

## ภาคผนวกที่ 4

เอกสารการสอบเทียบความถูกต้องของเครื่องมือ

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
<b>1. คุณภาพอากาศ</b>		
<u>คุณภาพอากาศในบรรยากาศ</u>		
- Total Suspended Particulate	- High Volume Air Sampler No. B04, B02, B18	- Digital Balance
- Nitrogen Dioxide	- NO <sub>x</sub> Analyzer No. B03, B14, B18	- NO <sub>x</sub> Analyzer No. B03, B14, B18
- o-Xylene	- Personal Pump SKC No. B26, B30, B31, B69	- GC/FID
- Maleic Anhydride	- Rotameter No. L-B04 - Personal Pump SKC No. B26, B30, B31, B69 - Rotameter No. L-B04	- HPLC Meter
<u>คุณภาพอากาศจากปล่อง</u>		
- Total Suspended Particulate	- Console No. B04, B01 - Pitot Tube No. B04, B35	- Digital Balance
- Oxide of Nitrogen	- Vacuum Gauge	- Spectrophotometer
- Carbon Monoxide	- Personal Pump SKC No. B14 - Rotameter No. H-B08	- CO Analyzer No. B07
- o-Xylene	- Personal Pump SKC No. B14 - Rotameter No. L-B07 - Pitot Tube No. B35	- GC/FID
- Maleic Anhydride	- Personal Pump SKC No. B21 - Rotameter No. H-B07 - Pitot Tube No. B35	- HPLC Meter
<u>คุณภาพอากาศในสถานประกอบการ</u>		
- Total Dust	- Personal Pump SKC No. B52, B76 - Rotameter No. H-B07, H-B10	- Digital Balance
- Octhanol	- Personal Pump SKC No. B59, B87 - Rotameter No. L-B07, L-B10	- GC/FID
- Dioctyl Phthalate	- Personal Pump SKC No. B25, R32, R23, B70, B79, B81 - Rotameter No. H-B07, H-B10	- GC/FID
- o-Xylene	- Personal Pump SKC No. B53, B90 - Rotameter No. L-B07, L-B10	- GC/FID

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

[illegible]

คุณภาพอากาศ





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## High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

### 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	04/05/2022	$y = 1.313x - 9.642$	0.999
B02	B02	02/05/2022	$y = 1.062x + 2.593$	1.000
B03	B03	04/05/2022	$y = 1.045x + 0.757$	0.998
B04	B04	04/05/2022	$y = 1.161x - 3.677$	0.996
B05	B05	02/05/2022	$y = 1.218x - 6.416$	1.000
B06	B06	04/05/2022	$y = 1.235x - 6.768$	0.998
B07	B07	06/05/2022	$y = 1.178x - 5.564$	0.999
B08	B08	02/05/2022	$y = 1.222x - 6.991$	1.000
B09	B09	04/05/2022	$y = 1.240x - 6.649$	0.996
B10	B10	04/05/2022	$y = 1.091x + 0.142$	0.995
B11	B11	04/05/2022	$y = 1.120x - 2.107$	1.000
B12	B12	02/05/2022	$y = 1.102x - 1.916$	0.996
B13	B13	03/05/2022	$y = 1.187x - 5.240$	0.999
B14	B14	06/05/2022	$y = 1.290x - 9.276$	0.998
B15	B15	03/05/2022	$y = 1.093x - 0.919$	0.999
B16	B16	04/05/2022	$y = 1.223x - 6.745$	0.999
B17	B17	03/05/2022	$y = 1.172x - 3.414$	0.998
B18	B18	04/05/2022	$y = 1.259x - 8.700$	1.000
B19	B19	03/05/2022	$y = 1.307x - 10.268$	0.999
B20	B20	02/05/2022	$y = 1.232x - 7.260$	0.999
B21	B21	04/05/2022	$y = 1.209x - 7.461$	0.996
B22	B22	02/05/2022	$y = 1.239x - 7.827$	0.999
B23	B23	03/05/2022	$y = 1.227x - 6.159$	0.999
B24	B24	03/05/2022	$y = 1.075x - 0.925$	0.997
B25	B25	04/05/2022	$y = 0.997x + 2.795$	0.998
B26	B26	04/05/2022	$y = 1.185x - 5.015$	0.998
B27	B27	06/05/2022	$y = 1.148x - 5.099$	0.996
B28	B28	04/05/2022	$y = 1.221x - 6.454$	1.000
B29	B29	02/05/2022	$y = 1.181x - 5.705$	0.995
B30	B30	04/05/2022	$y = 1.136x - 3.406$	0.999
B31	B31	04/05/2022	$y = 1.114x - 1.568$	0.999
B32	B32	04/05/2022	$y = 1.249x - 6.749$	1.000
B33	B33	06/05/2022	$y = 1.195x - 4.397$	0.996
B34	B34	04/05/2022	$y = 1.222x - 7.759$	0.999



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## High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

### Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	02/05/2022	$y = 1.345x - 12.323$	0.999
B36	B36	03/05/2022	$y = 1.154x - 4.565$	0.999
B37	B37	04/05/2022	$y = 1.139x - 2.122$	0.996
B38	B38	06/05/2022	$y = 1.126x - 2.401$	0.999
B39	B39	02/05/2022	$y = 1.188x - 5.455$	0.998
B40	B40	06/05/2022	$y = 1.156x - 3.823$	0.995
B41	B41	06/05/2022	$y = 1.187x - 6.052$	0.997
B42	B42	04/05/2022	$y = 1.063x + 0.537$	0.998
B43	B43	04/05/2022	$y = 1.258x - 9.645$	0.998
B44	B44	03/05/2022	$y = 1.252x - 9.964$	0.999
R01	R01	02/05/2022	$y = 1.220x - 6.992$	0.999
R02	R02	10/05/2022	$y = 1.121x - 3.616$	0.997
R03	R03	02/05/2022	$y = 1.161x - 5.046$	0.999
R04	R04	06/05/2022	$y = 1.115x - 1.773$	0.999
R05	R05	06/05/2022	$y = 1.217x - 7.663$	0.998
R06	R06	04/05/2022	$y = 1.245x - 8.155$	0.996
R07	R07	06/05/2022	$y = 1.042x + 1.155$	0.995
R08	R08	04/05/2022	$y = 1.220x - 6.674$	0.998
R09	R09	04/05/2022	$y = 1.192x - 5.710$	0.997
R10	R10	10/05/2022	$y = 1.209x - 6.199$	0.999
R11	R11	02/05/2022	$y = 1.101x - 2.414$	0.999
R12	R12	10/05/2022	$y = 1.209x - 6.618$	0.995
R13	R13	10/05/2022	$y = 1.158x - 3.923$	0.999
R14	R14	06/05/2022	$y = 1.128x - 2.065$	0.999
R15	R15	04/05/2022	$y = 1.014x + 2.496$	0.998
R16	R16	04/05/2022	$y = 1.159x - 5.442$	0.997
R17	R17	10/05/2022	$y = 1.203x - 5.717$	0.999
R18	R18	02/05/2022	$y = 1.325x - 12.252$	0.997
R19	R19	03/05/2022	$y = 1.246x - 7.147$	0.998
R20	R20	04/05/2022	$y = 1.230x - 7.354$	0.999





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## CALIBRATION REPORT

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

DATE : 12 June 2022

BRAND : API

MODEL : 200A

NO. NOX-B03

SERIAL NO. 2617

#### Calibrator (Dilution System)

Brand	: API	Model	: 700
Last Cal. Date	: 05 August 2021	Serial No.	: 911
Reference Standard Gas			
Standard Gas	: Nitric Oxide (NO)	Cylinder No.	: A00681SK
Certified Date	: 24 August 2020	Expired Date	: 24 August 2022
		Cylinder Conc.	: 51.0 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	0.11	-	0	-
NO Span	400	399.8	-0.050	400.0	1.005
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.009

#### API Model 200A NO<sub>x</sub> Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	509	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.0	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	674	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.0	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	314.7	°C	315 ± 5
RCELL PRESS	8.3	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	1.005	-	1.0 ± 0.3
NO <sub>x</sub> Slope	1.009	-	1.0 ± 0.3
NO Offset	1.3	mV	-20 to +150
NO <sub>x</sub> Offset	0.9	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	12 June 2022	BRAND :	API	MODEL :	200A
NO.	NOX-B14	SERIAL NO.	212		
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 05 August 2021			Serial No.	: 911
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00681SK
Certified Date	: 24 August 2020	Expired Date	: 24 August 2022	Cylinder Conc.	: 51.0 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	-
NO Span	400	400.1	0.025	400.0	1.007
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.011
API Model 200A NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	512	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	94.2	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.007	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.5	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		



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	12 June 2022	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B18	SERIAL NO.	N07543		
Calibrator (Dilution System)					
Brand	: API			Model	: 700
Last Cal. Date	: 05 August 2021			Serial No.	: 911
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00681SK
Certified Date	: 24 August 2020	Expired Date	: 24 August 2022	Cylinder Conc.	: 51.0 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	-
NO Span	400	399.6	-0.100	400.0	1.003
NO <sub>x</sub> Span	400	399.9	-0.025	400.0	1.007
API Model TML-41M NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	505	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.1	°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	1.003	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO <sub>x</sub> Offset	0.6	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		





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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	05/01/2022	1,000	1,500	2,000	995	1,496	1,995	0.999x - 1.938	1.000
B02	SKC	224-PCXR4	626166	05/01/2022	1,000	1,500	2,000	998	1,504	2,001	1.011x - 24.413	0.999
B03	SKC	224-PCXR4	612968	05/01/2022	1,000	1,500	2,000	995	1,490	1,995	1.001x - 6.653	1.000
B04	SKC	224-PCXR4	602804	05/01/2022	1,000	1,500	2,000	996	1,496	1,993	0.999x - 4.391	1.000
B05	SKC	224-PCXR4	612693	05/01/2022	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 21.952	0.999
B06	SKC	224-PCXR4	262188	05/01/2022	1,000	1,500	2,000	996	1,504	2,000	1.012x - 26.866	0.999
B07	SKC	224-PCXR4	626262	05/01/2022	1,000	1,500	2,000	998	1,492	1,994	0.996x + 1.898	1.000
B08	SKC	224-PCXR4	626100	05/01/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.011x - 21.912	0.999
B09	SKC	224-PCXR4	626479	05/01/2022	1,000	1,500	2,000	997	1,490	1,994	0.994x + 3.550	1.000
B10	SKC	224-PCXR4	091950	06/01/2022	1,000	1,500	2,000	994	1,504	2,001	1.016x - 32.434	0.999
B11	SKC	224-PCXR8	564315	06/01/2022	1,000	1,500	2,000	994	1,490	1,998	1.004x - 10.450	1.000
B12	SKC	224-PCXR4	034656	06/01/2022	1,000	1,500	2,000	1,001	1,503	2,003	1.012x - 22.618	0.999
B13	SKC	224-PCXR4	602073	06/01/2022	1,000	1,500	2,000	995	1,498	1,994	1.000x - 3.701	1.000
B14	SKC	224-PCXR4	626313	05/01/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 6.286	1.000
B15	SKC	224-PCXR4	626474	07/01/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 22.048	0.999
B16	SKC	224-PCXR4	626477	07/01/2022	1,000	1,500	2,000	993	1,504	2,000	1.015x - 31.345	0.999
B17	SKC	224-PCXR4	626860	07/01/2022	1,000	1,500	2,000	997	1,495	1,992	0.995x + 2.034	1.000
B18	SKC	224-PCXR4	691484	07/01/2022	1,000	1,500	2,000	1,003	1,501	2,001	1.009x - 18.586	0.999
B19	SKC	224-PCXR4	691599	07/01/2022	1,000	1,500	2,000	992	1,499	1,997	1.003x - 9.253	1.000
B20	SKC	224-PCXR4	691587	07/01/2022	1,000	1,500	2,000	992	1,504	1,999	1.015x - 31.915	0.999
B21	SKC	224-PCXR4	691531	07/01/2022	1,000	1,500	2,000	993	1,499	1,992	1.000x - 5.273	1.000
B22	SKC	224-PCXR4	691654	07/01/2022	1,000	1,500	2,000	1,005	1,501	2,003	1.010x - 18.195	0.999
B23	SKC	224-PCXR4	798393	07/01/2022	1,000	1,500	2,000	993	1,505	2,002	1.017x - 34.683	0.999
B24	SKC	224-PCXR4	626363	07/01/2022	1,000	1,500	2,000	1,000	1,501	2,005	1.016x - 28.338	0.999
B25	SKC	224-PCXR4	798489	06/01/2022	1,000	1,500	2,000	1,000	1,495	1,997	0.997x + 2.018	1.000
B26	SKC	224-PCXR4	798479	06/01/2022	1,000	1,500	2,000	997	1,497	1,990	0.994x + 3.251	1.000
B27	SKC	224-PCXR4	691673	06/01/2022	1,000	1,500	2,000	994	1,503	2,001	1.015x - 31.951	0.999
B28	SKC	224-PCXR4	691570	06/01/2022	1,000	1,500	2,000	1,000	1,500	2,003	1.015x - 27.022	0.999
B29	SKC	224-PCXR4	626472	06/01/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.856	1.000
B30	SKC	224-PCXR4	691489	06/01/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.013x - 24.106	0.999
B31	SKC	224-PCXR4	691509	06/01/2022	1,000	1,500	2,000	995	1,495	1,995	1.001x - 4.894	1.000
B32	SKC	224-PCXR4	091567	06/01/2022	1,000	1,500	2,000	994	1,504	2,001	1.014x - 28.868	0.999
B33	SKC	224-PCXR4	091756	06/01/2022	1,000	1,500	2,000	996	1,496	1,991	0.995x + 3.183	1.000
B34	SKC	224-PCXR4	612962	06/01/2022	1,000	1,500	2,000	1,001	1,501	2,002	1.012x - 22.531	0.999
B35	SKC	224-PCXR4	602682	06/01/2022	1,000	1,500	2,000	993	1,498	1,996	1.002x - 8.448	1.000
B36	SKC	224-PCXR4	626164	05/01/2022	1,000	1,500	2,000	1,000	1,497	1,999	0.999x - 3.231	1.000
B37	SKC	224-PCXR4	626256	05/01/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 31.604	0.999
B38	SKC	224-PCXR4	626167	10/01/2022	1,000	1,500	2,000	999	1,497	1,996	1.000x - 1.875	1.000
B39	SKC	224-PCXR4	034637	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,002	1.012x - 23.643	0.999
B40	SKC	224-PCXR4	798349	10/01/2022	1,000	1,500	2,000	993	1,505	2,000	1.016x - 32.992	0.999

