

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัด

เอกสารแนบ	4-1	เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ
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ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ TSP	High Volume Air Sampler Rec No. B01, B03, B11, B18, B24 Blower No. B01, B03, B11, B18, B24	Digital Balance
PM ₁₀	High Volume PM-10 Sampler Rec No. B02, B07, B11, B14, B21 Blower No. B02, B07, B11, B14, B21	Digital Balance
NO ₂	NO ₂ Analyzer No. B10, B11, B17, B20, B22	NO ₂ Analyzer No. B10, B11, B17, B20, B22
SO ₂	SO ₂ Analyzer No. B01, B02, B07, B08, B13	SO ₂ Analyzer No. B01, B02, B07, B08, B13
คุณภาพอากาศจากปล่องระบาย Particulate	Console No. B01, B04 Pitot Tube No. B04, B35, B36	Digital Balance
NO _x	Vacuum Gauge	Spectrophotometer
SO ₂	Personal Pump SKC No. B06, B10 Rotameter No. H-B08, B09	Digital Balance
CO	Personal Pump SKC No. B01, B06, B10, B17, B18, B79 Rotameter No. H-B08, B09	CO Analyzer No. B01
HF	Console No. B01, B04 Pitot Tube No. B04, B35, B36	Ion Chromatography
HCl	Console No. B01, B04 Pitot Tube No. B04, B35, B36	Ion Chromatography
Total Hydrocarbon	Personal Pump SKC No. B01, B06, B18 Rotameter No. H- B08, B09	THC Analyzer No. B01
Lead	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Cadmium	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Mercury	Console No. B01, B04 Pitot Tube No. B04, B35, B36	AAS
Arsenic	Console No. B01, B04 Pitot Tube No. B04, B35, B36	AAS
Nickel	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Chromium	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Beryllium	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Antimony	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Copper	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศจากปล่องระบาย (ต่อ)		
Manganese	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Tin	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Cobalt	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
Total Sb, As, Cr, Co, Cu, Mn, Ni และ Sn	Console No. B01, B04 Pitot Tube No. B04, B35, B36	ICP
VOCs	Personal Pump SKC No. B06, B17, B19 Rotameter No. L- B08, B09	GC/MS
Dioxin	Console No. B05 Pitot Tube No. B46	GC/MS
คุณภาพน้ำใต้ดิน		
pH	-	pH meter
Total Dissolved Solids	-	Digital Balance
Sulfur	-	Digital Balance
Nitrate	-	Spectrophotometer
Total Hardness	-	Digital Balance
Fluoride	-	Spectrophotometer
Chloride	-	Digital Balance
Cyanide	-	Spectrophotometer
Zinc	-	ICP
Copper	-	ICP
Manganese	-	ICP
Total Iron	-	ICP
Cadmium	-	AAS
Lead	-	AAS
Selenium	-	AAS
Arsenic	-	AAS
Mercury	-	AAS
ระดับเสียงในบรรยากาศ		
Leq 24 hr	Acoustic Calibrator	-
Lmax	Sound Level Meter No. ACO-B12, B13, B15, B19, B21, B22, B26, B27, B28, B29, B30, B33, B37, B38, B40, B41	

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ Total Dust	Personal Pump SKC No. B09, B13, B49, B65 Rotameter No. H- B01, B05, B09	Digital Balance
Respirable Dust	Personal Pump SKC No. B01, B29, B46, B49, B61, B67 Rotameter No. H- B01, B05, B09	Digital Balance
VOCs	Personal Pump SKC No. B03, B12, B15, B17, B46, B67, B85 Rotameter No. L- B01, B05, B09	GC/MS
ระดับเสียงในสถานประกอบการ Leq 8 hr Lmax	Acoustic Calibrator Sound Level Meter No. ACO- B04, B17, B31, B37, B39, B44, B46	-

เอกสารแนบ 4-1

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume Air Sampler Data

Calibration Data

Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	01/08/2023	y = 1.289x-5.669	0.999
B02	B02	02/08/2023	y = 1.106x+2.666	0.999
B03	B03	01/08/2023	y = 1.126x-0.852	0.997
B04	B04	01/08/2023	y = 1.294x-8.235	0.998
B05	B05	04/08/2023	y = 1.279x-7.416	0.996
B06	B06	01/08/2023	y = 1.280x-7.015	0.999
B07	B07	01/08/2023	y = 1.220x-6.249	0.998
B08	B08	01/08/2023	y = 1.268x-7.621	0.999
B09	B09	01/08/2023	y = 1.258x-5.982	1.000
B10	B10	04/08/2023	y = 1.142x+0.294	0.999
B11	B11	04/08/2023	y = 1.165x-3.050	0.998
B12	B12	04/08/2023	y = 1.227x-5.594	0.999
B13	B13	04/08/2023	y = 1.282x-7.522	0.998
B14	B14	04/08/2023	y = 1.298x-7.713	0.999
B15	B15	02/08/2023	y = 1.176x-3.322	0.997
B16	B16	02/08/2023	y = 1.316x-9.126	0.997
B17	B17	02/08/2023	y = 1.235x-5.694	1.000
B18	B18	02/08/2023	y = 1.323x-10.629	0.998
B19	B19	02/08/2023	y = 1.277x-8.109	0.997
B20	B20	02/08/2023	y = 1.297x-8.466	0.998
B21	B21	03/08/2023	y = 1.186x-3.582	1.000
B22	B22	03/08/2023	y = 1.274x-8.729	0.998
B23	B23	03/08/2023	y = 1.224x-5.880	0.995
B24	B24	03/08/2023	y = 1.185x-3.773	0.999
B25	B25	01/08/2023	y = 1.075x+1.295	0.998
B26	B26	01/08/2023	y = 1.282x-7.798	0.997
B27	B27	01/08/2023	y = 1.248x-7.408	0.997
B28	B28	01/08/2023	y = 1.279x-8.370	0.999
B29	B29	04/08/2023	y = 1.392x-7.541	0.999
B30	B30	04/08/2023	y = 1.270x-8.142	0.995
B31	B31	04/08/2023	y = 1.284x-8.212	0.999
B32	B32	04/08/2023	y = 1.294x-6.759	0.999
B33	B33	04/08/2023	y = 1.252x-5.024	0.999
B34	B34	04/08/2023	y = 1.262x-7.362	0.998

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data

Calibration Data

Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	03/08/2023	y = 1.268x-3.132	0.995
B02	B02	01/08/2023	y = 1.046x+2.277	0.999
B03	B03	01/08/2023	y = 1.277x-6.485	0.998
B04	B04	01/08/2023	y = 1.287x-8.164	0.999
B05	B05	01/08/2023	y = 1.229x-5.276	0.998
B06	B06	01/08/2023	y = 1.270x-6.448	0.997
B07	B07	03/08/2023	y = 1.285x-6.916	0.998
B08	B08	01/08/2023	y = 1.286x-6.261	0.998
B09	B09	03/08/2023	y = 1.257x-5.694	0.997
B10	B10	03/08/2023	y = 1.292x-8.553	0.996
B11	B11	03/08/2023	y = 1.250x-6.659	0.998
B12	B12	02/08/2023	y = 1.292x-8.553	0.996
B13	B13	02/08/2023	y = 1.285x-7.847	1.000
B14	B14	02/08/2023	y = 1.279x-5.782	0.999
B15	B15	02/08/2023	y = 1.144x-0.631	0.999
B16	B16	02/08/2023	y = 1.228x-0.850	0.995
B17	B17	01/08/2023	y = 1.279x-7.056	0.997
B18	B18	01/08/2023	y = 1.220x-3.845	0.998
B19	B19	01/08/2023	y = 1.123x-0.193	0.999
B20	B20	03/08/2023	y = 1.216x-5.924	0.999
B21	B21	03/08/2023	y = 1.182x-1.600	0.996
B22	B22	03/08/2023	y = 1.298x-8.251	0.998
B23	B23	02/08/2023	y = 1.227x-4.062	0.999
B24	B24	02/08/2023	y = 1.246x-4.841	0.999
B25	B25	02/08/2023	y = 1.224x-5.771	1.000
B26	B26	01/08/2023	y = 1.277x-6.994	0.998
B27	B27	04/08/2023	y = 1.258x-8.288	0.999
B28	B28	04/08/2023	y = 1.226x-6.184	0.998
B29	B29	04/08/2023	y = 1.275x-8.881	0.999
B30	B30	03/08/2023	y = 1.308x-9.003	0.999
B31	B31	03/08/2023	y = 1.205x-1.680	0.995
B32	B32	03/08/2023	y = 1.229x-4.453	0.998
B33	B33	03/08/2023	y = 1.273x-7.576	0.996
B34	B34	03/08/2023	y = 1.268x-3.565	0.997

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
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 : ATSAWIN Y.
CALIBRATION DATE : 10-Mar-23
APPROVED BY :
ISSUED DATE : 16-Mar-23
RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23°C \pm 1°C RELATIVE HUMIDITY : 49%RH \pm 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

