < 1.0		<u>0.77</u> %
	Mn 257.610 nm	% RSD < 1.0		<u>0.51</u> %
	La 379.478 nm	% RSD < 1.0		<u>0.44</u> %
	Ba 455.403 nm	% RSD < 1.0		<u>0.44</u> %
	Ba 493.408 nm	% RSD < 1.0		<u>0.46</u> %
Detection Limits : Axial	Tl 190.080 nm	3(sd)		<u>4.04</u> ppb
	As 193.696 nm	3(sd)		<u>3.58</u> ppb
	Pb 220.353 nm	3(sd)		<u>1.90</u> ppb
Detection Limits : Radial	As 193.696 nm	3(sd)		<u>47.72</u> ppb
	Zn 213.856 nm	3(sd)		<u>1.02</u> ppb
	Mn 257.610 nm	3(sd)		<u>0.68</u> ppb
	La 379.478 nm	3(sd)		<u>1.43</u> ppb
	Ba 455.403 nm	3(sd)		<u>0.10</u> ppb
	Ba 493.408 nm	3(sd)		<u>0.36</u> ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb		<u>58.36</u>
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb		<u>104142.80</u>



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER** 077C7042401**DATE TESTED** January 11, 2023**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

**Service Department PerkinElmer Ltd.**


**Authorized Representative:**

( Mr. Wiphan Promlumda )  
Service Engineer



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

<b>Company Name:</b>	SPS CONSULTING SERVICE CO.,LTD.		
<b>Address (Instrument Location):</b>	7 SOI PHAHOLYOTHIN 24,PHAHOLYOTHIN RD. JOMPOL,CHATUCHAK, BANGKOK		
<b>Serial Number:</b>	PTCS14111103	<b>PM Number:</b>	1-2
<b>Customer Name (if applicable):</b>	K. PHENPHA	<b>Telephone Number:</b>	083-926-9252
<b>Customer Support Engineer Name:</b>	K. DUANG	<b>Service Order Number:</b>	WO-02044564
<b>Date PM Performed: (DD-MMM-YYYY)</b>	06-Jan-2023	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	06-Jul-2023
<b>Standard Labor Hours to Complete PM :</b>		<b>5 hours</b>	

Part Number	Release	Publication Date	
09370143 Rev.9	A	January 2018	

### **Scope**

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

The customer should save their method before the PM begins.

### **General Instructions:**

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

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## Component List

Component / Specific Model	Serial #	Configuration Notes
AS900	AS9S14B1002	WINLAB 32

## Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A
N3160156	O-Ring Kits for Sampling Introduction ( Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction ( Plastic Nebulizer)	2
N9301714	Replacement Acetylene Filter Cartridge	1
TH001022	Replacement Air Filter Cartridge	2

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	56-021CRY1	30-Jun-2023

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



Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
B3100652 Or N9307029	Electronic Flow Meter	1	NA
B0505495	Test Jig	1	NA
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	102416-040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

# Procedure Checklist

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

## 1. General:

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

## 2. PC Instrument Software:

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

## 3. Mechanical:

- ✓ Inspect and clean all fans and filters. Replace filters if necessary
- ✓ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ✓ Clean exterior of the instrument.

### 3.1 Flame Technique

- ✓ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ✓ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification
- ✓ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ✓ Check the drain system for signs of wear. Replace worn or damaged parts.
- ✓ Visually check for proper flame conditions when igniting the Air-C<sub>2</sub>H<sub>2</sub> and N<sub>2</sub>O-C<sub>2</sub>H<sub>2</sub> flames (if applicable).

### 3.2 THGA Technique

- ✓ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ✓ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ✓ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ✓ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ✓ Check furnace open/close function.
- ✓ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ✓ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ✓ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ✓ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN



- ✓ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ✓ Check auto sampler operation.
- ✓ Perform an auto sampler check valve test as described in the Service Manual.
- ✓ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ✓ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.

#### 4. Electrical:

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

#### 5. Optics:

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

#### 6. Gasses:

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

#### 7. Flame Interlock Check:

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

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

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

### 8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.1982	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.9942	Passed

### 8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0014	Passed

### 8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

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

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0083	Passed

### 8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0002	Passed



### 8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	$\leq 0.005$	0.0021	Passed

### 8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	$> 0.250$ Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	$> 0.250$ Abs.	0.3281	Passed

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

### 9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

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

### 9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	$\leq 0.005$ Abs.	0.0000	Passed
Standard Deviation	$\leq 0.005$	0.0002	Passed

### 9.3 Chromium Characteristic Mass and Precision

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

Parameter	Specification	Results	Pass/Fail
Cr $m_0$ Results	$\leq 7.0$ pg/0.0044 A-s	5.7	Passed
Precision	$\leq 2.0$ %	0.74	Passed

#### 9.4 Copper Characteristic Mass and Zeeman Ratio

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

Parameter	Specification	Results	Pass/Fail
Cu m <sub>0</sub> Result	≤ 16.5 pg/0.0044 A-s	12.3	Passed
Zeeman Ratio	0.52 ± 0.04	0.54	Passed

#### 10. Review:



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



## Additional Comments

Additional Comments Regarding the PM	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1855}{0.1855 + 0.1563}$ $= 0.54$
REPLACE PM KIT	

## Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.</i>		
<i>This PinAAcle 900T Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>		
<b>Review of Preventive Maintenance:</b>		
Authorized PerkinElmer Representative:		Date: 06-Jan-2023 <small>(DD-MMM-YYYY)</small>
Authorized Customer Representative:		Date: 06-Jan-2023 <small>(DD-MMM-YYYY)</small>