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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>
B41	SKC	224-PCXR4	612669	10/01/2022	1,000	1,500	2,000	998	1,496	1,989	0.994x + 2.680	1.000
B42	SKC	224-PCXR4	626041	07/01/2022	1,000	1,500	2,000	1,003	1,498	1,993	0.990x + 11.710	1.000
B43	SKC	224-PCXR4	034636	05/01/2022	1,000	1,500	2,000	998	1,500	1,992	0.992x + 8.392	1.000
B44	SKC	224-PCXR8	529341	07/01/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.011x – 21.139	0.999
B45	SKC	224-PCXR8	529594	07/01/2022	1,000	1,500	2,000	997	1,498	1,992	0.995x + 2.728	1.000
B46	SKC	224-PCXR8	566743	07/01/2022	1,000	1,500	2,000	994	1,504	2,002	1.015x – 32.087	0.999
B47	SKC	224-PCXR8	566747	07/01/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.013x – 23.580	0.999
B48	SKC	224-PCXR8	566753	07/01/2022	1,000	1,500	2,000	1,000	1,494	1,996	0.996x + 1.567	1.000
B49	SKC	224-PCXR8	566780	07/01/2022	1,000	1,500	2,000	1,002	1,501	2,004	1.012x – 22.236	0.999
B50	SKC	224-PCXR8	500400	07/01/2022	1,000	1,500	2,000	1,000	1,493	1,996	0.995x + 3.641	1.000
B51	SKC	224-PCXR8	500363	07/01/2022	1,000	1,500	2,000	995	1,504	2,000	1.013x – 27.704	0.999
B52	SKC	224-PCXR8	093186	07/01/2022	1,000	1,500	2,000	995	1,498	1,994	0.997x – 0.283	1.000
B53	SKC	224-PCXR8	707670	10/01/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.012x – 23.580	0.999
B54	SKC	224-PCXR3	509821	05/01/2022	1,000	1,500	2,000	994	1,501	2,001	1.015x – 32.043	0.999
B55	SKC	224-PCXR3	510710	06/01/2022	1,000	1,500	2,000	1,000	1,494	1,994	0.994x + 4.830	1.000
B56	SKC	224-PCXR3	511450	06/01/2022	1,000	1,500	2,000	1,004	1,502	2,002	1.010x – 19.248	0.999
B57	SKC	224-PCXR3	510798	06/01/2022	1,000	1,500	2,000	997	1,492	1,996	0.996x + 1.747	1.000
B58	SKC	224-PCXR3	509852	06/01/2022	1,000	1,500	2,000	997	1,499	2,000	1.011x – 27.010	0.999
B59	SKC	224-PCXR3	509862	06/01/2022	1,000	1,500	2,000	997	1,495	1,991	0.995x + 3.833	1.000
B60	SKC	224-PCXR3	512655	06/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x – 24.688	0.999
B61	SKC	224-PCXR3	503915	06/01/2022	1,000	1,500	2,000	994	1,488	1,999	1.005x – 12.631	1.000
B62	SKC	224-PCXR3	505975	10/01/2022	1,000	1,500	2,000	994	1,491	1,995	1.002x – 8.089	1.000
B63	SKC	224-PCXR3	511432	10/01/2022	1,000	1,500	2,000	992	1,501	2,000	1.016x – 33.906	0.999
B64	SKC	224-PCXR3	508302	10/01/2022	1,000	1,500	2,000	998	1,493	1,990	0.994x + 4.272	1.000
B65	SKC	224-PCXR3	508310	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.012x – 23.077	0.999
B66	SKC	224-PCXR3	509861	10/01/2022	1,000	1,500	2,000	997	1,494	1,994	0.995x + 3.953	1.000
B67	SKC	224-PCXR3	506295	10/01/2022	1,000	1,500	2,000	993	1,507	2,002	1.017x – 34.005	0.999
B68	SKC	224-PCXR3	505872	13/01/2022	1,000	1,500	2,000	1,000	1,495	1,994	0.995x + 4.188	1.000
B69	SKC	224-PCXR3	508375	13/01/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x – 21.984	0.999
B70	SKC	224-PCXR3	510623	13/01/2022	1,000	1,500	2,000	995	1,490	1,997	1.001x – 7.267	1.000
B71	SKC	224-PCXR3	508367	13/01/2022	1,000	1,500	2,000	991	1,506	2,001	1.017x – 35.429	0.999
B72	SKC	224-PCXR3	505977	13/01/2022	1,000	1,500	2,000	1,001	1,498	1,991	0.991x + 8.882	1.000
B73	SKC	224-PCXR3	512606	13/01/2022	1,000	1,500	2,000	1,001	1,501	2,004	1.013x – 23.520	0.999
B74	SKC	224-PCXR3	505993	13/01/2022	1,000	1,500	2,000	996	1,495	1,995	1.000x – 5.161	1.000
B75	SKC	224-PCXR3	509820	13/01/2022	1,000	1,500	2,000	996	1,499	1,992	0.996x + 1.831	1.000
B76	SKC	224-PCXR3	509811	13/01/2022	1,000	1,500	2,000	995	1,496	1,998	1.003x – 9.050	1.000
B77	SKC	224-PCXR3	508301	13/01/2022	1,000	1,500	2,000	1,001	1,500	2,004	1.014x – 26.595	0.999
B78	SKC	224-PCXR3	510677	13/01/2022	1,000	1,500	2,000	994	1,504	1,999	1.013x – 28.238	0.999
B79	SKC	224-PCXR3	510920	12/01/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x – 4.304	1.000

Calibration



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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>
B80	SKC	224-PCXR3	504569	12/01/2022	1,000	1,500	2,000	1,003	1,499	2,002	1.010x – 20.915	0.999
B81	SKC	224-PCXR3	503480	10/01/2022	1,000	1,500	2,000	994	1,499	2,000	1.015x – 31.401	0.999
B82	SKC	224-PCXR3	505673	10/01/2022	1,000	1,500	2,000	993	1,499	1,996	1.003x – 7.857	1.000
B83	SKC	224-PCXR3	510785	13/01/2022	1,000	1,500	2,000	1,000	1,500	2,002	1.012x – 23.548	0.999
B84	SKC	224-PCXR3	508333	12/01/2022	1,000	1,500	2,000	995	1,497	1,992	0.997x – 0.016	1.000
B85	SKC	224-PCXR3	505757	10/01/2022	1,000	1,500	2,000	993	1,502	1,999	1.014x – 30.555	0.999
B86	SKC	224-PCXR3	512625	10/01/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x – 23.520	0.999
B87	SKC	224-PCXR3	504324	13/01/2022	1,000	1,500	2,000	997	1,499	1,997	1.000x – 1.667	1.000
B88	SKC	224-PCXR3	508307	13/01/2022	1,000	1,500	2,000	996	1,495	1,992	0.996x + 0.451	1.000
B89	SKC	224-PCXR3	509860	13/01/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.013x – 25.008	0.999
B90	SKC	224-PCXR3	508366	13/01/2022	1,000	1,500	2,000	992	1,502	2,001	1.017x – 33.531	0.999
B91	SKC	224-PCXR3	510919	13/01/2022	1,000	1,500	2,000	998	1,498	1,997	1.001x – 4.563	1.000
B92	SKC	224-PCXR3	510987	13/01/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x – 21.996	0.999
B93	SKC	224-PCXR3	509845	13/01/2022	1,000	1,500	2,000	1,000	1,498	1,999	1.000x – 3.059	1.000

Calibration





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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>
R01	SKC	224-PCXR4	602467	06/01/2022	1,000	1,500	2,000	995	1,505	2,002	1.017x - 33.519	0.999
R02	SKC	224-PCXR4	626450	06/01/2022	1,000	2,000	3,000	999	1,498	1,994	0.994x + 4.132	1.000
R03	SKC	224-PCXR4	691592	06/01/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.013x - 23.436	0.999
R04	SKC	224-PCXR4	691672	06/01/2022	1,000	1,500	2,000	996	1,493	1,995	1.000x - 5.153	1.000
R05	SKC	224-PCXR4	798470	12/01/2022	1,000	1,500	2,000	994	1,506	2,000	1.015x - 31.632	0.999
R06	SKC	224-PCXR4	798456	12/01/2022	1,000	1,500	2,000	993	1,497	1,993	1.000x - 5.496	1.000
R07	SKC	224-PCXR4	798480	12/01/2022	1,000	1,500	2,000	995	1,493	1,993	0.999x - 6.070	1.000
R08	SKC	224-PCXR4	883215	12/01/2022	1,000	1,500	2,000	1,002	1,501	2,004	1.014x - 25.235	0.999
R09	SKC	224-PCXR4	034650	06/01/2022	1,000	1,500	2,000	991	1,504	2,002	1.019x - 37.567	0.999
R10	SKC	224-PCXR4	091765	06/01/2022	1,000	1,500	2,000	1,000	1,492	1,994	0.995x + 3.159	1.000
R11	SKC	224-PCXR4	091763	06/01/2022	1,000	1,500	2,000	1,001	1,501	2,002	1.013x - 24.082	0.999
R12	SKC	224-PCXR4	091568	12/01/2022	1,000	1,500	2,000	999	1,499	1,995	0.997x - 0.024	1.000
R13	SKC	224-PCXR4	091638	12/01/2022	1,000	1,500	2,000	1,000	1,498	1,993	0.992x + 8.280	1.000
R14	SKC	224-PCXR4	091764	12/01/2022	1,000	1,500	2,000	993	1,502	1,998	1.013x - 30.093	0.999
R15	SKC	224-PCXR8	529457	12/01/2022	1,000	1,500	2,000	1,002	1,500	2,005	1.013x - 23.915	0.999
R16	SKC	224-PCXR8	529643	12/01/2022	1,000	1,500	2,000	999	1,497	1,994	0.997x + 0.219	1.000
R17	SKC	224-PCXR8	529645	12/01/2022	1,000	1,500	2,000	996	1,507	2,000	1.013x - 28.545	0.999
R18	SKC	224-PCXR8	566756	12/01/2022	1,000	1,500	2,000	991	1,496	1,998	1.003x - 9.193	1.000
R19	SKC	224-PCXR8	566802	10/01/2022	1,000	1,500	2,000	1,003	1,500	2,003	1.011x - 21.306	0.999
R20	SKC	224-PCXR8	529089	10/01/2022	1,000	1,500	2,000	991	1,503	2,001	1.019x - 37.942	0.999
R21	SKC	224-PCXR8	665728	10/01/2022	1,000	1,500	2,000	999	1,496	1,998	0.998x - 1.376	1.000
R22	SKC	224-PCXR8	707444	07/01/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.012x - 23.440	0.999
R23	SKC	224-PCXR8	761067	07/01/2022	1,000	1,500	2,000	998	1,494	1,992	0.992x + 6.270	1.000
R24	SKC	224-PCXR8	707893	10/01/2022	1,000	1,500	2,000	995	1,505	2,001	1.015x - 30.157	0.999
R25	SKC	224-PCXR8	761052	10/01/2022	1,000	1,500	2,000	998	1,500	1,994	0.995x + 4.519	1.000
R26	SKC	224-PCXR8	707956	10/01/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.013x - 24.282	0.999
R27	SKC	224-PCXR8	707398	05/01/2022	1,000	1,500	2,000	996	1,503	2,001	1.014x - 29.522	0.999
R28	SKC	224-PCXR8	707481	05/01/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.011x - 20.325	0.999
R29	SKC	224-PCXR8	707402	05/01/2022	1,000	1,500	2,000	1,003	1,493	1,991	0.991x + 9.245	1.000
R30	SKC	224-PCXR8	093811	05/01/2022	1,000	1,500	2,000	997	1,495	1,993	0.997x - 0.730	1.000
R31	SKC	224-PCXR8	093183	05/01/2022	1,000	1,500	2,000	1,000	1,500	2,001	1.013x - 25.087	0.999
R32	SKC	224-PCXR8	671950	05/01/2022	1,000	1,500	2,000	1,000	1,498	1,994	0.994x + 7.562	1.000
R33	SKC	224-PCXR4	626254	05/01/2022	1,000	1,500	2,000	992	1,502	2,000	1.017x - 35.697	0.999
R34	SKC	224-PCXR4	626131	05/01/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.013x - 24.533	0.999
R35	SKC	224-PCXR8	707460	07/01/2022	1,000	1,500	2,000	999	1,496	1,995	0.996x + 3.275	1.000
R36	SKC	224-PCXR8	707446	07/01/2022	1,000	1,500	2,000	1,003	1,500	2,003	1.011x - 21.187	0.999
R37	SKC	224-PCXR8	707432	07/01/2022	1,000	1,500	2,000	999	1,499	1,998	0.998x + 0.044	1.000
R38	SKC	224-PCXR8	707349	07/01/2022	1,000	1,500	2,000	996	1,503	2,001	1.015x - 30.563	0.999
R39	SKC	224-PCXR8	761095	07/01/2022	1,000	1,500	2,000	998	1,494	1,995	0.995x + 1.599	1.000