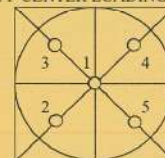
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.00001	-0.00001	0.00011
100.00	100.00001	-0.00001	0.00019
200.00	200.00001	-0.00001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0001
3	50.0000
4	50.0000
5	49.9999
OFF-CENTER LOADING	0.0001

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

END OF CALIBRATION REPORT



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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	200E
NO.	NOX-B10	SERIAL NO.	4465		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
Cylinder Conc.	: 49.1 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.004
NO _x Span	400	400.1	0.025	400.0	1.008
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	505	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.3	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	315.1	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO _x Slope	1.008	-	1.0 ± 0.3		
NO Offset	0.9	mV	-20 to +150		
NO _x Offset	0.5	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 



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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	200E
NO.	NOX-B11	SERIAL NO.	4467		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
Cylinder Conc.	: 49.1 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.9	-0.025	400.0	1.006
NO _x Span	400	400.2	0.050	400.0	1.011
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	511	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.1	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	674	V	420 - 900 constant		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.0	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.006	-	1.0 ± 0.3		
NO _x Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO _x Offset	0.8	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	200A
NO.	NOX-B17	SERIAL NO.	1977		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
Cylinder Conc.	: 49.1 ppm				
CALIBRATING CONDITION					
Pressure	1011	minbar	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 _x Span	400	399.9	-0.025	400.0	1.007
API Model 200A NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.5	mV	-20 ~ 150		
AZERO	94.2	mV	-20 ~ 150		
HVPS	673	V	420 ~ 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.4	°C	8 ~ 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 ~ 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 ~ 30 constant		
NO Span Conc	400	PPB	20 ~ 20,000		
NO _x Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.003	-	1.0 ± 0.3		
NO _x Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO _x Offset	0.6	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 
(Mr. Adul Dangklom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B20	SERIAL NO.	N02782		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
Cylinder Conc.	: 49.1 ppm				
CALIBRATING CONDITION					
Pressure	1011	minbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.2	0.050	400.0	1.009
NO _x Span	400	400.3	0.075	400.0	1.014
API Model TML-41M NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	509	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.9	mV	-20 ~ 150		
AZERO	93.7	mV	-20 ~ 150		
HVPS	671	V	420 ~ 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.6	°C	8 ~ 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.8	°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 _x Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.009	-	1.0 ± 0.3		
NO _x Slope	1.014	-	1.0 ± 0.3		
NO Offset	1.7	mV	-20 to +150		
NO _x Offset	1.0	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 
(Mr. Adul Dangklom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B22	SERIAL NO.	NO1818		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022	Expired Date	: 20 April 2024	Cylinder Conc.	: 49.1 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	% Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.008
NO _x Span	400	400.2	0.050	400.0	1.012
API Model TML-41M NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	504	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO _x Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.6	mV	-20 to +150		
NO _x Offset	1.0	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B01	SERIAL NO.	1749		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	400.3	0.075	400.0	1.015
API Model 100A SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	654	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3049.6	mV	1000-4900		
STR. LGT	61.7	PPB	<100		
DRK PMT	63.3	mV	-50 - 200		
DRK LMP	57.6	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2518	mV	2500 ± 200		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.2	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.015	-	1.0 ± 0.3		
SO ₂ Offset	21.9	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 pph)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B02	SERIAL NO.	1847		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 50.0 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	399.8	-0.050	400.0	1.007
API Model 100A SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.7	in-Hg	25-35		
SAMPLE FLOW	659	cc/min	650 ± 10%		
PMT	103.1	mV	-20-150 with Zero Air		
UV LAMP	3038.1	mV	1000-4900		
STR. LGT	61.3	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.6	mV	-50 - 200		
HVPS	669	V	550-900 constant		
DCPS	2527	mV	2500 ± 200		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.007	-	1.0 ± 0.3		
SO ₂ Offset	22.2	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 pph)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	100E
NO.	SO ₂ -B07	SERIAL NO.	1706		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
			Cylinder Conc.	: 50.0 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	400.2	0.050	400.0	1.013
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.3	in-Hg	25-35		
SAMPLE FLOW	655	cc/min	650 ± 10%		
PMT	102.9	mV	-20-150 with Zero Air		
UV LAMP	3015.3	mV	1000-4900		
STR. LGT	61.8	PPB	<100		
DRK PMT	63.5	mV	-50 - 200		
DRK LMP	58.1	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2515	mV	2500 ± 200		
RCCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.5	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.013	-	1.0 ± 0.3		
SO ₂ Offset	22.0	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	11 September 2023	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B08	SERIAL NO.	1003		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
			Cylinder Conc.	: 50.0 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	399.7	-0.075	400.0	1.005
API Model 100A SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.4	in-Hg	25-35		
SAMPLE FLOW	657	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	3052.7	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	63.1	mV	-50 - 200		
DRK LMP	57.9	mV	-50 - 200		
HVPS	675	V	550-900 constant		
DCPS	2529	mV	2500 ± 200		
RCCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.1	°C	5-40		
PMT TEMP	7.3	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.005	-	1.0 ± 0.3		
SO ₂ Offset	22.1	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	11 September 2023	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO ₂ -B13	SERIAL NO.	1891		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
			Cylinder Conc.	: 50.0 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	400.1	0.025	400.0	1.010
API Model TML-50 SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.6	in-Hg	25-35		
SAMPLE FLOW	652	cc/min	650 ± 10%		
PMT	103.5	mV	-20-150 with Zero Air		
UV LAMP	3059.4	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	58.2	mV	-50 - 200		
HVPS	672	V	550-900 constant		
DCPS	2521	mV	2500 ± 200		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.6	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.010	-	1.0 ± 0.3		
SO ₂ Offset	21.8	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangdom)

Approved by

เอกสารแนบ 4-2

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศจากปล่อง



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, Chaluchak, Bangkok 10900
Tel : (662) 939-4370-72 Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	ΔH_{\oplus} (mmH ₂ O)
B01	1563	02/06/2023	1.002	50.06
B02	8002514	05/06/2023	0.998	49.11
B03	1503016	01/06/2023	1.004	50.26
B04	00006659	05/06/2023	0.996	49.89
B05	00007428	02/06/2023	0.997	49.51
R01	1561	01/06/2023	0.995	49.93
R02	8002513	02/06/2023	1.003	49.77
R03	1570	01/06/2023	0.996	49.70
R04	8002519	05/06/2023	0.995	49.44
R05	1503015	01/06/2023	0.997	50.37

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

Accept Value of ΔH_{\oplus} (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	DH _⊕ (mmH ₂ O)
B01	1563	04/09/2023	0.997	50.11
B02	8002514	06/09/2023	1.002	49.25
B03	1503016	05/09/2023	0.998	50.44
B04	00006659	05/09/2023	1.004	49.37
B05	00007428	05/09/2023	0.996	49.77
R01	1561	06/09/2023	1.004	49.86
R02	8002513	08/09/2023	1.005	50.36
R03	1570	07/09/2023	0.997	49.55
R04	8002519	04/09/2023	1.004	49.69
R05	1503015	07/09/2023	0.999	50.08

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

Accept Value of DH_⊕ (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	γ	DH_{\oplus} (mmH ₂ O)
B01	1563	01/12/2023	0.998	50.05
B02	8002514	02/12/2023	1.006	49.58
B03	1503016	01/12/2023	1.003	50.16
B04	00006659	04/12/2023	0.998	49.71
B05	00007428	04/12/2023	0.999	49.24
R01	1561	02/12/2023	1.005	49.98
R02	8002513	03/12/2023	1.003	49.90
R03	1570	04/12/2023	0.996	49.68
R04	8002519	01/12/2023	1.002	49.43
R05	1503015	01/12/2023	0.997	50.24

Remark : Accept Value of γ (test) is $0.97 < \gamma < 1.03$

Accept Value of DH_{\oplus} (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data					
Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	02/05/2023	0.85	0.84
B04	S	0.99	02/05/2023	0.84	0.84
B05	S	0.99	02/05/2023	0.84	0.83
B07	S	0.99	02/05/2023	0.83	0.84
B08	S	0.99	03/05/2023	0.84	0.85
B09	S	0.99	04/05/2023	0.85	0.84
B11	S	0.99	04/05/2023	0.84	0.83
B16	S	0.99	04/05/2023	0.84	0.85
B18	S	0.99	02/05/2023	0.84	0.84
B19	S	0.99	02/05/2023	0.85	0.84
B21	S	0.99	03/05/2023	0.84	0.85
B24	S	0.99	03/05/2023	0.84	0.83
B27	S	0.99	02/05/2023	0.83	0.84
B30	S	0.99	04/05/2023	0.84	0.84
B31	S	0.99	02/05/2023	0.83	0.84
B33	S	0.99	03/05/2023	0.85	0.84
B35	S	0.99	02/05/2023	0.84	0.83

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by : 	Approved by : 
(Mr. Adul Dangklom)	



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	02/05/2023	0.84	0.84
B37	S	0.99	02/05/2023	0.83	0.84
B38	S	0.99	03/05/2023	0.85	0.84
B39	S	0.99	03/05/2023	0.84	0.83
B40	S	0.99	02/05/2023	0.84	0.83
B41	S	0.99	02/05/2023	0.84	0.84
B44	S	0.99	03/05/2023	0.85	0.84
B45	S	0.99	03/05/2023	0.85	0.84
B46	S	0.99	04/05/2023	0.84	0.83
B47	S	0.99	03/05/2023	0.84	0.85
B48	S	0.99	03/05/2023	0.83	0.84
B49	S	0.99	03/05/2023	0.85	0.84
B54	S	0.99	03/05/2023	0.83	0.84
B56	S	0.99	02/05/2023	0.84	0.85
B57	S	0.99	02/05/2023	0.84	0.83
B58	S	0.99	02/05/2023	0.85	0.84

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by : 	Approved by : 
(Mr. Adul Dangklom)	



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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	02/08/2023	0.84	0.84
B04	S	0.99	02/08/2023	0.85	0.84
B05	S	0.99	02/08/2023	0.84	0.83
B07	S	0.99	02/08/2023	0.84	0.84
B08	S	0.99	03/08/2023	0.84	0.85
B09	S	0.99	01/08/2023	0.85	0.84
B11	S	0.99	04/08/2023	0.84	0.85
B16	S	0.99	02/08/2023	0.84	0.85
B18	S	0.99	02/08/2023	0.83	0.84
B19	S	0.99	01/08/2023	0.84	0.84
B21	S	0.99	03/08/2023	0.84	0.85
B24	S	0.99	03/08/2023	0.84	0.84
B27	S	0.99	02/08/2023	0.84	0.84
B30	S	0.99	01/08/2023	0.85	0.84
B31	S	0.99	03/08/2023	0.83	0.84
B33	S	0.99	03/08/2023	0.84	0.84
B35	S	0.99	01/08/2023	0.84	0.85

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by :

(Mr. Adul Dangklom)

Approved 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	01/08/2023	0.85	0.84
B37	S	0.99	02/08/2023	0.84	0.84
B38	S	0.99	03/08/2023	0.84	0.83
B39	S	0.99	03/08/2023	0.84	0.84
B40	S	0.99	01/08/2023	0.85	0.84
B41	S	0.99	02/08/2023	0.84	0.85
B44	S	0.99	01/08/2023	0.84	0.84
B45	S	0.99	01/08/2023	0.85	0.84
B46	S	0.99	01/08/2023	0.84	0.85
B47	S	0.99	01/08/2023	0.84	0.84
B48	S	0.99	01/08/2023	0.84	0.85
B49	S	0.99	03/08/2023	0.85	0.84
B54	S	0.99	03/08/2023	0.83	0.84
B56	S	0.99	03/08/2023	0.84	0.85
B57	S	0.99	03/08/2023	0.84	0.83
B58	S	0.99	03/08/2023	0.85	0.84

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by :

(Mr. Adul Dangklom)

Approved 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	01/11/2023	0.84	0.85
B04	S	0.99	01/11/2023	0.84	0.84
B05	S	0.99	01/11/2023	0.85	0.84
B07	S	0.99	01/11/2023	0.84	0.83
B08	S	0.99	02/11/2023	0.85	0.84
B09	S	0.99	02/11/2023	0.84	0.84
B11	S	0.99	02/11/2023	0.85	0.84
B16	S	0.99	03/11/2023	0.84	0.84
B18	S	0.99	03/11/2023	0.84	0.85
B19	S	0.99	03/11/2023	0.84	0.85
B21	S	0.99	02/11/2023	0.84	0.84
B24	S	0.99	02/11/2023	0.84	0.83
B27	S	0.99	02/11/2023	0.85	0.84
B30	S	0.99	01/11/2023	0.84	0.85
B31	S	0.99	02/11/2023	0.84	0.84
B33	S	0.99	02/11/2023	0.84	0.85
B35	S	0.99	02/11/2023	0.84	0.84

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by : _____	Approved 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	01/11/2023	0.84	0.84
B37	S	0.99	01/11/2023	0.84	0.85
B38	S	0.99	02/11/2023	0.85	0.84
B39	S	0.99	03/11/2023	0.84	0.83
B40	S	0.99	04/11/2023	0.84	0.85
B41	S	0.99	04/11/2023	0.85	0.84
B44	S	0.99	04/11/2023	0.84	0.84
B45	S	0.99	01/11/2023	0.84	0.83
B46	S	0.99	01/11/2023	0.84	0.84
B47	S	0.99	01/11/2023	0.85	0.84
B48	S	0.99	01/11/2023	0.84	0.83
B49	S	0.99	01/11/2023	0.84	0.85
B54	S	0.99	02/11/2023	0.85	0.84
B56	S	0.99	02/11/2023	0.84	0.83
B57	S	0.99	03/11/2023	0.84	0.84
B58	S	0.99	03/11/2023	0.84	0.83

Remark : Accept value of Cp (test) is 0.84 ± 0.01

Calibrated by : _____ (Mr. Adui Dangklom)	Approved by : _____
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CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
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 : ATSAWIN Y.
CALIBRATION DATE : 10-Mar-23
APPROVED BY :
ISSUED DATE : 16-Mar-23
RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23°C \pm 1°C RELATIVE HUMIDITY : 49%RH \pm 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

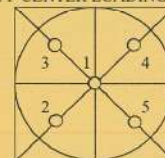
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.0001	-0.0001	0.00011
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0001
3	50.0000
4	50.0000
5	49.9999
OFF-CENTER LOADING	0.0001

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

END OF CALIBRATION REPORT



CALIBRATION LABORATORY Co., LTD.

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



CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

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

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

DATE OF RECEIVED : 20 July 2022

DATE OF ISSUED : 22 July 2022

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

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
22 July 2022



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

Certificate No. Q22073201

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

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

UNCERTAINTY :

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

Certificate No. Q22073201

F3-011-04/01-12

page 2 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

2/10-11,14,58 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

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

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note, k factor 1 kPa = 0.2952998 inHg

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

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

End of Certificate

Certificate No. Q22073201

F3-011-04/01-12

page 3 of 3



@clccalibration



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 : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
CLID. NO. : 212301419
JOB CONTROL NO. : 230725081570

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

DATE OF RECEIVED : 25 July 2023

DATE OF ISSUED : 31 July 2023

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

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
31 July 2023



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

Certificate No. Q23081570

F3-011-04/01-12

page 1 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
DATE OF CALIBRATION : 26 July 2023
DUE DATE OF CALIBRATION : 26 July 2024

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

Document Process Calibrator, Fluke Model 741B S/N. 8295020 with Pressure Module Model 700PD5 S/N. 89404505.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. MP-0035-23, Due Date 02 February 2024.

UNCERTAINTY :

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

Certificate No. Q23081570

F3-011-04/01-12

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (kPa)		Conversion to inHg		Correction (inHg)	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-15.07	-15.10	-4.5	-4.5	+0.5	+0.5
-10	-32.10	-32.13	-9.5	-9.5	+0.5	+0.5
-15	-49.20	-49.23	-14.5	-14.5	+0.5	+0.5
-20	-66.26	-66.26	-19.6	-19.6	+0.4	+0.4
-25	-83.30	-83.33	-24.6	-24.6	+0.4	+0.4
-30	-100.39	-100.39	-29.6	-29.6	+0.4	+0.4

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

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

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

End of Certificate



SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP22018
Pages 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY

Condition As Found : GOOD

Customer : S.P.S. CONSULTING SERVICE CO., L.TD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.

Location : ORGANIC LABORATORY IV

Ambient Temperature : (24.4 ± 5) °C

Relative Humidity : (60.1 ± 25) %

Received Date : 30 AUGUST 2022

Calibration Date : 30 AUGUST 2022

Date of Issue : 31 AUGUST 2022

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

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SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP22018
Job No. : VC65SP0008
Pages : 2 of 3

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

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

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	0.0032	2.00

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
RM-0204060810	235.0	20	0.2436	0.2419	-0.0017	0.0101	2.00
		40	0.4905	0.4855	-0.0050	0.0115	2.00
		60	0.7453	0.7388	-0.0065	0.0067	2.00
		80	0.9920	0.9839	-0.0081	0.0071	2.00
		100	1.2487	1.2414	-0.0073	0.0073	2.00

UUC* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm
Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance
Wavelength Scan 1100 nm-190 nm
Scanning Speed 7.5 nm/min
Data Pitch 0.1 nm
Band width(Wavelength) 1.0 nm
Band width(Vis) 1.0 nm
Band width(Uv) 1.0 nm

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

**Specific Acceptance :

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

**Stray light not ITSI Accredited

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY
Condition As Found : GOOD
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.
Location : ORGANIC LABORATORY IV
Ambient Temperature : (25.0 ± 5) °C
Relative Humidity : (48.4 ± 25) %
Received Date : 30 AUGUST 2023
Calibration Date : 30 AUGUST 2023
Date of Issue : 31 AUGUST 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

SITHIPORN
associates

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP23016
Job No. : VC66SP0014
Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	20	20	0.2422	0.2462	0.0040	0.0101	2.00	
		40	0.4866	0.4900	0.0034	0.0115	2.00	
	235.0	60	0.7414	0.7390	-0.0024	0.0068	2.00	
		80	0.9858	0.9871	0.0013	0.0093	2.00	
		100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC* = Unit Under Calibration