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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	01/04/2022	1,000	1,500	2,000	994	1,497	1,998	1.001x - 3.749	1.000
B02	SKC	224-PCXR4	626166	04/04/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.010x - 20.465	0.999
B03	SKC	224-PCXR4	612968	04/04/2022	1,000	1,500	2,000	996	1,494	2,000	1.006x - 12.986	1.000
B04	SKC	224-PCXR4	602804	01/04/2022	1,000	1,500	2,000	1,000	1,502	1,996	1.001x - 2.928	1.000
B05	SKC	224-PCXR4	612693	12/04/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 23.061	0.999
B06	SKC	224-PCXR4	262188	01/04/2022	1,000	1,500	2,000	995	1,508	1,999	1.012x - 25.219	0.999
B07	SKC	224-PCXR4	626262	01/04/2022	1,000	1,500	2,000	998	1,492	1,995	0.992x + 6.804	1.000
B08	SKC	224-PCXR4	626100	12/04/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.750	0.999
B09	SKC	224-PCXR4	626479	11/04/2022	1,000	1,500	2,000	997	1,490	1,994	0.994x + 3.231	1.000
B10	SKC	224-PCXR4	091950	04/04/2022	1,000	1,500	2,000	994	1,503	2,001	1.016x - 32.594	0.999
B11	SKC	224-PCXR8	564315	06/04/2022	1,000	1,500	2,000	995	1,490	1,998	1.003x - 9.054	1.000
B12	SKC	224-PCXR4	034656	01/04/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.011x - 19.603	0.999
B13	SKC	224-PCXR4	602073	12/04/2022	1,000	1,500	2,000	995	1,500	1,999	1.001x - 4.072	1.000
B14	SKC	224-PCXR4	626313	05/04/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 5.727	1.000
B15	SKC	224-PCXR4	626474	01/04/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.012x - 22.726	0.999
B16	SKC	224-PCXR4	626477	11/04/2022	1,000	1,500	2,000	994	1,504	2,000	1.014x - 30.627	0.999
B17	SKC	224-PCXR4	626860	04/04/2022	1,000	1,500	2,000	997	1,495	1,991	0.997x + 0.479	1.000
B18	SKC	224-PCXR4	691484	04/04/2022	1,000	1,500	2,000	1,003	1,501	2,001	1.010x - 19.424	0.999
B19	SKC	224-PCXR4	691599	01/04/2022	1,000	1,500	2,000	995	1,503	1,999	1.005x - 8.224	1.000
B20	SKC	224-PCXR4	691587	04/04/2022	1,000	1,500	2,000	993	1,504	1,999	1.014x - 30.520	0.999
B21	SKC	224-PCXR4	691531	04/04/2022	1,000	1,500	2,000	993	1,499	1,992	1.000x - 4.714	1.000
B22	SKC	224-PCXR4	691654	04/04/2022	1,000	1,500	2,000	1,004	1,501	2,004	1.012x - 20.788	0.999
B23	SKC	224-PCXR4	798393	12/04/2022	1,000	1,500	2,000	994	1,505	2,002	1.017x - 33.567	0.999
B24	SKC	224-PCXR4	626363	04/04/2022	1,000	1,500	2,000	1,000	1,502	2,005	1.016x - 28.210	0.999
B25	SKC	224-PCXR4	798489	01/04/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 5.009	1.000
B26	SKC	224-PCXR4	798479	12/04/2022	1,000	1,500	2,000	998	1,499	1,993	0.997x + 1.855	1.000
B27	SKC	224-PCXR4	691673	04/04/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 33.826	0.999
B28	SKC	224-PCXR4	691570	04/04/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.013x - 24.230	0.999
B29	SKC	224-PCXR4	626472	06/04/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.378	1.000
B30	SKC	224-PCXR4	691489	06/04/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.012x - 22.431	0.999
B31	SKC	224-PCXR4	691509	12/04/2022	1,000	1,500	2,000	993	1,495	1,995	1.002x - 7.965	1.000
B32	SKC	224-PCXR4	091567	04/04/2022	1,000	1,500	2,000	993	1,504	2,001	1.015x - 30.208	0.999
B33	SKC	224-PCXR4	091756	01/04/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.475	1.000
B34	SKC	224-PCXR4	612962	04/04/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.135	0.999
B35	SKC	224-PCXR4	602682	11/04/2022	1,000	1,500	2,000	994	1,498	1,996	1.001x - 6.493	1.000
B36	SKC	224-PCXR4	626164	04/04/2022	1,000	1,500	2,000	1,000	1,497	1,999	0.999x - 2.393	1.000
B37	SKC	224-PCXR4	626256	01/04/2022	1,000	1,500	2,000	994	1,506	2,002	1.016x - 31.285	0.999
B38	SKC	224-PCXR4	626167	04/04/2022	1,000	1,500	2,000	997	1,497	1,996	1.001x - 4.387	1.000
B39	SKC	224-PCXR4	034637	04/04/2022	1,000	1,500	2,000	1,003	1,500	2,002	1.012x - 22.527	0.999
B40	SKC	224-PCXR4	798349	12/04/2022	1,000	1,500	2,000	992	1,505	2,000	1.017x - 34.109	0.999

Calibrated





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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>
B41	SKC	224-PCXR4	612669	04/04/2022	1,000	1,500	2,000	998	1,496	1,989	0.994x + 3.829	1.000
B42	SKC	224-PCXR4	626041	01/04/2022	1,000	1,500	2,000	1,003	1,498	1,993	0.990x + 12.348	1.000
B43	SKC	224-PCXR4	034636	11/04/2022	1,000	1,500	2,000	1,001	1,501	1,992	0.990x + 12.839	1.000
B44	SKC	224-PCXR8	529341	01/04/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x – 21.577	0.999
B45	SKC	224-PCXR8	529594	12/04/2022	1,000	1,500	2,000	997	1,498	1,992	0.995x + 2.928	1.000
B46	SKC	224-PCXR8	566743	04/04/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x – 33.204	0.999
B47	SKC	224-PCXR8	566747	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x – 24.202	0.999
B48	SKC	224-PCXR8	566753	01/04/2022	1,000	1,500	2,000	999	1,494	1,997	0.999x + 1.795	1.000
B49	SKC	224-PCXR8	566780	12/04/2022	1,000	1,500	2,000	1,003	1,502	2,003	1.011x – 21.031	0.999
B50	SKC	224-PCXR8	500400	01/04/2022	1,000	1,500	2,000	1,002	1,495	2,002	1.001x + 2.900	1.000
B51	SKC	224-PCXR8	500363	01/04/2022	1,000	1,500	2,000	995	1,504	2,000	1.012x – 26.268	0.999
B52	SKC	224-PCXR8	093186	11/04/2022	1,000	1,500	2,000	995	1,498	1,994	0.997x – 1.240	1.000
B53	SKC	224-PCXR8	707670	01/04/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.012x – 22.742	0.999
B54	SKC	224-PCXR3	509821	11/04/2022	1,000	1,500	2,000	993	1,501	2,001	1.016x – 33.718	0.999
B55	SKC	224-PCXR3	510710	01/04/2022	1,000	1,500	2,000	1,000	1,494	1,994	0.994x + 4.635	1.000
B56	SKC	224-PCXR3	511450	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x – 20.684	0.999
B57	SKC	224-PCXR3	510798	12/04/2022	1,000	1,500	2,000	997	1,493	1,998	1.001x + 3.398	1.000
B58	SKC	224-PCXR3	509852	04/04/2022	1,000	1,500	2,000	1,001	1,498	2,000	1.007x – 19.631	0.999
B59	SKC	224-PCXR3	509862	01/04/2022	1,000	1,500	2,000	996	1,503	1,995	0.998x + 2.916	1.000
B60	SKC	224-PCXR3	512655	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x – 23.891	0.999
B61	SKC	224-PCXR3	503915	12/04/2022	1,000	1,500	2,000	994	1,489	1,999	1.004x – 11.786	1.000
B62	SKC	224-PCXR3	505975	12/04/2022	1,000	1,500	2,000	999	1,494	1,995	0.997x – 0.503	1.000
B63	SKC	224-PCXR3	511432	01/04/2022	1,000	1,500	2,000	991	1,501	2,000	1.017x – 36.139	0.999
B64	SKC	224-PCXR3	508302	04/04/2022	1,000	1,500	2,000	997	1,493	1,990	0.994x + 3.992	1.000
B65	SKC	224-PCXR3	508310	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x – 23.109	0.999
B66	SKC	224-PCXR3	509861	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.701	1.000
B67	SKC	224-PCXR3	506295	12/04/2022	1,000	1,500	2,000	993	1,507	2,004	1.017x – 33.104	0.999
B68	SKC	224-PCXR3	505872	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.556	1.000
B69	SKC	224-PCXR3	508375	01/04/2022	1,000	1,500	2,000	1,001	1,500	2,000	1.010x – 21.689	0.999
B70	SKC	224-PCXR3	510623	11/04/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x – 6.693	1.000
B71	SKC	224-PCXR3	508367	12/04/2022	1,000	1,500	2,000	991	1,506	2,002	1.018x – 36.227	0.999
B72	SKC	224-PCXR3	505977	12/04/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.992x + 7.087	1.000
B73	SKC	224-PCXR3	512606	01/04/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.014x – 24.517	0.999
B74	SKC	224-PCXR3	505993	12/04/2022	1,000	1,500	2,000	996	1,495	1,994	0.999x – 4.363	1.000
B75	SKC	224-PCXR3	509820	12/04/2022	1,000	1,500	2,000	996	1,499	1,992	0.995x + 2.429	1.000
B76	SKC	224-PCXR3	509811	12/04/2022	1,000	1,500	2,000	992	1,498	1,998	1.007x – 15.040	1.000
B77	SKC	224-PCXR3	508301	12/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x – 26.643	0.999
B78	SKC	224-PCXR3	510677	01/04/2022	1,000	1,500	2,000	996	1,503	1,999	1.012x – 27.520	0.999
B79	SKC	224-PCXR3	510920	01/04/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x – 3.705	1.000

Calibrated



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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>
B80	SKC	224-PCXR3	504569	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,001	1.010x - 20.517	0.999
B81	SKC	224-PCXR3	503480	01/04/2022	1,000	1,500	2,000	994	1,499	2,000	1.015x - 31.561	0.999
B82	SKC	224-PCXR3	505673	01/04/2022	1,000	1,500	2,000	993	1,499	1,996	1.002x - 7.299	1.000
B83	SKC	224-PCXR3	510785	04/04/2022	1,000	1,500	2,000	1,000	1,500	2,002	1.012x - 23.787	0.999
B84	SKC	224-PCXR3	508333	04/04/2022	1,000	1,500	2,000	995	1,497	1,991	0.997x - 0.383	1.000
B85	SKC	224-PCXR3	505757	04/04/2022	1,000	1,500	2,000	993	1,502	1,999	1.014x - 30.476	0.999
B86	SKC	224-PCXR3	512625	12/04/2022	1,000	1,500	2,000	1,003	1,502	2,004	1.012x - 22.463	0.999
B87	SKC	224-PCXR3	504324	11/04/2022	1,000	1,500	2,000	998	1,496	2,000	1.001x - 2.305	1.000
B88	SKC	224-PCXR3	508307	04/04/2022	1,000	1,500	2,000	997	1,498	1,993	0.996x + 1.212	1.000
B89	SKC	224-PCXR3	509860	12/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 25.646	0.999
B90	SKC	224-PCXR3	508366	04/04/2022	1,000	1,500	2,000	992	1,502	2,001	1.017x - 33.850	0.999
B91	SKC	224-PCXR3	510919	04/04/2022	1,000	1,500	2,000	998	1,498	1,996	1.000x - 3.765	1.000
B92	SKC	224-PCXR3	510987	04/04/2022	1,000	1,500	2,000	1,003	1,501	2,004	1.012x - 21.916	0.999
B93	SKC	224-PCXR3	509845	12/04/2022	1,000	1,500	2,000	1,000	1,498	1,998	1.000x - 2.261	1.000