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

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

Stray Light** UUC* Reading at 220 nm	
Transmission T(%)	Absorbance(A)
0.0111	3.9564

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate



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, Chaluchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)					
					1	2	3	1	2	3	y	R ²	
B01	SKC	224-PCXR4	262101	04/04/2023	1,000	1,500	2,000	994	1,498	2,003	1.006x - 7.897	1.000	
B02	SKC	224-PCXR4	626166	04/04/2023	1,000	1,500	2,000	1,004	1,503	2,003	1.010x - 19.866	0.999	
B03	SKC	224-PCXR4	612968	07/04/2023	1,000	1,500	2,000	995	1,496	2,001	1.007x - 13.684	1.000	
B04	SKC	224-PCXR4	602804	05/04/2023	1,000	1,500	2,000	998	1,499	1,994	0.999x - 1.611	1.000	
B05	SKC	224-PCXR4	612693	07/04/2023	1,000	1,500	2,000	1,002	1,501	2,004	1.014x - 24.856	0.999	
B06	SKC	224-PCXR4	262188	07/04/2023	1,000	1,500	2,000	994	1,509	2,006	1.012x - 21.589	0.999	
B07	SKC	224-PCXR4	626262	04/04/2023	1,000	1,500	2,000	997	1,490	1,996	0.994x + 3.494	1.000	
B08	SKC	224-PCXR4	626100	04/04/2023	1,000	1,500	2,000	1,001	1,499	2,005	1.015x - 27.137	0.999	
B09	SKC	224-PCXR4	620479	05/04/2023	1,000	1,500	2,000	997	1,492	1,994	0.994x + 2.386	1.000	
B10	SKC	224-PCXR4	091960	03/04/2023	1,000	1,500	2,000	993	1,504	2,005	1.013x - 23.779	1.000	
B11	SKC	224-PCXR8	564315	10/04/2023	1,000	1,500	2,000	995	1,492	1,998	1.002x - 7.259	1.000	
B12	SKC	224-PCXR4	634656	04/04/2023	1,000	1,500	2,000	1,002	1,504	2,001	1.009x - 17.609	0.999	
B13	SKC	224-PCXR4	602073	04/04/2023	1,000	1,500	2,000	997	1,501	2,000	1.004x - 7.022	1.000	
B14	SKC	224-PCXR4	626313	03/04/2023	1,000	1,500	2,000	997	1,492	1,991	0.996x + 1.699	1.000	
B15	SKC	224-PCXR4	626474	07/04/2023	1,000	1,500	2,000	1,003	1,503	2,006	1.013x - 33.245	0.999	
B16	SKC	224-PCXR4	626477	03/04/2023	1,000	1,500	2,000	995	1,506	2,003	1.011x - 22.132	0.999	
B17	SKC	224-PCXR4	626560	04/04/2023	1,000	1,500	2,000	996	1,493	1,993	1.000x - 4.627	1.000	
B18	SKC	224-PCXR4	691484	04/04/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.010x - 21.179	0.999	
B19	SKC	224-PCXR4	691599	04/04/2023	1,000	1,500	2,000	994	1,504	2,000	1.006x - 10.498	1.000	
B20	SKC	224-PCXR4	691587	03/04/2023	1,000	1,500	2,000	991	1,502	2,000	1.016x - 35.102	0.999	
B21	SKC	224-PCXR4	691531	04/04/2023	1,000	1,500	2,000	994	1,501	1,995	1.001x - 5.153	1.000	
B22	SKC	224-PCXR4	691654	07/04/2023	1,000	1,500	2,000	1,000	1,502	2,004	1.014x - 25.574	0.999	
B23	SKC	224-PCXR4	798393	05/04/2023	1,000	1,500	2,000	990	1,508	2,004	1.013x - 23.994	1.000	
B24	SKC	224-PCXR4	626363	03/04/2023	1,000	1,500	2,000	1,002	1,503	1,999	1.009x - 18.837	0.999	
B25	SKC	224-PCXR4	798489	07/04/2023	1,000	1,500	2,000	1,002	1,494	2,000	0.997x + 3.494	1.000	
B26	SKC	224-PCXR4	798479	07/04/2023	1,000	1,500	2,000	1,001	1,501	1,994	0.995x + 5.564	1.000	
B27	SKC	224-PCXR4	691673	04/04/2023	1,000	1,500	2,000	995	1,505	2,004	1.013x - 25.091	0.999	
B28	SKC	224-PCXR4	691570	04/04/2023	1,000	1,500	2,000	1,003	1,501	2,001	1.010x - 19.922	0.999	
B29	SKC	224-PCXR4	626472	05/04/2023	1,000	1,500	2,000	1,001	1,498	2,000	0.999x - 1.891	1.000	
B30	SKC	224-PCXR4	691489	04/04/2023	1,000	1,500	2,000	1,002	1,507	2,003	1.009x - 13.936	0.999	
B31	SKC	224-PCXR4	691509	07/04/2023	1,000	1,500	2,000	994	1,496	1,997	1.004x - 9.680	1.000	
B32	SKC	224-PCXR4	691567	10/04/2023	1,000	1,500	2,000	992	1,506	2,001	1.013x - 25.542	0.999	
B33	SKC	224-PCXR4	091756	05/04/2023	1,000	1,500	2,000	993	1,498	1,992	0.998x - 1.121	1.000	
B34	SKC	224-PCXR4	612962	07/04/2023	1,000	1,500	2,000	1,002	1,503	2,003	1.008x - 14.753	0.999	
B35	SKC	224-PCXR4	602682	05/04/2023	1,000	1,500	2,000	991	1,497	1,996	1.003x - 11.598	1.000	
B36	SKC	224-PCXR4	626164	05/04/2023	1,000	1,500	2,000	997	1,495	1,998	1.002x - 8.097	1.000	
B37	SKC	224-PCXR4	626256	07/04/2023	1,000	1,500	2,000	993	1,505	1,996	1.012x - 27.161	0.999	
B38	SKC	224-PCXR4	626167	07/04/2023	1,000	1,500	2,000	998	1,493	1,997	1.003x - 8.613	1.000	
B39	SKC	224-PCXR4	034637	10/04/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.013x - 23.125	0.999	
B40	SKC	224-PCXR4	798349	07/04/2023	1,000	1,500	2,000	993	1,507	1,998	1.015x - 30.304	0.999	

Calibrated by :

(Mr. Adin Dangkhom)