Calibra



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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	05/01/2022	500	1,000	2,000	497.9	988.8	1983.7	0.998x - 4.774	1.000
H-B02	Dwyer	VFB-65	05/01/2022	500	1,000	2,000	498.7	1002.2	1983.0	0.998x - 1.083	1.000
H-B03	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	497.9	996.3	2004.2	1.003x - 5.511	1.000
H-B04	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	498.8	999.1	1985.1	0.998x - 1.448	1.000
H-B05	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	497.4	997.6	1993.3	0.993x + 6.450	1.000
H-B06	Dwyer	VFB-65	07/01/2022	500	1,000	2,000	497.2	998.8	1985.9	0.992x + 5.181	1.000
H-B07	Dwyer	VFB-65	07/01/2022	500	1,000	2,000	498.9	998.3	1991.8	0.995x + 3.563	1.000
H-B08	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	496.2	992.4	1984.0	0.997x - 1.707	1.000
H-B09	Dwyer	VFB-65	07/01/2022	500	1,000	2,000	502.5	999.1	2007.2	1.003x - 4.310	1.000
H-B10	Dwyer	VFB-65	05/01/2022	500	1,000	2,000	497.3	989.9	2017.0	0.994x + 4.485	1.000

Calibrated





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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	01/04/2022	500	1,000	2,000	505.5	988.5	1973.5	0.990x + 8.611	1.000
H-B02	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	495.5	997.8	1995.3	0.998x - 4.832	1.000
H-B03	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	499.1	987.5	2009.2	1.004x - 15.366	0.999
H-B04	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	500.4	999.1	2008.7	0.998x - 2.127	1.000
H-B05	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	498.6	997.4	1972.3	0.981x + 20.608	1.000
H-B06	Dwyer	VFB-65	05/04/2022	500	1,000	2,000	501.0	993.4	1981.4	1.006x + 12.163	0.999
H-B07	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	504.5	988.6	2018.3	1.001x + 1.713	1.000
H-B08	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	499.8	999.2	1975.4	0.996x - 3.367	0.999
H-B09	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	503.7	1007.0	2014.3	0.994x - 14.557	1.000
H-B10	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	493.7	998.6	2012.4	0.998x + 0.535	1.000

Calibrated by





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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

Rotameter Calibration Report (For Personal Pump Low 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>
L-B01	Dwyer	VFA-21	05/01/2022	50	100	200	50.5	99.3	199.9	0.992x + 0.587	1.000
L-B02	Dwyer	VFA-21	05/01/2022	50	100	200	49.4	99.2	199.3	0.993x – 0.049	1.000
L-B03	Dwyer	VFA-21	06/01/2022	50	100	200	50.0	98.8	198.5	0.998x – 0.422	1.000
L-B04	Dwyer	VFA-21	06/01/2022	50	100	200	49.5	100.4	200.3	0.994x + 0.727	1.000
L-B05	Dwyer	VFA-21	06/01/2022	50	100	200	49.8	98.4	199.2	1.004x – 1.156	1.000
L-B06	Dwyer	VFA-21	07/01/2022	50	100	200	49.9	100.7	198.8	0.992x + 0.922	1.000
L-B07	Dwyer	VFA-21	07/01/2022	50	100	200	49.8	100.2	199.2	1.007x – 1.047	1.000
L-B08	Dwyer	VFA-21	06/01/2022	50	100	200	50.2	99.9	200.7	0.994x + 0.789	1.000
L-B09	Dwyer	VFA-21	07/01/2022	50	100	200	49.8	99.8	199.6	1.010x – 1.438	1.000
L-B10	Dwyer	VFA-21	05/01/2022	50	100	200	50.6	100.2	201.6	0.991x + 1.825	1.000

Calibrat



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)			y	R <sup>2</sup>
				1	2	3	1	2	3		
L-B01	Dwyer	VFA-21	01/04/2022	50	100	200	50.7	99.5	198.5	$0.985x + 1.282$	1.000
L-B02	Dwyer	VFA-21	04/04/2022	50	100	200	49.8	99.8	198.3	$1.016x - 2.084$	1.000
L-B03	Dwyer	VFA-21	01/04/2022	50	100	200	50.4	98.8	197.9	$1.017x - 2.648$	1.000
L-B04	Dwyer	VFA-21	01/04/2022	50	100	200	49.5	101.6	201.1	$0.995x + 1.217$	1.000
L-B05	Dwyer	VFA-21	01/04/2022	50	100	200	50.1	98.1	201.2	$0.993x + 0.208$	1.000
L-B06	Dwyer	VFA-21	05/04/2022	50	100	200	50.3	100.1	202.6	$1.010x + 0.004$	1.000
L-B07	Dwyer	VFA-21	01/04/2022	50	100	200	49.8	100.4	200.1	$1.016x - 1.655$	1.000
L-B08	Dwyer	VFA-21	04/04/2022	50	100	200	50.2	100.9	198.1	$0.999x - 0.281$	1.000
L-B09	Dwyer	VFA-21	01/04/2022	50	100	200	49.2	99.6	201.1	$1.022x - 2.466$	1.000
L-B10	Dwyer	VFA-21	01/04/2022	50	100	200	50.6	100.2	203.2	$0.992x + 2.233$	1.000

Calibrated





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## 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	03/12/2021	1.002	50.02
B02	8002514	01/12/2021	0.995	49.25
B03	1503016	02/12/2021	1.003	50.46
B04	00006659	03/12/2021	0.997	49.64
B05	00007428	03/12/2021	0.998	49.80
R01	1561	02/12/2021	0.999	49.86
R02	8002513	01/12/2021	0.998	50.51
R03	1570	01/12/2021	1.003	49.68
R04	8002519	09/12/2021	1.004	49.52
R05	1503015	08/12/2021	0.997	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



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## 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	01/06/2022	0.999	50.02
B02	8002514	03/06/2022	1.002	49.37
B03	1503016	06/06/2022	1.003	50.46
B04	00006659	02/06/2022	1.002	49.71
B05	00007428	02/06/2022	0.997	49.55
R01	1561	02/06/2022	0.999	49.94
R02	8002513	03/06/2022	0.994	50.51
R03	1570	06/06/2022	1.002	49.68
R04	8002519	02/06/2022	1.004	49.55
R05	1503015	01/06/2022	0.997	50.14

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



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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	01/11/2021	0.84	0.84
B04	S	0.99	01/11/2021	0.84	0.83
B05	S	0.99	01/11/2021	0.85	0.84
B07	S	0.99	01/11/2021	0.85	0.84
B08	S	0.99	03/11/2021	0.84	0.84
B09	S	0.99	03/11/2021	0.84	0.83
B11	S	0.99	03/11/2021	0.84	0.84
B16	S	0.99	02/11/2021	0.85	0.84
B18	S	0.99	02/11/2021	0.83	0.84
B19	S	0.99	02/11/2021	0.84	0.84
B21	S	0.99	01/11/2021	0.84	0.85
B24	S	0.99	02/11/2021	0.84	0.84
B27	S	0.99	02/11/2021	0.83	0.84
B30	S	0.99	02/11/2021	0.84	0.83
B31	S	0.99	02/11/2021	0.84	0.84
B33	S	0.99	02/11/2021	0.85	0.84
B35	S	0.99	01/11/2021	0.83	0.84

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

Calibrated by



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
B36	S	0.99	03/11/2021	0.84	0.84
B37	S	0.99	03/11/2021	0.85	0.84
B38	S	0.99	03/11/2021	0.83	0.84
B39	S	0.99	03/11/2021	0.84	0.84
B40	S	0.99	03/11/2021	0.84	0.85
B41	S	0.99	04/11/2021	0.84	0.84
B44	S	0.99	04/11/2021	0.85	0.84
B45	S	0.99	04/11/2021	0.84	0.83
B46	S	0.99	01/11/2021	0.84	0.84
B47	S	0.99	11/11/2021	0.84	0.83
B48	S	0.99	11/11/2021	0.84	0.84
B49	S	0.99	11/11/2021	0.85	0.84
B54	S	0.99	04/11/2021	0.84	0.84
B56	S	0.99	04/11/2021	0.84	0.83
B57	S	0.99	04/11/2021	0.83	0.84
B58	S	0.99	04/11/2021	0.84	0.84

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

Calibrated by :



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	03/05/2022	0.84	0.85
B04	S	0.99	03/05/2022	0.84	0.84
B05	S	0.99	05/05/2022	0.84	0.83
B07	S	0.99	06/05/2022	0.85	0.84
B08	S	0.99	03/05/2022	0.84	0.84
B09	S	0.99	05/05/2022	0.83	0.84
B11	S	0.99	03/05/2022	0.83	0.84
B16	S	0.99	05/05/2022	0.85	0.84
B18	S	0.99	06/05/2022	0.84	0.85
B19	S	0.99	05/05/2022	0.84	0.83
B21	S	0.99	03/05/2022	0.84	0.85
B24	S	0.99	03/05/2022	0.83	0.84
B27	S	0.99	06/05/2022	0.84	0.85
B30	S	0.99	03/05/2022	0.84	0.84
B31	S	0.99	03/05/2022	0.83	0.84
B33	S	0.99	06/05/2022	0.83	0.84
B35	S	0.99	03/05/2022	0.84	0.84

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

Calibrated by :



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## Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	03/05/2022	0.83	0.84
B37	S	0.99	05/05/2022	0.84	0.84
B38	S	0.99	05/05/2022	0.85	0.84
B39	S	0.99	03/05/2022	0.85	0.84
B40	S	0.99	06/05/2022	0.84	0.83
B41	S	0.99	03/05/2022	0.85	0.84
B44	S	0.99	03/05/2022	0.83	0.84
B45	S	0.99	06/05/2022	0.84	0.84
B46	S	0.99	03/05/2022	0.83	0.84
B47	S	0.99	06/05/2022	0.84	0.84
B48	S	0.99	03/05/2022	0.83	0.84
B49	S	0.99	03/05/2022	0.84	0.85
B54	S	0.99	02/05/2022	0.84	0.85
B56	S	0.99	02/05/2022	0.85	0.84
B57	S	0.99	04/05/2022	0.84	0.84
B58	S	0.99	04/05/2022	0.84	0.83

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

Calibrated by



## Certificate of Calibration

**Certificate No. :** 64-220066-1

**Page : 1 of 2**

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

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

**Equipment :** Vacuum Gauge

**Manufacturer :** HI-LIGHT **Model :** N/A

**ID No. :** 1/60

**Range :** 0 in Hg to -30 in Hg **Resolution :** 1 in Hg

**Environment :** Ambient Temperature :  $(20 \pm 2) ^\circ \text{C}$

Relative Humidity :  $(50 \pm 10) \%$

**Date of Received :** 02 July 2021

**Date of Calibration :** 05 July 2021

**Date of Issue :** 05 July 2021

**Calibrated by :** Satja Sangkhum

**Calibration Method :** In-house method CAL-M2201 based on BS EN 837-1:2016 with Pressure Calibrator

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

Pressure Calibrator & Pressure Sensors Modules

<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>	<u>Traceability</u>
220007	MP-0036-20	11 Mar 2022	National Institute of Metrology (Thailand), (NIMT)
220001	MP-0036-20	11 Mar 2022	National Institute of Metrology (Thailand), (NIMT)



Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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## Certificate of Calibration

**Certificate No. :** 64-220066-1

**Page : 2 of 2**

**Result of Calibration :** Without Adjustment

**Function :** Vacuum measurement

**Condition of calibration :**

- 1 Scale and conversion factor is 1 kPa = 0.295 in Hg
- 2 Angle of mounting from horizontal at 90 °
- 3 UUC reading after lightly tapped
- 4 Reference plane of UUC at center of Gauge
- 5 UUC calibrated by using clean air as pressure media
6. UUC Condition As-Received : Good

Standard Reading ( in Hg )	UUC Reading ( in Hg )	Correction ( in Hg )
0.00	0	0.0
-4.69	-5	0.3
-9.57	-10	0.4
-14.67	-15	0.3
-19.71	-20	0.3
-29.93	-30	0.1
-29.92	-30	0.1
-19.69	-20	0.3
-14.69	-15	0.3
-9.58	-10	0.4
-4.69	-5	0.3
0.00	0	0.0

Remark

UUC : Unit Under Calibration

The uncertainty is combined hysteresis

The uncertainty of measurement was with in  $\pm 0.39$  in Hg

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

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

- o0o -





**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

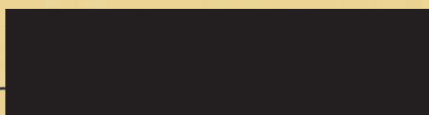
**ID No** : BA 05/50

**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**

:

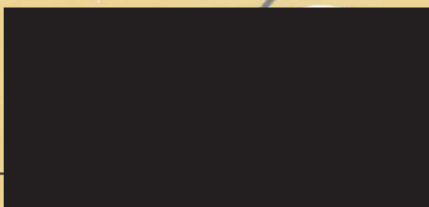
**CALIBRATION DATE**

:

11-Mar-22

**APPROVED BY**

:

**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

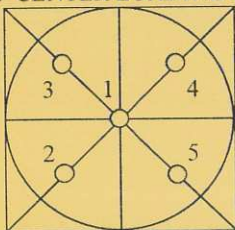
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

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	100.0001	-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





## GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0821/20202

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

Organization : S.P.S. Consulting Service Co., Ltd.