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	07/04/2023	1,000	1,500	2,000	997	1,496	1,991	0.998x - 1.396	1.000
B42	SKC	224-PCXR4	626041	10/04/2023	1,000	1,500	2,000	1,006	1,496	1,992	0.988x + 14.223	1.000
B43	SKC	224-PCXR4	034636	07/04/2023	1,000	1,500	2,000	1,001	1,503	1,993	0.992x + 8.810	1.000
B44	SKC	224-PCXR8	529341	10/04/2023	1,000	1,500	2,000	1,000	1,499	2,005	1.008x - 14.358	1.000
B45	SKC	224-PCXR8	529594	10/04/2023	1,000	1,500	2,000	998	1,506	1,987	0.990x + 12.580	1.000
B46	SKC	224-PCXR8	566743	05/04/2023	1,000	1,500	2,000	996	1,502	2,000	1.012x - 26.902	0.999
B47	SKC	224-PCXR8	566747	07/04/2023	1,000	1,500	2,000	998	1,501	2,002	1.014x - 27.552	0.999
B48	SKC	224-PCXR8	566753	10/04/2023	1,000	1,500	2,000	998	1,493	1,996	0.997x - 0.359	1.000
B49	SKC	224-PCXR8	566780	05/04/2023	1,000	1,500	2,000	1,007	1,501	2,007	1.011x - 19.156	0.999
B50	SKC	224-PCXR8	500400	07/04/2023	1,000	1,500	2,000	1,004	1,495	2,004	1.000x - 1.663	1.000
B51	SKC	224-PCXR8	500363	04/04/2023	1,000	1,500	2,000	997	1,502	1,998	1.008x - 21.322	0.999
B52	SKC	224-PCXR8	093186	05/04/2023	1,000	1,500	2,000	993	1,493	1,995	1.000x - 6.106	1.000
B53	SKC	224-PCXR8	707670	05/04/2023	1,000	1,500	2,000	1,000	1,498	2,002	1.009x - 18.883	0.999
B54	SKC	224-PCXR3	509821	05/04/2023	1,000	1,500	2,000	995	1,500	2,001	1.016x - 32.482	0.999
B55	SKC	224-PCXR3	510710	10/04/2023	1,000	1,500	2,000	998	1,497	1,992	0.996x - 0.191	1.000
B56	SKC	224-PCXR3	511450	05/04/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.005x - 8.081	1.000
B57	SKC	224-PCXR3	510798	05/04/2023	1,000	1,500	2,000	999	1,490	2,000	1.001x - 2.920	1.000
B58	SKC	224-PCXR3	509852	10/04/2023	1,000	1,500	2,000	1,002	1,496	1,998	1.004x - 15.922	0.999
B59	SKC	224-PCXR3	509862	10/04/2023	1,000	1,500	2,000	998	1,501	1,996	0.996x + 4.471	1.000
B60	SKC	224-PCXR3	512655	07/04/2023	1,000	1,500	2,000	1,003	1,499	2,004	1.005x - 9.971	1.000
B61	SKC	224-PCXR3	503915	10/04/2023	1,000	1,500	2,000	993	1,488	1,999	1.007x - 15.934	1.000
B62	SKC	224-PCXR3	505975	10/04/2023	1,000	1,500	2,000	1,001	1,495	1,997	1.000x - 4.802	1.000
B63	SKC	224-PCXR3	511432	07/04/2023	1,000	1,500	2,000	993	1,500	2,000	1.015x - 32.709	0.999
B64	SKC	224-PCXR3	508302	05/04/2023	1,000	1,500	2,000	998	1,491	1,987	0.989x + 9.855	1.000
B65	SKC	224-PCXR3	508310	10/04/2023	1,000	1,500	2,000	998	1,502	2,005	1.012x - 20.596	1.000
B66	SKC	224-PCXR3	509861	10/04/2023	1,000	1,500	2,000	1,000	1,492	1,992	0.990x + 10.912	1.000
B67	SKC	224-PCXR3	506295	07/04/2023	1,000	1,500	2,000	993	1,506	2,002	1.007x - 13.999	1.000
B68	SKC	224-PCXR3	505872	05/04/2023	1,000	1,500	2,000	998	1,488	1,997	0.996x - 1.743	1.000
B69	SKC	224-PCXR3	508375	04/04/2023	1,000	1,500	2,000	1,004	1,502	2,002	1.008x - 18.897	0.999
B70	SKC	224-PCXR3	510623	05/04/2023	1,000	1,500	2,000	994	1,505	1,998	1.004x - 8.846	1.000
B71	SKC	224-PCXR3	506307	10/04/2023	1,000	1,500	2,000	994	1,503	2,003	1.011x - 23.444	0.999
B72	SKC	224-PCXR3	505977	10/04/2023	1,000	1,500	2,000	1,005	1,493	1,992	0.988x + 13.309	1.000
B73	SKC	224-PCXR3	512606	05/04/2023	1,000	1,500	2,000	1,000	1,504	2,004	1.008x - 14.506	1.000
B74	SKC	224-PCXR3	505993	05/04/2023	1,000	1,500	2,000	997	1,497	1,996	1.001x - 7.514	1.000
B75	SKC	224-PCXR3	509820	07/04/2023	1,000	1,500	2,000	997	1,496	1,992	0.997x - 0.195	1.000
B76	SKC	224-PCXR3	509811	05/04/2023	1,000	1,500	2,000	995	1,498	1,999	1.004x - 11.212	1.000
B77	SKC	224-PCXR3	506301	10/04/2023	1,000	1,500	2,000	1,002	1,502	2,004	1.013x - 23.811	0.999
B78	SKC	224-PCXR3	510677	04/04/2023	1,000	1,500	2,000	997	1,505	2,000	1.007x - 16.113	0.999
B79	SKC	224-PCXR3	510920	10/04/2023	1,000	1,500	2,000	996	1,495	1,993	0.998x - 1.232	1.000



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)								
					Setting			Actual (Q std.)			Value From Calibration Curve		
					1	2	3	1	2	3	y	R ²	
B01	SKC	224-PCXR4	262101	03/07/2023	1,000	1,500	2,000	992	1,495	1,996	1.001x - 4.542	1.000	
B02	SKC	224-PCXR4	626166	03/07/2023	1,000	1,500	2,000	1,002	1,504	1,999	1.009x - 20.101	0.999	
B03	SKC	224-PCXR4	612968	10/07/2023	1,000	1,500	2,000	995	1,493	1,999	1.005x - 12.388	1.000	
B04	SKC	224-PCXR4	602804	05/07/2023	1,000	1,500	2,000	999	1,501	1,992	0.998x - 0.040	1.000	
B05	SKC	224-PCXR4	612693	03/07/2023	1,000	1,500	2,000	1,002	1,498	2,000	1.010x - 21.803	0.999	
B06	SKC	224-PCXR4	262188	05/07/2023	1,000	1,500	2,000	994	1,506	2,004	1.011x - 20.811	1.000	
B07	SKC	224-PCXR4	626262	10/07/2023	1,000	1,500	2,000	997	1,490	1,993	0.992x + 6.399	1.000	
B08	SKC	224-PCXR4	626100	07/07/2023	1,000	1,500	2,000	1,002	1,498	2,005	1.013x - 26.473	0.999	
B09	SKC	224-PCXR4	626479	05/07/2023	1,000	1,500	2,000	996	1,489	1,991	0.993x + 1.797	1.000	
B10	SKC	224-PCXR4	091950	06/07/2023	1,000	1,500	2,000	991	1,501	1,999	1.017x - 36.784	0.999	
B11	SKC	224-PCXR8	564315	10/07/2023	1,000	1,500	2,000	995	1,489	1,997	1.003x - 8.260	1.000	
B12	SKC	224-PCXR4	034656	07/07/2023	1,000	1,500	2,000	1,002	1,501	2,003	1.004x - 7.152	1.000	
B13	SKC	224-PCXR4	602073	05/07/2023	1,000	1,500	2,000	994	1,489	1,996	1.000x - 3.092	1.000	
B14	SKC	224-PCXR4	626313	07/07/2023	1,000	1,500	2,000	998	1,491	1,987	0.991x + 8.312	1.000	
B15	SKC	224-PCXR4	626474	07/07/2023	1,000	1,500	2,000	1,000	1,500	2,003	1.009x - 17.930	0.999	
B16	SKC	224-PCXR4	626477	04/07/2023	1,000	1,500	2,000	993	1,502	1,999	1.014x - 31.373	0.999	
B17	SKC	224-PCXR4	626860	04/07/2023	1,000	1,500	2,000	996	1,493	1,989	0.996x - 0.944	1.000	
B18	SKC	224-PCXR4	691484	04/07/2023	1,000	1,500	2,000	1,002	1,499	1,999	1.008x - 17.894	0.999	
B19	SKC	224-PCXR4	691599	06/07/2023	1,000	1,500	2,000	992	1,501	1,997	1.005x - 10.491	1.000	
B20	SKC	224-PCXR4	691587	03/07/2023	1,000	1,500	2,000	990	1,502	1,998	1.009x - 21.896	1.000	
B21	SKC	224-PCXR4	691531	10/07/2023	1,000	1,500	2,000	992	1,476	1,993	1.000x - 11.272	1.000	
B22	SKC	224-PCXR4	691654	05/07/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.011x - 21.141	0.999	
B23	SKC	224-PCXR4	798393	10/07/2023	1,000	1,500	2,000	992	1,505	2,000	1.017x - 53.720	0.999	
B24	SKC	224-PCXR4	626363	05/07/2023	1,000	1,500	2,000	999	1,501	1,997	1.003x - 8.933	1.000	
B25	SKC	224-PCXR4	798489	10/07/2023	1,000	1,500	2,000	1,000	1,491	1,998	0.996x + 1.689	1.000	
B26	SKC	224-PCXR4	798479	04/07/2023	1,000	1,500	2,000	999	1,498	1,991	0.993x + 6.351	1.000	
B27	SKC	224-PCXR4	691673	10/07/2023	1,000	1,500	2,000	993	1,502	2,000	1.015x - 32.306	0.999	
B28	SKC	224-PCXR4	691570	04/07/2023	1,000	1,500	2,000	1,002	1,498	1,999	1.005x - 12.188	1.000	
B29	SKC	224-PCXR4	626472	04/07/2023	1,000	1,500	2,000	999	1,496	1,998	1.002x - 6.471	1.000	
B30	SKC	224-PCXR4	691489	06/07/2023	1,000	1,500	2,000	1,002	1,508	2,004	1.002x - 7.722	0.999	
B31	SKC	224-PCXR4	691509	10/07/2023	1,000	1,500	2,000	991	1,475	1,995	0.999x - 10.348	1.000	
B32	SKC	224-PCXR4	091567	05/07/2023	1,000	1,500	2,000	990	1,501	1,998	1.011x - 24.321	1.000	
B33	SKC	224-PCXR4	091756	05/07/2023	1,000	1,500	2,000	992	1,496	1,990	0.991x + 4.498	1.000	
B34	SKC	224-PCXR4	612962	10/07/2023	1,000	1,500	2,000	1,001	1,499	2,000	1.006x - 14.460	0.999	
B35	SKC	224-PCXR4	602682	05/07/2023	1,000	1,500	2,000	992	1,497	1,994	1.002x - 9.742	1.000	
B36	SKC	224-PCXR4	626164	05/07/2023	1,000	1,500	2,000	998	1,496	1,999	1.000x - 6.056	1.000	
B37	SKC	224-PCXR4	626256	03/07/2023	1,000	1,500	2,000	993	1,505	1,997	1.005x - 13.443	1.000	
B38	SKC	224-PCXR4	626167	03/07/2023	1,000	1,500	2,000	996	1,496	1,996	1.001x - 3.347	1.000	
B39	SKC	224-PCXR4	034637	10/07/2023	1,000	1,500	2,000	1,004	1,499	1,999	1.009x - 18.599	0.999	
B40	SKC	224-PCXR4	798349	06/07/2023	1,000	1,500	2,000	993	1,504	1,997	1.013x - 29.094	0.999	