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 10/08/2021

### ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

### RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector ( FID Channel Front)

INJECTOR : Capillary Injector Model 1079

#### GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14, C15, C16 in hexane

SENSITIVITY TEST: C15. ( Area count ) = 144,661 Counts.



**Detector Sensitivity ( FID )**

Detector Response	Result	Specification
Baseline Noise ( $\mu$ V)	2.94	$\leq 50$
Baseline Drift (%)	0.24	$\leq 1$
Sensitivity ( S/N for C15)	2,295	$\geq 1,024$

**Temperature Specification**

Temperature	Set	Result	Specification
Column Oven ( $^{\circ}$ C)	80	80	$\pm 5$
Injector ( $^{\circ}$ C)	220	220	$\pm 5$
Detector ( $^{\circ}$ C)	300	300	$\pm 5$
Incubator ( $^{\circ}$ C)	60	N/A	$\pm 5$

**Relative Standard Deviation % ( % RSD)**

Checkout Procedure	Result	Specification
Area C15 ( % )	2.53	$\leq 5$
Retention Time C15( % )	0.04	$\leq 0.5$

APPROVAL :



Date : 10/08/2021





Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	149,057
C15 Area 2	140,715
C15 Area 3	146,288
C15 Area 4	140,957
C15 Area 5	146,288
C15 Area Average	144,661
* % RSD ( < 5 % )	2.53

\* The precision specification should be less than 2.0 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/08/2021	

Comments			
Reviewed by			Date 10/08/2021







Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	149,057
C15 Area 2	140,715
C15 Area 3	146,288
C15 Area 4	140,957
C15 Area 5	146,288
C15 Area Average	144,661
* % RSD ( < 5 % )	2.53

\* The precision specification should be less than 2.0 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/08/2021	

Comments			
Reviewed by			Date 10/08/2021



**GAS CHROMATOGRAPH TEST CERTIFICATION**

Certificate No. : SV0821/20207

Instrument Type : GC

Model : CP- 3800

Serial Number : 00734

Organization : S.P.S. Consulting Service Co., Ltd.

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 10/08/2021

**ELECTRONIC TEST**

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

**RUN CHROMATOGRAM TEST**

DETECTOR : Pulsed Flame Photometric Detector ( PFPD Channel Rear )

INJECTOR : Capillary Injector Model 1079

**GC CONDITION:**

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Carrier flow	5 mL/min
H2 flow	13 mL/min
Air1 flow	20 mL/min
Air2 flow	10 mL/min

**Column:** Capillary Column CP sil 5 CB 0.25 ID x 15 M**Sample:** 1 µL Injection FPD Test Sample 0.002% Dodecanethiol, Methyl Parathion in Iso-octane**SENSITIVITY TEST:** Methyl Parathion (Area count) = 247,263 Counts



## Detector Sensitivity ( FID )

Detector Response	Result	Specification
Baseline Noise ( $\mu$ V)	2.94	$\leq 50$
Baseline Drift (%)	0.18	$\leq 1$
Sensitivity ( S/N for Methyl Parathion)	4,770	$\geq 1,024$

## Temperature Specification

Temperature	Set	Result	Specification
Column Oven ( $^{\circ}$ C)	80	80	$\pm 5$
Injector ( $^{\circ}$ C)	220	220	$\pm 5$
Detector ( $^{\circ}$ C)	300	300	$\pm 5$
Incubator ( $^{\circ}$ C)	60	N/A	$\pm 5$

## Relative Standard Deviation % ( % RSD)

Checkout Procedure	Result	Specification
Area Methyl Parathion ( %)	0.72	$\leq 5$
Retention Time Methyl Parathion ( %)	0.16	$\leq 0.5$

APPROVAL :



Date : 10/08/2021



VARIAN



**Results Integrated System Testing**

<b>Checkout Procedure</b>	<b>PFPD</b>
<b>Detector Position</b>	Rear
<b>Inlet Type</b>	1079 Injector
<b>Methyl Parathion Area 1</b>	249,065
<b>Methyl Parathion Area 2</b>	246,065
<b>Methyl Parathion Area 3</b>	245,065
<b>Methyl Parathion Area 4</b>	249,055
<b>Methyl Parathion Area 5</b>	247,065
<b>Methyl Parathion Area Average</b>	247,263
<b>* % RSD ( &lt; 5 % )</b>	<b>0.72</b>

\* The precision specification should be less than 2.0 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the Methyl Parathion peak area for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/08/2021	

Comments			
Reviewed by		Date	10/08/2021



**Results Integrated System Testing**

<b>Checkout Procedure</b>	PFPD
<b>Detector Position</b>	Rear
<b>Inlet Type</b>	1079 Injector
<b>Methyl Parathion RT 1</b>	5.976
<b>Methyl Parathion RT 2</b>	5.956
<b>Methyl Parathion RT 3</b>	5.966
<b>Methyl Parathion RT 4</b>	5.976
<b>Methyl Parathion RT 5</b>	5.956
<b>Methyl Parathion RT Average</b>	6.00
<b>* % RSD ( &lt; 0.5 % )</b>	<b>0.16</b>

\* The precision specification should be less than 0.5 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT Methyl Parathion peak for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/07/2021	

Comments			
Reviewed by		Date	10/08/2021



Customer Information	
<b>Sold-To#:</b> 0000268970 <b>S.P.S Consulting Service Co., Ltd</b> <b>7 Phaholyotin 24 Jumpon Chatuchuk</b> <b>Bangkok, 10900</b>	<b>Bill-To#:</b> 0000111501 <b>SITHIPORN ASSOCIATES CO., LTD.,</b> <b>451-451/1 Sirinthorn Road, Bangbumru,</b> <b>Bangplud,</b> <b>Bangkok, 10700,</b>

Order Information			
<b>User Name:</b>		<b>User Email:</b>	
<b>Engineer:</b>	SG31TH09 - Wipach	<b>Arrival Date:</b>	05/05/2021
<b>CIT Record:</b>	SGASC2R6AA59	<b>PO Number:</b>	AS+AC64WAT2083
<b>Description:</b>	<b>Qualification</b>		
<b>Date Completed:</b>	06/05/2021		

Instrument Information			
<b>Service Report:</b>	SGASC2R6AA5A	<b>Model:</b>	2475B
<b>Activity:</b>	QU - Qualification	<b>Warranty End:</b>	27/03/2015
<b>Contract Desc.:</b>	<b>Contract Dates:</b> -		
<b>Corrective Action:</b>	PM 2475 - Normalize Unit / Pass - Raman Band Of Water / Pass ***** Operation Qualification 2475 - Flow Rate Accuracy / Pass - Manual OQ 2475 / Pass - Column Heater Temperature Accuracy / Pass Performance Qualification 2475 - Test Injections / Pass - System Precision / Pass - Wavelength Accuracy / Pass - Carryover / Pass - Detector Linearity And Sensitivity / Pass - Gain Linearity / Pass - Injector Linearity And Accuracy / Pass - Noise And Drift / Pass - Compositional Accuracy / Pass ***** Replace WAT700001644 : MIRROR 40 DEGREE PARABOLA M2 : 1 S/N 11/26/19,6-1773 LOT 2104057CAS64WAT2083D I01/2104057C ***** COMPLETE		
<b>Serial:</b>	L13475758N		
<b>Contract:</b>			

Type Legend
BB = Billable PS = Plan Service PR = Pre Paid SE = Service Expense SA = Sales Expense WA = Instrument Warranty WP = Parts Warranty

Material Supplied				
FSR Number	Material	Description	Type	Qty
SGASC2R6AA5A	741000125	Service Travel	SE	3.0

SGASC2R6AA5A	741000122	Service Labour 1 hour	SE	14.0
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NOTE:

THIS IS NOT AN INVOICE - THIS AMOUNT DOES NOT INCLUDE GST.

UPON RECEIPT OF YOUR PURCHASE ORDER WE WILL ISSUE OUR INVOICE.

Engineer Signature :





## CERTIFICATE OF QUALIFICATION

Qualification Date : 22 June 2022

Next Due : 22 June 2023

<b>Certificate No.</b>	QUAL2022-004
<b>Customer Name</b>	S.P.S Consulting Service Co.,Ltd.
<b>Address</b>	7 Soi Phaholyothin 24, Phaholyothin Road, Ladyao, Jatujak, Bangkok, 10900
<b>Phone</b>	+66 (0) 2939 4370
<b>Fax</b>	-

## Instrument Identification

Model	Serial No.	Manufacturer
e2695	M13SM7942A	WATERS
Column Heater/Cooler	C14SMC892G	WATERS
2489 UV/Vis Detector	B1487E998A	WATERS
TCM	A14TC2310G	WATERS
CHM	L13PRM568M	WATERS
PCR	M13CHM092M	WATERS
RMA	J13RMA889M	WATERS
RMA	J13RMA890M	WATERS

## Operational And Performance Qualification Test Completed

<input checked="" type="checkbox"/> 1. System Precision 250uL	<input checked="" type="checkbox"/> 6. Flow Rate Linearity Accuracy
<input checked="" type="checkbox"/> 2. Wavelength Accuracy	<input checked="" type="checkbox"/> 7. Compositional Precision
<input checked="" type="checkbox"/> 3. Detector Linearity Sensitivity	<input checked="" type="checkbox"/> 8. Noise and Drift
<input checked="" type="checkbox"/> 4. Injector Linearity Accuracy	<input checked="" type="checkbox"/> 9. Signal to Noise
<input checked="" type="checkbox"/> 5. Injector Carryover	<input checked="" type="checkbox"/> 10. Temperature Accuracy

Result Of Qualification: **Passes & Certifies For 1 Year**

Engineer Technical Services



AGM, Technical Services

- The document is invalid if without authorize signatures and reference numbers.
- The data and numbers on this document cannot be changed and replaced in any cases.
- The expired date is valid on the date specified and cannot be reprinted or rewrite in any cases.
- The inspector can check the operator by the address mentioned on above only.
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**DKSH (Thailand) Limited**


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 Phone +662 301 7200, Fax +66 2333 1014, [www.dksh.co.th/tech](http://www.dksh.co.th/tech)

ศูนย์บริการลูกค้าหลังการขาย- Technology service call center



### ***Lambda UV Preventive Maintenance (PM)***

<b>Company Name:</b>	S.P.S. CONSULTING SERVICE CO., LTD.		
<b>Address:</b>	7, Soi Phaholyothin24, Ladyao, Jatujak, Bangkok		
<b>User Name:</b>		<b>WO Number:</b>	WO-01550999
<b>Telephone Number:</b>		<b>PM Number:</b>	6 of 6 P
<b>Customer Support Engineer:</b>		<b>Certificate Number:</b>	UV2004-2022
<b>Date PM Performed:</b> (DD-MMM-YYYY)	25-Jan-2022	<b>Next PM Due Date:</b> (DD-MMM-YYYY)	25-Jul-2022

<b>Part Number</b>	<b>Release</b>	<b>Publication Date</b>	
09370504	B	March 2013	

#### **Scope**

The purpose of this PM is to ensure the continued functionality of the PerkinElmer Lambda UV/Vis Spectrophotometer 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 should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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## Component List

Component Specific Model	Serial #	Software Version		Configuration Notes
Lambda 25	501S14123010	6.2.0.0741	STD	1.27
NA	NA	NA	NA	NA

## Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Serial Number	Expiration Date (MM/YY)
B250 0099	Stray Light standard			
	Nal cell	1	1943	Jan-22
	NaNO2 cell	1	2963	
	KCl cell	1	31030	
	H2O	1	71497	
B050 7805	Secondary Standards for calibration of wavelength and photometric accuracy or use NBS/NIST 390 standards			
	Gray Glass G1	1	2926	Jan-22
	Gray Glass G2	1	3501	
	Gray Glass G3	1	2552	
	Holmium Glass	1	1085	

Additional Tools Required for PM					
Part Number (if applicable)	Description	Quantity	Serial #		Remark
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

Additional Reagents and Standards Required for PM					
Part Number (if applicable)	Description	Quantity	Batch/Lot #		Expiration Date (MM/YY)
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

## 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. Optical checks:

- ☒ Lamp Alignment/Energy
- ☒ Sample Compartment Windows/Monochromator
- ☒ Mirror and Grating Alignment
- ☒ Cell Holder Alignment

### 3. Mechanical:

- ☒ Physical inspection – Please write any comments in the additional comments section.
- ☒ Grating Drive Mechanism.
- ☒ Lamp Change Mechanism.
- ☐ Slit Drive Manual Servo.