Calibrated by :

(Mr. Nuan Sangsri)

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data					Calibration Data							
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	10/07/2023	1,000	1,500	2,000	998	1,495	1,989	0.995x + 1.833	1.000
B42	SKC	224-PCXR4	626041	10/07/2023	1,000	1,500	2,000	1,003	1,496	1,989	0.985x + 18.950	1.000
B43	SKC	224-PCXR4	034636	05/07/2023	1,000	1,500	2,000	999	1,500	1,990	0.990x + 11.352	1.000
B44	SKC	224-PCXR8	529341	10/07/2023	1,000	1,500	2,000	1,001	1,500	2,000	1.003x - 8.128	1.000
B45	SKC	224-PCXR8	529594	06/07/2023	1,000	1,500	2,000	998	1,500	1,985	0.988x + 13.443	1.000
B46	SKC	224-PCXR8	566743	04/07/2023	1,000	1,500	2,000	994	1,504	2,000	1.006x - 14.882	1.000
B47	SKC	224-PCXR8	566747	04/07/2023	1,000	1,500	2,000	1,001	1,500	2,002	1.012x - 24.217	0.999
B48	SKC	224-PCXR8	566753	10/07/2023	1,000	1,500	2,000	999	1,491	1,996	1.002x - 11.236	1.000
B49	SKC	224-PCXR8	566780	04/07/2023	1,000	1,500	2,000	1,002	1,501	2,004	1.012x - 23.640	0.999
B50	SKC	224-PCXR8	500400	10/07/2023	1,000	1,500	2,000	1,000	1,506	2,000	0.997x + 1.566	1.000
B51	SKC	224-PCXR8	500363	04/07/2023	1,000	1,500	2,000	995	1,502	1,998	1.010x - 25.405	0.999
B52	SKC	224-PCXR8	093186	10/07/2023	1,000	1,500	2,000	993	1,494	1,990	0.995x + 0.992	1.000
B53	SKC	224-PCXR8	707670	05/07/2023	1,000	1,500	2,000	1,001	1,499	2,000	1.007x - 16.304	0.999
B54	SKC	224-PCXR3	509821	03/07/2023	1,000	1,500	2,000	992	1,500	2,000	1.017x - 35.039	0.999
B55	SKC	224-PCXR3	510710	10/07/2023	1,000	1,500	2,000	999	1,493	1,990	0.993x + 2.638	1.000
B56	SKC	224-PCXR3	511450	04/07/2023	1,000	1,500	2,000	1,001	1,498	1,999	1.004x - 9.108	1.000
B57	SKC	224-PCXR3	510798	10/07/2023	1,000	1,500	2,000	996	1,490	1,997	1.005x - 13.675	1.000
B58	SKC	224-PCXR3	509852	05/07/2023	1,000	1,500	2,000	999	1,497	1,997	1.006x - 19.133	0.999
B59	SKC	224-PCXR3	509862	06/07/2023	1,000	1,500	2,000	995	1,501	1,995	1.001x - 5.136	1.000
B60	SKC	224-PCXR3	512655	06/07/2023	1,000	1,500	2,000	1,001	1,498	2,015	1.017x - 25.660	1.000
B61	SKC	224-PCXR3	503915	05/07/2023	1,000	1,500	2,000	992	1,488	1,997	1.004x - 13.766	1.000
B62	SKC	224-PCXR3	505975	06/07/2023	1,000	1,500	2,000	998	1,493	1,994	0.996x + 0.183	1.000
B63	SKC	224-PCXR3	511432	04/07/2023	1,000	1,500	2,000	989	1,499	1,998	1.010x - 24.150	1.000
B64	SKC	224-PCXR3	508302	03/07/2023	1,000	1,500	2,000	997	1,491	1,987	0.990x + 8.411	1.000
B65	SKC	224-PCXR3	508310	10/07/2023	1,000	1,500	2,000	1,011	1,499	2,000	0.998x + 0.263	0.999
B66	SKC	224-PCXR3	509861	10/07/2023	1,000	1,500	2,000	1,001	1,489	1,990	0.987x + 13.691	1.000
B67	SKC	224-PCXR3	506295	04/07/2023	1,000	1,500	2,000	994	1,506	2,009	1.012x - 20.281	1.000
B68	SKC	224-PCXR3	505872	04/07/2023	1,000	1,500	2,000	1,001	1,489	1,996	0.994x + 3.757	1.000
B69	SKC	224-PCXR3	508375	04/07/2023	1,000	1,500	2,000	1,001	1,498	1,998	1.008x - 19.635	0.999
B70	SKC	224-PCXR3	510623	05/07/2023	1,000	1,500	2,000	991	1,502	1,994	1.001x - 5.451	1.000
B71	SKC	224-PCXR3	508367	10/07/2023	1,000	1,500	2,000	991	1,504	2,000	1.016x - 35.155	0.999
B72	SKC	224-PCXR3	505977	05/07/2023	1,000	1,500	2,000	1,000	1,498	1,992	0.992x + 7.080	1.000
B73	SKC	224-PCXR3	512606	05/07/2023	1,000	1,500	2,000	1,000	1,499	2,002	1.000x - 7.240	0.999
B74	SKC	224-PCXR3	505993	05/07/2023	1,000	1,500	2,000	995	1,495	1,992	0.996x - 2.446	1.000
B75	SKC	224-PCXR3	509820	05/07/2023	1,000	1,500	2,000	995	1,495	1,989	0.995x + 1.829	1.000
B76	SKC	224-PCXR3	509811	04/07/2023	1,000	1,500	2,000	992	1,497	1,997	1.005x - 14.428	1.000
B77	SKC	224-PCXR3	508301	04/07/2023	1,000	1,500	2,000	999	1,499	2,001	1.008x - 21.556	0.999
B78	SKC	224-PCXR3	510677	05/07/2023	1,000	1,500	2,000	994	1,502	1,997	1.012x - 28.449	0.999
B79	SKC	224-PCXR3	510920	03/07/2023	1,000	1,500	2,000	993	1,492	1,992	1.000x - 5.853	1.000





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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter Model : Defender 510-H S/N : 136164

Environmental Conditions
Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B01	SKC	224-PCXR4	262101	02/10/2023	1,000	1,500	2,000	997	1,494	1,995	0.998x - 5.198	1.000
B02	SKC	224-PCXR4	626166	02/10/2023	1,000	1,500	2,000	995	1,491	1,987	0.995x - 0.239	1.000
B03	SKC	224-PCXR4	612968	02/10/2023	1,000	1,500	2,000	994	1,498	1,996	1.004x - 17.211	0.999
B04	SKC	224-PCXR4	602804	03/10/2023	1,000	1,500	2,000	1,001	1,502	1,997	0.999x - 3.961	1.000
B05	SKC	224-PCXR4	612693	03/10/2023	1,000	1,500	2,000	1,000	1,500	1,998	1.008x - 19.564	0.999
B06	SKC	224-PCXR4	262188	04/10/2023	1,000	1,500	2,000	999	1,497	1,998	1.005x - 13.275	1.000
B07	SKC	224-PCXR4	626262	04/10/2023	1,000	1,500	2,000	997	1,491	1,992	0.995x + 0.103	1.000
B08	SKC	224-PCXR4	626100	03/10/2023	1,000	1,500	2,000	995	1,490	1,994	0.999x - 3.152	1.000
B09	SKC	224-PCXR4	626479	04/10/2023	1,000	1,500	2,000	1,012	1,500	2,001	0.998x + 1.604	0.999
B10	SKC	224-PCXR4	091590	05/10/2023	1,000	1,500	2,000	992	1,486	1,994	1.002x - 11.842	1.000
B11	SKC	224-PCXR8	564315	05/10/2023	1,000	1,500	2,000	993	1,501	1,996	1.010x - 26.335	0.999
B12	SKC	224-PCXR4	034656	05/10/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.007x - 17.721	0.999
B13	SKC	224-PCXR4	602073	04/10/2023	1,000	1,500	2,000	1,000	1,488	1,987	0.986x + 13.398	1.000
B14	SKC	224-PCXR4	626313	04/10/2023	1,000	1,500	2,000	996	1,493	1,996	0.999x - 2.380	1.000
B15	SKC	224-PCXR4	626474	06/10/2023	1,000	1,500	2,000	1,000	1,498	1,998	1.007x - 16.567	0.999
B16	SKC	224-PCXR4	626477	06/10/2023	1,000	1,500	2,000	1,001	1,498	1,999	1.010x - 21.673	0.999
B17	SKC	224-PCXR4	626860	06/10/2023	1,000	1,500	2,000	1,000	1,492	1,998	0.997x - 1.859	1.000
B18	SKC	224-PCXR4	691484	03/10/2023	1,000	1,500	2,000	995	1,494	1,992	1.000x - 5.493	1.000
B19	SKC	224-PCXR4	691599	02/10/2023	1,000	1,500	2,000	991	1,500	1,998	1.015x - 32.922	0.999
B20	SKC	224-PCXR4	691587	02/10/2023	1,000	1,500	2,000	1,001	1,496	1,999	1.010x - 23.222	0.999
B21	SKC	224-PCXR4	691531	03/10/2023	1,000	1,500	2,000	994	1,491	1,997	1.004x - 12.881	1.000
B22	SKC	224-PCXR4	691654	03/10/2023	1,000	1,500	2,000	991	1,492	1,994	1.002x - 9.860	1.000
B23	SKC	224-PCXR4	798393	02/10/2023	1,000	1,500	2,000	991	1,498	1,997	1.014x - 33.810	0.999
B24	SKC	224-PCXR4	626363	02/10/2023	1,000	1,500	2,000	1,001	1,499	2,001	1.011x - 23.676	0.999
B25	SKC	224-PCXR4	798489	04/10/2023	1,000	1,500	2,000	996	1,497	1,989	0.991x + 6.619	1.000
B26	SKC	224-PCXR4	798479	05/10/2023	1,000	1,500	2,000	996	1,492	1,990	0.996x - 1.146	1.000
B27	SKC	224-PCXR4	691673	09/10/2023	1,000	1,500	2,000	989	1,506	1,998	1.016x - 34.646	0.999
B28	SKC	224-PCXR4	691570	09/10/2023	1,000	1,500	2,000	992	1,487	1,996	1.006x - 16.996	1.000
B29	SKC	224-PCXR4	626472	09/10/2023	1,000	1,500	2,000	998	1,495	1,992	0.997x - 0.693	1.000
B30	SKC	224-PCXR4	691489	03/10/2023	1,000	1,500	2,000	993	1,490	1,990	0.999x - 7.320	1.000
B31	SKC	224-PCXR4	691509	03/10/2023	1,000	1,500	2,000	1,001	1,497	1,997	1.007x - 18.788	0.999
B32	SKC	224-PCXR4	091567	04/10/2023	1,000	1,500	2,000	998	1,499	1,996	1.009x - 22.760	0.999
B33	SKC	224-PCXR4	091756	05/10/2023	1,000	1,500	2,000	1,000	1,489	1,994	0.995x - 0.223	1.000
B34	SKC	224-PCXR4	612962	05/10/2023	1,000	1,500	2,000	992	1,501	1,997	1.013x - 31.362	0.999
B35	SKC	224-PCXR4	602682	03/10/2023	1,000	1,500	2,000	998	1,496	1,998	0.998x - 7.157	0.999
B36	SKC	224-PCXR4	626164	07/10/2023	1,000	1,500	2,000	995	1,487	1,990	0.991x + 3.901	1.000
B37	SKC	224-PCXR4	626256	02/10/2023	1,000	1,500	2,000	990	1,500	1,993	1.000x - 6.520	1.000
B38	SKC	224-PCXR4	626167	03/10/2023	1,000	1,500	2,000	989	1,498	1,995	1.015x - 35.470	0.999
B39	SKC	224-PCXR4	034637	09/10/2023	1,000	1,500	2,000	991	1,495	1,994	1.004x - 14.572	1.000
B40	SKC	224-PCXR4	798349	07/10/2023	1,000	1,500	2,000	999	1,497	1,996	1.008x - 21.526	0.999

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



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter Model : Defender 510-H S/N : 136164

Environmental Conditions
Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	10/10/2023	1,000	1,500	2,000	999	1,491	1,993	0.994x + 2.802	1.000
B42	SKC	224-PCXR4	626041	10/10/2023	1,000	1,500	2,000	994	1,490	1,989	0.995x - 1.759	1.000
B43	SKC	224-PCXR4	034636	07/10/2023	1,000	1,500	2,000	995	1,488	1,989	0.991x + 2.866	1.000
B44	SKC	224-PCXR8	529341	07/10/2023	1,000	1,500	2,000	992	1,503	1,998	1.009x - 23.051	0.999
B45	SKC	224-PCXR8	529594	10/10/2023	1,000	1,500	2,000	1,000	1,495	1,989	0.989x + 10.094	1.000
B46	SKC	224-PCXR8	566743	02/10/2023	1,000	1,500	2,000	1,000	1,500	1,998	1.008x - 19.564	0.999
B47	SKC	224-PCXR8	566747	02/10/2023	1,000	1,500	2,000	994	1,502	1,996	1.011x - 27.787	0.999
B48	SKC	224-PCXR8	566753	03/10/2023	1,000	1,500	2,000	1,000	1,495	2,000	1.005x - 13.577	1.000
B49	SKC	224-PCXR8	566780	02/10/2023	1,000	1,500	2,000	998	1,498	2,000	1.010x - 21.853	0.999
B50	SKC	224-PCXR8	500400	07/10/2023	1,000	1,500	2,000	999	1,495	1,989	0.993x + 5.640	1.000
B51	SKC	224-PCXR8	500363	07/10/2023	1,000	1,500	2,000	993	1,501	1,996	1.009x - 24.941	0.999
B52	SKC	224-PCXR8	093186	07/10/2023	1,000	1,500	2,000	994	1,500	1,991	0.996x + 2.910	1.000
B53	SKC	224-PCXR8	707670	06/10/2023	1,000	1,500	2,000	990	1,498	1,996	1.014x - 33.638	0.999
B54	SKC	224-PCXR3	509821	05/10/2023	1,000	1,500	2,000	991	1,499	1,995	1.012x - 30.494	0.999
B55	SKC	224-PCXR3	510710	05/10/2023	1,000	1,500	2,000	996	1,493	1,996	0.999x - 2.301	1.000
B56	SKC	224-PCXR3	511450	05/10/2023	1,000	1,500	2,000	992	1,487	1,996	1.006x - 16.797	1.000
B57	SKC	224-PCXR3	510798	04/10/2023	1,000	1,500	2,000	989	1,493	1,994	1.001x - 9.175	1.000
B58	SKC	224-PCXR3	509852	04/10/2023	1,000	1,500	2,000	1,000	1,497	1,997	1.009x - 21.172	0.999
B59	SKC	224-PCXR3	509862	04/10/2023	1,000	1,500	2,000	995	1,495	1,988	0.993x + 2.723	1.000
B60	SKC	224-PCXR3	512655	07/10/2023	1,000	1,500	2,000	992	1,498	1,997	1.013x - 31.979	0.999
B61	SKC	224-PCXR3	503915	07/10/2023	1,000	1,500	2,000	1,000	1,502	1,997	1.007x - 20.065	0.999
B62	SKC	224-PCXR3	505975	07/10/2023	1,000	1,500	2,000	996	1,489	1,991	0.990x + 6.791	1.000
B63	SKC	224-PCXR3	511432	07/10/2023	1,000	1,500	2,000	993	1,500	1,995	1.003x - 8.208	1.000
B64	SKC	224-PCXR3	508302	05/10/2023	1,000	1,500	2,000	991	1,496	1,988	0.998x - 5.262	1.000
B65	SKC	224-PCXR3	508310	05/10/2023	1,000	1,500	2,000	993	1,492	1,991	0.999x - 4.884	1.000
B66	SKC	224-PCXR3	509861	06/10/2023	1,000	1,500	2,000	996	1,493	1,985	0.992x + 2.675	1.000
B67	SKC	224-PCXR3	506295	04/10/2023	1,000	1,500	2,000	1,000	1,498	1,998	1.009x - 21.534	0.999
B68	SKC	224-PCXR3	505872	04/10/2023	1,000	1,500	2,000	994	1,493	1,987	0.993x + 3.176	1.000
B69	SKC	224-PCXR3	508375	07/10/2023	1,000	1,500	2,000	999	1,495	1,996	1.005x - 19.592	0.999
B70	SKC	224-PCXR3	510623	04/10/2023	1,000	1,500	2,000	992	1,486	1,995	1.002x - 11.762	1.000
B71	SKC	224-PCXR3	508367	05/10/2023	1,000	1,500	2,000	999	1,497	1,996	1.008x - 21.646	0.999
B72	SKC	224-PCXR3	505977	05/10/2023	1,000	1,500	2,000	993	1,490	1,990	0.997x - 4.295	1.000
B73	SKC	224-PCXR3	512606	05/10/2023	1,000	1,500	2,000	995	1,495	1,989	0.994x + 1.210	1.000
B74	SKC	224-PCXR3	505993	05/10/2023	1,000	1,500	2,000	997	1,496	1,986	0.987x + 12.602	1.000
B75	SKC	224-PCXR3	509820	05/10/2023	1,000	1,500	2,000	994	1,490	1,991	0.998x - 5.143	1.000
B76	SKC	224-PCXR3	509811	06/10/2023	1,000	1,500	2,000	1,000	1,497	1,999	1.010x - 23.063	0.999
B77	SKC	224-PCXR3	508301	06/10/2023	1,000	1,500	2,000	992	1,501	1,998	1.013x - 32.023	0.999
B78	SKC	224-PCXR3	510677	05/10/2023	1,000	1,500	2,000	1,001	1,498	1,997	1.007x - 18.549	0.999
B79	SKC	224-PCXR3	510620	03/10/2023	1,000	1,500	2,000	999	1,509	1,997	0.996x + 4.999	1.000