### 4. Test:

Refer to Appendix A for the specifications of the instrument being tested.

- ☒ D2 Wavelength accuracy

	Actual Value	Specification
Accuracy at 656.1 nm	656.16	± 0.1



☒ Holmium Oxide wavelength accuracy

Filter ID #		1085		
Test	Calibration Value	Actual Value	Deviation	Specification
279.3 nm	279.3	279.39	-0.09	± 0.5
360.8 nm	360.9	360.93	-0.03	± 0.5
459.9 nm	460.0	460.07	-0.07	± 0.5
536.4 nm	536.2	536.40	-0.20	± 0.5

☒ Scattered Light.

Test	Filter ID #	Result	Specification
NaI @ 220 nm	1943	0.0133	< 0.02 %T
NaNO <sub>2</sub> @ 340 nm	2963	-0.1296	< 0.02 %T
NaNO <sub>2</sub> @ 370 nm	2963	-0.0002	< 0.02 %T
KCl @ 200 nm	31030	2.4808	≥ 2 A

☒ Baseline Flatness.

Corrected Baseline	Specification
0.000163	± 0.001 A

☒ Noise Test @ 500 nm.

Actual Value	Specification
0.0000240	± 0.00008 A

☒ Photometric Accuracy.

Filter 1 ID #		2926		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	0.3483	0.3493	-0.0010	± 0.006 A
546 nm	0.3029	0.3046	-0.0017	± 0.006 A
635 nm	0.3200	0.3232	-0.0032	± 0.006 A
Filter 2 ID #		3501		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	1.001	1.0024	-0.0014	± 0.006 A
546 nm	0.9797	0.9813	-0.0016	± 0.006 A
635 nm	1.0285	1.0325	-0.0040	± 0.006 A
Filter 3 ID #		2552		
Test	Calibrated Value	Actual Value	Deviation	Specification
440 nm	0.489	0.4935	-0.0045	± 0.006 A
546 nm	0.4582	0.4595	-0.0013	± 0.006 A
635 nm	0.5046	0.5075	-0.0029	± 0.006 A

**5. Accessory (where applicable):**

- ☐ Integrating Sphere
- ☐ Reflecting Attachment
- ☐ Cell Changer
- ☐ Sipper
- ☐ Auto Sampler

**6. 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.
- ☒ Update Logbook.

## Additional Comments

Additional Comments Regarding the PM

## Review

<p><i>The preventive maintenance checks and if applicable performance tests for Lambda UV have been completed.</i></p>		
<p><i>This Lambda UV Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></p>		
Review of Preventive Maintenance:		
		<p>Date:</p> <p>25-Jan-2022 (DD-MM-YYYY)</p>
<p>Authorized Customer Representative:</p>		<p>Date:</p> <p>25-Jan-2022 (DD-MM-YYYY)</p>





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

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	07 June 2022	Brand :	Thermo	Model :	48C
No.	CO-B07	Serial No.	0335203746		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 20 September 2021		Serial No.	: 421	
Reference Standard Gas					
Standard Gas	: Carbon Monoxide (CO)		Cylinder No.	: D196045	
Certified Date	: 16 April 2022	Expired Date	: 15 April 2024	Cylinder Conc.	: 4,570 ppm
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	49	
Calibration Setting					
Span	Initial Reading (Before Adj.),PPM			Final Reading (After Adj.),PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	39.96	-0.100	40.00	
Instrument Status					
Chamber Temp	47.4 °C		Flow	1.5 LPM	
Pressure	730.8 mm Hg		Motor Speed	100.00%	

ระดับเสียง

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

## CALIBRATION CERTIFICATE

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

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

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

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

### Ambient Environment

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

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 : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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 Brüel&Kjaer 4180	93.93	-0.07	$\pm 0.10$	$\pm 0.40$ dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	999.9	-0.1	$\pm 1.5$	$\pm 1.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1.44	$\pm 0.50$	$\pm 3.0\%$

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

Calibrated by :



Approved



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Ref : 2011265042601787001

2 / 2

End of Certificate

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

Noise B\_333/22

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B06	ACO	6236	00142003	14 June 2022	93.9	94.0
ACO-B16	ACO	6236	00172039	14 June 2022	94.0	94.0
ACO-B22	ACO	6236	00172060	14 June 2022	94.1	94.0
ACO-B28	ACO	6236	00182009	14 June 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :





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Noise B\_359/22

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B25	ACO	6236	00182006	12 June 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :



Request No. 21-65/0389

MTC No. EEL. BP. 70/0365

## CALIBRATION CERTIFICATE

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

**Address** : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106120

**Ambient Environment**

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

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

Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

**Standards used :**

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

**Date of Receipt** : 16 Mar. 2022

**Date of Calibration** : 18 Mar. 2022

1 / 2

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Request No. 21-65/0389

MTC No. EEL. BP. 70/0365

**Acoustic signal test of frequency weightings**

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.0	0.0	0.25	2.0
1 000	0.2	0.0	0.25	1.4
4 000	0.1	0.2	0.25	3.6

- Note :**
- 1) There was no adjustment.
  - 2) The calibration was performed at a sound pressure level of 114 dB.
  - 3) The measured values did not include the correction of microphone of UUT.
  - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :

...

**Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre**

Ref : 2011265031601187001

**Date of Calibration** : 18 Mar. 2022

**Date of Issue** : 18 Mar. 2022

2 / 2

**End of Certificate**

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0389

MTC No. EEL. BP. 72/0365

## CALIBRATION CERTIFICATE

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

**Address** : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106123

**Ambient Environment**

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

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

Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

**Standards used :**

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

**Date of Receipt** : 16 Mar. 2022

**Date of Calibration** : 18 Mar. 2022

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Request No. 21-65/0389

MTC No. EEL. BP. 72/0365

**Acoustic signal test of frequency weightings**

Frequency (Hz)	Deviation from response curve		Uncertainty (+dB)	Tolerance Limits Class 2 (+dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.3	-0.1	0.25	2.0
1 000	0.1	0.0	0.25	1.4
4 000	0.0	0.0	0.25	3.6

**Note :** 1) There was no adjustment.

2) The calibration was performed at a sound pressure level of 114 dB.

3) The measured values did not include the correction of microphone of UUT.

4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

**Calibrated by :**

**Approved by :**



**Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre**

**Ref : 2011265031601187003**

**Date of Calibration :** 18 Mar. 2022

**Date of Issue :** 18 Mar. 2022

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**End of Certificate**

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0389

MTC No. EEL. BP. 73/0365

## CALIBRATION CERTIFICATE

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

**Address** : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106124

**Ambient Environment**

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

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

Ambient Pressure :  $(101.325 \pm 1.5) \text{ kPa}$

**Standards used :**

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

**Date of Receipt** : 16 Mar. 2022

**Date of Calibration** : 18 Mar. 2022

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Request No. 21-65/0389

MTC No. EEL. BP. 73/0365

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.0	-0.2	0.25	2.0
1 000	0.1	0.0	0.25	1.4
4 000	-0.3	-0.3	0.25	3.6

- Note :**
- 1) There was no adjustment.
  - 2) The calibration was performed at a sound pressure level of 114 dB.
  - 3) The measured values did not include the correction of microphone of UUT.
  - 4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

Approved by :



Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Ref : 2011265031601187004

Date of Calibration : 18 Mar. 2022

Date of Issue : 18 Mar. 2022

2 / 2

End of Certificate

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Noise Dose B\_349/22

## Noise Dose Meter Calibration Report

### Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 06/62
Model	SV34	Serial No.	33139
Calibration Range	114 dB, 1000 Hz	Last Calibration	17 September 2021
		Due Date	17 September 2022

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B16	SVANTEK	SV-104IS	106120	14 June 2022	113.5	113.6
NMD-B18	SVANTEK	SV-104IS	106123	14 June 2022	113.6	113.6
NMD-B19	SVANTEK	SV-104IS	106124	14 June 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67± 0.10 dB	

Calibrated



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Noise B\_333/22

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	28 April 2022
		Due Date	28 April 2023

### Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B06	ACO	6236	00142003	14 June 2022	93.9	94.0
ACO-B16	ACO	6236	00172039	14 June 2022	94.0	94.0
ACO-B22	ACO	6236	00172060	14 June 2022	94.1	94.0
ACO-B28	ACO	6236	00182009	14 June 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrat

คุณภาพน้ำ



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
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TEL. 0-2717-3000-27 FAX. 0-2719-9484



Cert.No.: 21CH1216

Page.: 1 of 2

## Certificate of Calibration

Equipment :	pH Meter
Manufacturer :	HANNA
Model :	HI 3512
Serial No. :	08685754
ID No. :	-
Condition As-Received:	Used Item
Received Date :	14 September 2021
Calibration Date :	16 September 2021
Reference :	2109-0508WN-1
Submitted by :	S.P.S. Consulting Service Co.,Ltd. 7 Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok10900
Ambient Temperature :	(25 ± 2.5) °C
Relative Humidity :	(50 ± 15) %
Calibration Procedure :	In - house method : - CP-CH5 by direct measurement with standard voltage calibrator and direct measurement with certified reference material (CRM)

Calibrated by :

Approved by :

(✓) Malee Butkruea  
( ) Saithip Meangmai  
( ) Warakorn Lernagtrakul

Issue Date :

22 September 2021

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 Corporate Services 3 : Equipment Calibration and Testing Services.

A 0032410





Cert. No.: 21CH1216

Page.: 2 of 2

**Condition of this calibration result**

1. Reference Standard Instrument : -

<u>Instrument</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Document Process Calibrator	46530031	130RC098	20E3666	14 Oct 2021

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

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

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,  
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

<u>Buffer Solution</u>	<u>Manufacturer</u>	<u>Lot No.</u>	<u>Exp. date</u>
pH 4.008	CPA chem	754028	28 June 2023
pH 6.985	CPA chem	725927	12 Jan 2022
pH 10.015	CPA chem	761018	02 Aug 2022

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

**Calibration Results****Function : mV Measurement**

Performing standard curve by Fluke at pH (4,7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement ( $\pm$ mV)	Coverage factor <i>k</i>
	pH	mV	mV	pH		
pH Meter S/N.: 08685754	4.000	177.48	177.9	4.000	0.058	2.00
	7.000	0.00	0.4	7.000	0.058	2.00
	10.000	-177.48	-177.2	10.000	0.058	2.00

**Function : pH Measurement**

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement ( $\pm$ )	Coverage factor <i>k</i>
pH Electrode S/N.: 061416CM	4.008	4.008	169.2	0.0046	2.00
	6.985	6.985	-4.4	0.0075	2.00
	10.015	10.013	-178.9	0.013	2.05

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-



CERTIFICATE No : 22M2568

REFERENCE No : 64386-2

PAGE : 1 OF 2

## Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591842

ID No : BA 08/61

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 :

CALIBRATION DATE :

11-Mar-22

APPROVED BY :

ISSUED DATE :

17-Mar-22

RECEIVED DATE :

11-Mar-22





CERTIFICATE No : 22M2568

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW  
MANUFACTURER : SARTORIUS S/N : 36591842  
ID No : BA 08/61 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

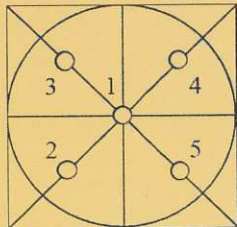
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.  
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.  
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-  
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL 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	100.0000
3	99.9999
4	100.0000
5	100.0000
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





# 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 : 22T0569

REFERENCE No : 63773-1

PAGE : 1 OF 2

## Certificate of Calibration

**EQUIPMENT** : COD REACTOR

**MANUFACTURER** : HACH

**MODEL** : DRB 200

**SERIAL No** : 15110C0235

**ID No** : DRB 05/59

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

**CALIBRATED BY** :



**CALIBRATION DATE** :

21-Jan-22

**APPROVED BY** :



**ISSUED DATE** :

21-Jan-22

**RECEIVED DATE** :

19-Jan-22





CERTIFICATE No : 22T0569

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
ID NUMBER : DRB 05/59  
RECEIVED DATE : 19-Jan-22  
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200  
SERIAL NUMBER : 15110C0235  
CALIBRATION DATE : 21-Jan-22  
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

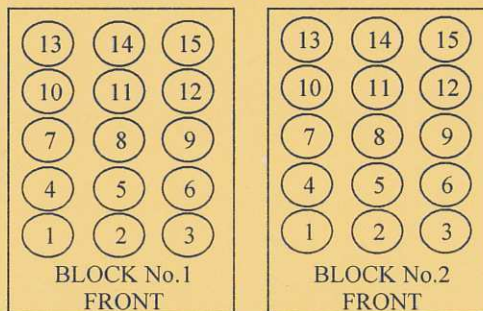
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

### 2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	21T6767	10-Jul-22

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

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



### TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	150.1
	2	149.8
	3	150.3
	4	149.6
	5	150.1
	6	150.0
	7	150.4
	8	150.0
	9	150.1
	10	149.9
	11	149.5
	12	149.5
	13	150.6
	14	150.1
	15	150.3
Uncertainty of Measurement(± °C)	0.86	0.86

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAM

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

END OF CALIBRATION REPORT





**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.:** 21TW92

**Page.:** 1 of 2

## **Certificate of Testing**

<b>Equipment :</b>	DO Meter
<b>Manufacturer :</b>	YSI
<b>Model :</b>	5100
<b>Serial No. :</b>	01H1079 AB
<b>ID No. :</b>	-
<b>Received Date :</b>	19 April 2021
<b>Test Date :</b>	21 April 2021
<b>Reference :</b>	2104-0372WN-1
<b>Submitted by :</b>	S.P.S. Consulting Service Co.,Ltd. 7 Soi Phaholyothin 24, Phaholyothin Rd., 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

**Tested by :**

**Approved by :**

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

**Issue Date :**

26 April 2021



**Cert.No.:** 21TW92

**Page.:** 2 of 2

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

**Dissolved Oxygen Probe No.:** 14J100195

<b>Titration Method (Azide Modification Method) (mg/L)</b>	<b>DO Meter Reading (mg/L)</b>	<b>Standard Deviation (mg/L)</b>
8.00	7.99	0.0055

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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**TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)**  
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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>	
<b>Approved by :</b>	
<input checked="" type="checkbox"/> Malee Butkruea <input type="checkbox"/> Saithip Meangmai <input type="checkbox"/> Warakorn Lerngagtrakul	
<b>Issue Date :</b>	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) (mg/L)</b>	<b>DO Meter Reading (mg/L)</b>	<b>Standard Deviation (mg/L)</b>
8.12	8.14	0.0084

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# Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: CN10925120  
Organization Name: S.P.S Consulting service  
Organization Location: 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900  
Date: March 29, 2022 3:56:41 PM  
EQP Name: AgilentRecommended , AgilentRecommended  
EQP Revision: GC.02.50, GCMS.02.50  
Overall Qualification Status: Pass

## System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

## Overall System Inspection and Basic Safety and Operation Test Status

Pass

## Inlet Pressure Decay

Name: 7890

Back

SSL

Setpoint Status:

Pass

Pressure:

25.0

psi

Pressure Change:

-0.2

psi

/5 minutes

Agilent Recommended:

&gt;=

-2.0

and

&lt;=

0.5

## Overall Inlet Pressure Decay Test Status

Pass

## Inlet Pressure Accuracy

Name: 7890

Back

SSL

Date: March 29, 2022 3:56:41 PM  
System ID: CN10925120

## Setpoint Status:

Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.0	psi
Accuracy:			0.0	psi
Agilent Recommended:			<= 1.2	

## Overall Inlet Pressure Accuracy Test Status

Pass

## Inlet Pressure Accuracy

Name:

7890

Front

SSL

## Setpoint Status:

Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	25.0	psi
Accuracy:			0.0	psi
Agilent Recommended:			<= 1.2	

## Overall Inlet Pressure Accuracy Test Status

Pass

## Detector Flow Accuracy

Name:

7890

Front

FID

## Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

30.4

mL/min

Accuracy:

0.4

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

( 3.0 mL/min )

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Date:

March 29, 2022 3:56:41 PM

System ID:

CN10025120

## Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

392.6

mL/min

Accuracy:

7.4

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

40.0

mL/min

)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

25.4

mL/min

Accuracy:

0.4

mL/min

Agilent Recommended:

&lt;=

10.0

% setpoint

(

2.5

mL/min

)

Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

## Overall Detector Flow Accuracy Test Status

Pass

## GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

230.6

°C

Accuracy:

0.6

°C

Agilent Recommended:

&gt;=

-1.0

% setpoint in K

(

-5.0

°C )

&lt;=

1.0

% setpoint in K

(

5.0

°C )

Date:

March 29, 2022 3:56:41 PM

System ID:

CN10025120



## Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.3 °C

Accuracy:

0.3 °C

Agilent Recommended:

&gt;= -1.0 % setpoint in K

( -3.7 °C )

&lt;= 1.0 % setpoint in K

( 3.7 °C )

## Overall GC Oven Temperature Accuracy Test Status

Pass

## GC Oven Temperature Stability

Name:

7890

## Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.2333 °C

Stability:

0.1 °C

Agilent Recommended:

&lt;= 0.5

## Overall GC Oven Temperature Stability Test Status

Pass

## Scouting Run

Tested Combination1

Back

SSL

/ Front

FID

Manual Injection

Name:

Not applicable

## Setpoint Status:

Completed

Injection Volume on Column:

1.0 uL

## Overall Scouting Run Status

Completed

## Noise and Drift

Tested Combination1

Back

SSL

/ Front

FID

Date:

March 29, 2022 3:56:41 PM

System ID:

CN10025120

Name:	7890			
Setpoint Status:	Pass			
Base Signal:	12.1	pA		
	ASTM Noise		Drift	
	counts		counts/Hr	
		712.29		275.82
Agilent Recommended:	<=	768.00	<=	19200.00
Status:	Pass		Pass	

**Overall Noise and Drift Test Status**

Pass

**Signal to Noise**

Tested Combination1	Back	SSL	/ Front	FID
	Manual Injection			
Name:	7890			
Setpoint Status:	Pass			
Signal to Noise:		874687		
Agilent Recommended:	>=	300000		

**Overall Signal to Noise Test Status**

Pass

**Log Amp**

Tested Combination2	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			

**Overall Log Amp Test Status**

Pass

**RFPA**

Date: March 29, 2022 3:56:41 PM  
System ID: CN10025120

Tested Combination2	Front	SSL	/ External	SQ			
Name:	5975C Inert XL with TAD						
Setpoint Status:	Pass						
Amu:	1050	m/z	Drift After Five Minutes:	RFP Voltage:			
			4	485			
			mV	mV			
Agilent Recommended:	>=	-100	and	<=	100	<=	1100
<b>Overall RFP Test Status</b>							
Pass							

## Tune EI

Tested Combination2	Front	SSL	/ External	SQ
Name:	5975C Inert XL with TAD			
Setpoint Status:	Pass			
Filament:	1			
Setpoint Status:	Pass			
Filament:	2			
<b>Overall Tune EI Test Status</b>				
Pass				

## Signal to Noise EI

Tested Combination2	Front	SSL	/ External	SQ
Name:	5975C Inert XL with TAD			
Source:	EI - Inert	Filament:	1	
Setpoint Status:	Pass			
Signal to Noise:	332			
Agilent Recommended:	>=	320		

Date: March 29, 2022 3:56:41 PM  
System ID: CN10025120

Source: EI - Inert Filament: 2

Setpoint Status: Pass

Signal to Noise: 422

Agilent Recommended:  $\geq$  320

---

**Overall Signal to Noise EI Test Status**

Pass



## Instrument Details

### Purpose

This section describes the as found system configuration.

### Details

#### System

System ID	CN10925120
Manufacturer	Agilent Technologies
Name	7890

#### Tested Combination1

Injection Technique	Manual Injection
Sampler Identifier	Sampler 1
Inlet	Back
Detector	Front
LTM Included?	No

#### Tested Combination2

Injection Technique	Manual Injection
Sampler Identifier	Sampler 2
Inlet	Front
Detector	External
LTM Included?	No

#### Sampler 1

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

#### Sampler 2

Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

## Mainframe 1

Manufacturer	Agilent Technologies
Name	7890
Model Number	G3440A
Serial Number	CN10925120
Firmware Revision	A.01.10.3
Oven Type	Standard

## Inlet 1

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Inlet 2

Manufacturer	Agilent Technologies
Name	7890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

## Detector 1

Manufacturer	Agilent Technologies
Name	7890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

## Detector 2

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

## Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C inert XL with TAD
Serial Number	US91732743
Firmware Revision	5975 5.02.07
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

## MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

## Electronic Signature

### Purpose

This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and logon to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

### Details

Full Name of Signer:	Saenguthai Tarak
Logged On User Name:	saenguthai.tarak@non.agilent.com
Signature Creation Date:	March 29, 2022
Reason for Signature:	Executed protocol and published this original version of document

### Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

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---

Date:	March 29, 2022 3:56:41 PM
System ID:	CN10925120



User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:45:41 PM	Audit	SessionCreated	Session	None
March 29, 2022 1:45:41 PM	Start	Configuration	Session	None
March 29, 2022 1:45:41 PM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
March 29, 2022 1:46:18 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.50/Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.50/GcMs.02.50.eqp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
March 29, 2022 1:46:20 PM	End	Configuration	Session	None
March 29, 2022 1:46:24 PM	Start	Qualification	Session	OQ
March 29, 2022 1:46:24 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 29, 2022 1:47:33 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:47:36 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 29, 2022 1:47:47 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 29, 2022 1:47:48 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 29, 2022 1:47:53 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 29, 2022 1:47:54 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 29, 2022 1:48:02 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 29, 2022 1:48:04 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:18 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 29, 2022 1:48:20 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:26 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

Page 2 / 7

Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:48:27 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 29, 2022 1:48:40 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 29, 2022 1:48:42 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 29, 2022 1:49:00 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 29, 2022 1:49:03 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 29, 2022 1:49:06 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 29, 2022 1:49:30 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 29, 2022 1:49:31 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature ; Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 29, 2022 1:49:33 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None

Page 3 / 7

Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 1:50:29 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 29, 2022 1:50:30 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 29, 2022 3:15:23 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 29, 2022 3:15:26 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 29, 2022 3:15:39 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 29, 2022 3:16:02 PM	Audit	Data	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : F:\PMOQ2022\SC_FID.D\FID 1A.ch
March 29, 2022 3:16:37 PM	End	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 29, 2022 3:16:39 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 29, 2022 3:25:39 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None

Page 4 / 7

Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120



User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:26:13 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : F:\PMOQ2022\ND_FID.D\FID 1A.ch
March 29, 2022 3:26:19 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 29, 2022 3:27:37 PM	Start	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	None
March 29, 2022 3:27:49 PM	Audit	Data	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : F:\PMOQ2022\SN_FID.D\FID 1A.ch
March 29, 2022 3:28:18 PM	End	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 29, 2022 3:29:49 PM	Audit	AcqRestarted	Session	None
March 29, 2022 3:30:44 PM	Audit	SessionReloaded	Session	None
March 29, 2022 3:30:47 PM	Start	Qualification	Session	OQ
March 29, 2022 3:30:53 PM	Start	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Inert	None
March 29, 2022 3:31:02 PM	End	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Inert	Run Count : 1
March 29, 2022 3:31:05 PM	Start	Execution	RFP - 5975C inert XL with TAD SQ: - Source: EI - Inert	None
March 29, 2022 3:33:09 PM	End	Execution	RFP - 5975C inert XL with TAD SQ: - Source: EI - Inert	Run Count : 1
March 29, 2022 3:33:11 PM	Start	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	None

Page 5 / 7

Date: March 29, 2022 3:56:41 PM  
 System ID: CN10925120

User Name: saenguthai.tarak  
 Hostname: LAPTOP-CQ3SKQMV

System Id: CN10925120  
 Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:33:43 PM	End	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 29, 2022 3:33:45 PM	Start	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 29, 2022 3:34:05 PM	End	Execution	Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 29, 2022 3:34:37 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	None
March 29, 2022 3:34:51 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	Data files Path : F:\PMOQ2022\SN_F1_05.D\ DATASIM.MS
March 29, 2022 3:35:27 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320	Run Count : 1
March 29, 2022 3:35:30 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None
March 29, 2022 3:35:58 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None

User Name: saenguthai.tarak  
Hostname: LAPTOP-CQ3SKOMV

System Id: CN10925120  
Print Date: March 29, 2022 3:56:43 PM

## OQ\_GCMS\_SPS CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 29, 2022 3:36:32 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	None
March 29, 2022 3:36:46 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	Data files Path : F:\PMOQ2022\SN_F2_05.D\ DATASIM.MS
March 29, 2022 3:36:53 PM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320	Run Count : 1
March 29, 2022 3:36:58 PM	End	Qualification	Session	OQ
March 29, 2022 3:36:58 PM	Start	Reporting	Session	None
March 29, 2022 3:50:19 PM	Audit	Reporting	Session	Report Generated : Certificate



## GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0821/20202

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

Organization : S.P.S. Consulting Service Co., Ltd.

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 10/08/2021

### ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

### RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector ( FID Channel Front)

INJECTOR : Capillary Injector Model 1079

#### GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14, C15, C16 in hexane

SENSITIVITY TEST: C15. ( Area count ) = 144,661 Counts.







## Detector Sensitivity ( FID )

Detector Response	Result	Specification
Baseline Noise ( $\mu$ V)	2.94	$\leq 50$
Baseline Drift (%)	0.24	$\leq 1$
Sensitivity ( S/N for C15)	2,295	$\geq 1,024$

## Temperature Specification

Temperature	Set	Result	Specification
Column Oven ( $^{\circ}$ C)	80	80	$\pm 5$
Injector ( $^{\circ}$ C)	220	220	$\pm 5$
Detector ( $^{\circ}$ C)	300	300	$\pm 5$
Incubator ( $^{\circ}$ C)	60	N/A	$\pm 5$

## Relative Standard Deviation % ( % RSD)

Checkout Procedure	Result	Specification
Area C15 ( % )	2.53	$\leq 5$
Retention Time C15( % )	0.04	$\leq 0.5$

APPROVAL :



Date : 10/08/2021





Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	149,057
C15 Area 2	140,715
C15 Area 3	146,288
C15 Area 4	140,957
C15 Area 5	146,288
C15 Area Average	144,661
* % RSD ( < 5 % )	2.53

\* The precision specification should be less than 2.0 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/08/2021	

Comments			
Reviewed by		Date	10/08/2021





Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	149,057
C15 Area 2	140,715
C15 Area 3	146,288
C15 Area 4	140,957
C15 Area 5	146,288
C15 Area Average	144,661
* % RSD ( < 5 % )	2.53

\* The precision specification should be less than 2.0 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/08/2021	

Comments			
Reviewed by			
		Date	10/08/2021





**GAS CHROMATOGRAPH TEST CERTIFICATION**

Certificate No. : SV0821/20207

Instrument Type : GC

Model : CP- 3800

Serial Number : 00734

Organization : S.P.S. Consulting Service Co., Ltd.

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 10/08/2021

**ELECTRONIC TEST**

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

**RUN CHROMATOGRAM TEST**

DETECTOR : Pulsed Flame Photometric Detector ( PFPD Channel Rear )

INJECTOR : Capillary Injector Model 1079

**GC CONDITION:**

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Carrier flow	5 mL/min
H2 flow	13 mL/min
Air1 flow	20 mL/min
Air2 flow	10 mL/min

**Column:** Capillary Column CP sil 5 CB 0.25 ID x 15 M**Sample:** 1 µL Injection FPD Test Sample 0.002% Dodecanethiol, Methyl Parathion in Iso-octane**SENSITIVITY TEST:** Methyl Parathion (Area count) = 247,263 Counts





## Detector Sensitivity ( FID )

Detector Response	Result	Specification
Baseline Noise ( $\mu$ V)	2.94	$\leq 50$
Baseline Drift (%)	0.18	$\leq 1$
Sensitivity ( S/N for Methyl Parathion)	4,770	$\geq 1,024$

## Temperature Specification

Temperature	Set	Result	Specification
Column Oven ( $^{\circ}$ C)	80	80	$\pm 5$
Injector ( $^{\circ}$ C)	220	220	$\pm 5$
Detector ( $^{\circ}$ C)	300	300	$\pm 5$
Incubator ( $^{\circ}$ C)	60	N/A	$\pm 5$

## Relative Standard Deviation % ( % RSD)

Checkout Procedure	Result	Specification
Area Methyl Parathion ( %)	0.72	$\leq 5$
Retention Time Methyl Parathion ( %)	0.16	$\leq 0.5$

APPROVAL :



Date : 10/08/2021



VARIAN

**Results Integrated System Testing**

<b>Checkout Procedure</b>	<b>PFPD</b>
<b>Detector Position</b>	Rear
<b>Inlet Type</b>	1079 Injector
<b>Methyl Parathion Area 1</b>	249,065
<b>Methyl Parathion Area 2</b>	246,065
<b>Methyl Parathion Area 3</b>	245,065
<b>Methyl Parathion Area 4</b>	249,055
<b>Methyl Parathion Area 5</b>	247,065
<b>Methyl Parathion Area Average</b>	247,263
<b>* % RSD ( &lt; 5 % )</b>	<b>0.72</b>

\* The precision specification should be less than 2.0 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the Methyl Parathion peak area for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/08/2021	



Comments			
Reviewed by		Date	10/08/2021





Results Integrated System Testing

Checkout Procedure	PFPD
Detector Position	Rear
Inlet Type	1079 Injector
Methyl Parathion RT 1	5.976
Methyl Parathion RT 2	5.956
Methyl Parathion RT 3	5.966
Methyl Parathion RT 4	5.976
Methyl Parathion RT 5	5.956
Methyl Parathion RT Average	6.00
* % RSD ( < 0.5 % )	0.16

\* The precision specification should be less than 0.5 % RSD \*\* ( Relative Standard Deviation ) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT Methyl Parathion peak for each of the five ( 5 ) samples.

\*\* (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = ( \text{std.dev} / \text{avg} ) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/07/2021	

Comments			
Reviewed by			Date 10/08/2021



ระดับความร้อน





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

Heat B001\_4/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B36	Verification Date	: 21 April 2022
Brand	: QUEST TECHNOLOGIES	Ambient Temp.	: 24.5 °C
Model	: QUESTemp <sup>o</sup> 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSI010028	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by





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

Heat B001\_4/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B36	Verification Date	: 21 April 2022
Brand	: QUEST TECHNOLOGIES	Ambient Temp.	: 24.5 °C
Model	: QUESTemp <sup>o</sup> 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSI010028	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :





# CALIBRATION LABORATORY Co., LTD.

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



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER  
(THERMAL ENVIRONMENT MONITOR)  
MANUFACTURER : QUEST TECHNOLOGIES  
MODEL / TYPE : QUES TEMP ° 46  
SERIAL NO. : TSI010028  
CLID. NO. : 232002960  
JOB CONTROL NO. : 211026102934

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

DATE OF RECEIVED : 26 October 2021

DATE OF ISSUED : 30 October 2021

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

Calibrated By :



Approved By :

Authorized Signatory

30 October 2021

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. Q21102934

F3-011-04/01-12

page 1 of 3



@clccalibration



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER  
(THERMAL ENVIRONMENT MONITOR)  
MANUFACTURER : QUEST TECHNOLOGIES  
MODEL / TYPE : QUES TEMP ° 46  
SERIAL NO. : TSI010028  
DATE OF CALIBRATION : 27 October 2021

---

#### 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. **WI-305-74**. The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.  
Certificate No.18815, Due Date 11 November 2021.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.  
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. **Q21102934**

F3-011-04/01-12

page 2 of 3





## 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 the measuring digital thermohygro meter (thermal environment monitor).

### CALIBRATION DATA

#### \*1. CORRECTION OF TEMPERATURE : WET

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
30.0	30.20	31.9	-1.70	0.40
35.0	35.02	36.7	-1.68	
40.0	40.19	40.4	-0.21	

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

#### 2. CORRECTION OF TEMPERATURE : DRY

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
30.0	30.07	29.9	+0.17	0.40
35.0	34.92	34.8	+0.12	
40.0	40.09	39.9	+0.19	

#### 3. CORRECTION OF TEMPERATURE : GLOBE

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
30.0	30.07	29.9	+0.17	0.40
35.0	34.92	34.8	+0.12	
40.0	40.09	39.9	+0.19	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

### End of Certificate ###

Certificate No. Q21102934

F3-011-04/01-12

page 3 of 3



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER  
(THERMAL ENVIRONMENT MONITOR)  
MANUFACTURER : QUEST TECHNOLOGIES  
MODEL / TYPE : QUES TEMP ° 46  
SERIAL NO. : TSI010004  
CLID. NO. : 232002963  
JOB CONTROL NO. : 211026102933

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

DATE OF RECEIVED : 26 October 2021

DATE OF ISSUED : 30 October 2021

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

Calibrated By :

Approved By :



30 October 2021

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. Q21102933

F3-011-04/01-12

page 1 of 3



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER  
(THERMAL ENVIRONMENT MONITOR)  
MANUFACTURER : QUEST TECHNOLOGIES  
MODEL / TYPE : QUES TEMP ° 46  
SERIAL NO. : TSI010004  
DATE OF CALIBRATION : 27 October 2021

---

#### 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. **WI-305-74**. The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 44602.

Temperature & Humidity Chamber, PGC Model 9141-5116 S/N. 1304261.

#### TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Thunder Scientific Corporation.

Certificate No.18815, Due Date 11 November 2021.

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2.00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q21102933

F3-011-04/01-12

page 2 of 3





## 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 the measuring digital thermohygro meter (thermal environment monitor).

### CALIBRATION DATA

#### \*1. CORRECTION OF TEMPERATURE : WET

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
30.0	30.20	31.3	-1.10	0.40
35.0	35.02	36.5	-1.48	
40.0	40.19	40.3	-0.11	

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

#### 2. CORRECTION OF TEMPERATURE : DRY

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
30.0	30.07	30.0	+0.07	0.40
35.0	34.92	34.9	+0.02	
40.0	40.09	39.9	+0.19	

#### 3. CORRECTION OF TEMPERATURE : GLOBE

Test point ( ° C )	Actual Temperature ( ° C )	DUC Reading ( ° C )	Correction ( ° C )	Uncertainty ± ( ° C )
30.0	30.07	30.1	-0.03	0.40
35.0	34.92	35.0	-0.08	
40.0	40.09	39.9	+0.19	

Note. The Scope of Accredited TISI Certificate No. 19C087/0655 Issue 1 Page 36 of 111

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

### End of Certificate ###

Certificate No. Q21102933

F3-011-04/01-12

page 3 of 3



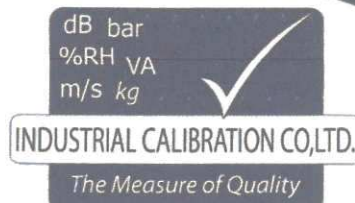


ระดับความเข้มของแสงสว่าง

## Industrial Calibration Co., Ltd.

38/41 Moo. 3, Lum Luk Ka Road., Khu Khot Subdistrict,  
Lam Luk Ka District, Phatum Thani 12130 Thailand.

Tel : +66 (02) 991 0440  
Fax : +66 (02) 531 6294  
Email : info@industrial.co.th



CERTIFICATE No. ....CAL06052-21..... PAGE .....1..... OF .....2.....

# Certificate of Calibration

Equipment : HEAVY DUTY LIGHT METER  
Manufacture : EXTECH  
Model / Type : 407026  
Serial No. : A.052156  
ID No. : N/A  
Customer : S.P.S. CONSULTING SERVICE CO.,LTD.

7 SOI PHAHOLYOTHIN 24 ROAD., JOMPOL, CHATUCHAK, BANGKOK 10900

Environment: 25 +/- 3°C (IN-HOUSE); 50 +/- 20%RH

Date Of Receipt : JUNE 24, 2021

Date Of Calibration : JUNE 26, 2021

Calibration By :

Approved By :

Date of Issue : JUNE 26, 2021

### MEASUREMENT UNCERTAINTY :

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR  $k = 2$ , WHICH EFFECTIVE DEGREE OF FREEDOM  $V_{eff} > 100$  CORRESPONDS A LEVEL OF CONFIDENCE OF APPROXIMATELY 95 %

This certificate may not be reproduced other than in full except with the prior written approval of industrial calibration laboratory.

# Industrial Calibration Co., Ltd.

38/41 Moo. 3, Lum Luk Ka Road., Khu Khot Subdistrict,  
Lam Luk Ka District, Phatum Thani 12130 Thailand.

Tel : +66 (02) 991 0440

Fax : +66 (02) 531 6294

Email : info@industrial.co.th

dB bar  
%RH VA  
m/s kg



INDUSTRIAL CALIBRATION CO.,LTD.

The Measure of Quality

CERTIFICATE No. ....CAL06052-21..... PAGE .....2..... OF .....2.....

## Calibration Report

ORDER No. : 2008-242

RECEIVED DATE :JUNE 24, 2021

CALIBRATION DATE : JUNE 26, 2021

<b>DESCRIPTION:</b> HEAVY DUTY LIGHT METER		<b>MANUFACTURER:</b> EXTECH	
<b>MODEL:</b> 407026	<b>SERIAL No.</b> A.052156	<b>IDENTIFICATION No:</b> N/A	<b>MADE IN :</b> N/A
<b>CALIBRATION METHOD :</b> CALIBRATION WAS CONDUCTED USING IN-HOUSE METHOD BASED ON REFERENCE LAMP COMPARISON BY LIGHT METER			
<b>REFERENCE STANDARD :</b>			
<b>DESCRIPTION :</b> DATA LOGGER LIGHT METER	<b>MODEL</b> DT-8809A	<b>S/N No.</b> 11094203	<b>CERTIFICATE No.</b> PL06069/21

### TRACEABILITY:

THE CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT: -  
-NATIONAL INSTITUTE OF METROLOGY THAILAND (NIMT)

### RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

FUNTION : LIGHT MEASUREMENT

RANGE : 2000 LUX

RESOLUTION : 1 LUX

UUC RANGE (LUX)	STANDARD READING (LUX)	UUC* READING (LUX)	UUC* CORRECTION (LUX)	UNCERTAINTY MASUREMENT (±LUX)
0	000	000	0	0.9
2000	2002	1998	4	20

REMARK : UUC\* UNIT UNDER CALIBRATION

- END OF CERTIFICATE -