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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.)			y	R ²
				1	2	3	1	2	3		
H-B01	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	508.9	990.3	1974.3	$0.989x + 9.271$	1.000
H-B02	Dwyer	VFB-65	04/04/2023	500	1,000	2,000	495.3	999.1	1996.1	$0.994x + 4.127$	1.000
H-B03	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	497.3	988.1	2009.6	$1.003x - 14.485$	0.999
H-B04	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	501.2	1000.3	2006.5	$0.997x + 1.216$	1.000
H-B05	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	500.2	999.6	1974.3	$0.980x + 21.307$	0.999
H-B06	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	504.3	996.2	1984.0	$1.004x - 6.770$	1.000
H-B07	Dwyer	VFB-65	04/04/2023	500	1,000	2,000	502.3	990.7	2016.7	$1.001x - 1.134$	1.000
H-B08	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	500.2	1000.6	1979.8	$0.995x + 5.040$	0.999
H-B09	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	504.4	1007.4	2010.7	$0.993x + 15.376$	1.000
H-B10	Dwyer	VFB-65	10/04/2023	500	1,000	2,000	495.7	1001.6	2009.2	$0.996x + 3.956$	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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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 ²
				1	2	3	1	2	3		
L-B01	Dwyer	VFA-21	05/04/2023	50	100	200	50.3	98.7	198.9	$0.986x + 0.859$	1.000
L-B02	Dwyer	VFA-21	04/04/2023	50	100	200	50.6	99.8	198.3	$0.995x + 0.956$	0.999
L-B03	Dwyer	VFA-21	07/04/2023	50	100	200	50.4	99.6	197.9	$1.009x - 1.350$	1.000
L-B04	Dwyer	VFA-21	07/04/2023	50	100	200	49.5	102.0	200.7	$1.012x - 0.487$	1.000
L-B05	Dwyer	VFA-21	07/04/2023	50	100	200	50.9	98.9	201.2	$0.998x + 1.040$	0.999
L-B06	Dwyer	VFA-21	07/04/2023	50	100	200	50.8	99.7	202.8	$1.009x + 0.150$	1.000
L-B07	Dwyer	VFA-21	04/04/2023	50	100	200	49.0	101.2	200.5	$1.014x - 1.381$	1.000
L-B08	Dwyer	VFA-21	05/04/2023	50	100	200	50.2	102.1	197.7	$0.997x + 0.307$	1.000
L-B09	Dwyer	VFA-21	07/04/2023	50	100	200	50.8	99.6	201.1	$0.990x + 2.095$	0.999
L-B10	Dwyer	VFA-21	10/04/2023	50	100	200	51.0	99.0	203.2	$1.005x + 0.453$	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data				Calibration Data							
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-801	Dwyer	VFB-65	04/07/2023	500	1,000	2,000	503.2	990.1	1974.7	0.990x + 7.225	1.000
H-802	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	495.6	994.6	1994.1	0.995x + 2.972	1.000
H-803	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	497.1	989.8	2007.6	1.002x - 12.719	0.999
H-804	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	500.3	999.5	2004.4	0.996x - 0.709	1.000
H-805	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	499.3	990.7	1972.3	0.982x + 17.213	0.999
H-806	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	504.0	991.4	1982.0	0.988x + 8.755	1.000
H-807	Dwyer	VFB-65	04/07/2023	500	1,000	2,000	501.3	989.4	2014.7	0.999x - 0.490	1.000
H-808	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	499.2	996.1	1977.8	0.993x + 2.247	0.999
H-809	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	504.0	1006.4	2008.7	0.991x + 16.313	1.000
H-810	Dwyer	VFB-65	10/07/2023	500	1,000	2,000	495.7	993.0	2011.6	1.000x - 1.820	1.000

Calibrated by :

(Mr.Adul Dangklorn)

Approved by :



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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 ²
H-R01	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	501.2	993.0	1978.7	0.999x - 3.855	0.999
H-R02	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	501.5	998.1	1986.7	1.000x - 2.024	1.000
H-R03	Dwyer	VFB-65	04/07/2023	500	1,000	2,000	501.2	989.3	1995.7	0.992x + 3.827	1.000
H-R04	Dwyer	VFB-65	10/07/2023	500	1,000	2,000	496.3	991.2	2014.5	1.006x - 10.883	1.000
H-R05	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	499.1	987.9	1988.7	1.002x - 6.676	1.000
H-R06	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	504.7	994.0	1980.6	0.998x - 1.539	0.999

Calibrated by :

(Mr.Adul Dangklorn)

Approved by :



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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 ²
H-B01	Dwyer	VFB-65	02/10/2023	500	1,000	2,000	500.1	992.7	1979.6	0.993x + 4.560	1.000
H-B02	Dwyer	VFB-65	03/10/2023	500	1,000	2,000	503.6	989.1	1983.1	0.991x + 6.131	1.000
H-B03	Dwyer	VFB-65	02/10/2023	500	1,000	2,000	498.7	991.6	2006.8	0.999x - 9.214	0.999
H-B04	Dwyer	VFB-65	04/10/2023	500	1,000	2,000	502.3	988.1	2003.7	1.000x - 2.013	1.000
H-B05	Dwyer	VFB-65	03/10/2023	500	1,000	2,000	497.8	989.1	1971.6	0.981x + 16.401	0.999
H-B06	Dwyer	VFB-65	05/10/2023	500	1,000	2,000	499.3	995.9	1979.0	0.988x + 11.304	1.000
H-B07	Dwyer	VFB-65	04/10/2023	500	1,000	2,000	495.1	995.8	1991.3	0.997x - 1.222	1.000
H-B08	Dwyer	VFB-65	05/10/2023	500	1,000	2,000	500.7	998.7	1975.8	0.990x + 5.555	0.999
H-B09	Dwyer	VFB-65	03/10/2023	500	1,000	2,000	496.9	998.5	1979.0	0.989x + 10.735	1.000
H-B10	Dwyer	VFB-65	07/10/2023	500	1,000	2,000	499.4	997.5	2004.6	0.998x - 1.062	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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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.)				
				1	2	3	1	2	3	y	R ²
L-B01	Dwyer	VFA-21	02/10/2023	50	100	200	50.2	100.3	202.6	$0.997x + 0.475$	0.999
L-B02	Dwyer	VFA-21	03/10/2023	50	100	200	50.5	98.9	201.1	$1.001x - 0.121$	1.000
L-B03	Dwyer	VFA-21	02/10/2023	50	100	200	50.1	100.7	200.2	$1.007x - 1.206$	0.999
L-B04	Dwyer	VFA-21	04/10/2023	50	100	200	50.4	99.6	201.9	$1.006x - 0.142$	1.000
L-B05	Dwyer	VFA-21	03/10/2023	50	100	200	49.7	101.1	197.7	$0.997x - 0.218$	1.000
L-B06	Dwyer	VFA-21	05/10/2023	50	100	200	50.3	101.5	200.1	$1.003x - 0.332$	0.999
L-B07	Dwyer	VFA-21	04/10/2023	50	100	200	50.9	100.4	202.4	$0.990x + 2.441$	1.000
L-B08	Dwyer	VFA-21	05/10/2023	50	100	200	50.7	99.8	197.9	$1.005x - 1.343$	0.999
L-B09	Dwyer	VFA-21	03/10/2023	50	100	200	50.2	100.3	203.0	$1.007x + 0.375$	1.000
L-B10	Dwyer	VFA-21	07/10/2023	50	100	200	49.5	99.4	200.3	$1.009x - 1.182$	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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Calibration Report Non-Dispersive Infrared CO Analyzer			
Date :	03 July 2023	Brand :	API
No.	CO-801	Model :	300E
		Serial No.	782
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	06 September 2022	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	%Diff
Zero	0	0.11	-
CO Span	40.00	40.06	0.150
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	± 1 ppm With Zero Air
CO Measure	4015.2	mV	2500-4800 mV
CO Reference	3947.7	mV	2500-4800 mV
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air
Sample Pressure	28.7	In-Hg-A	~2" ± Ambient Absolute Pressure
Sample Flow	806	CC/Min	800 ± 10%
Sample Temperature	48.5	°C	48 ± 4
Bench Temperature	48.2	°C	48 ± 2
Wheel Temperature	68.4	°C	68 ± 2
Box Temperature	30.7	°C	Ambient Temp + 7 ± 10
Photo-Drive	3037.6	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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

Calibration Report Non-Dispersive Infrared CO Analyzer			
Date :	04 August 2023	Brand :	API
No.	CO-B01	Model :	300E
		Serial No.	782
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	06 September 2022	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. :	24.5 °C
		% RH :	49
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Diff
Zero	0	0.10	-
CO Span	40.00	39.95	-0.125
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	± 1 ppm With Zero Air
CO Measure	4014.2	mV	2500-4800 mV
CO Reference	3948.3	mV	2500-4800 mV
Measure/Reference Ratio	1.179	-	1.1-1.3 W/Zero Air
Sample Pressure	28.5	In-Hg-A	~2" ± Ambient Absolute Pressure
Sample Flow	804	CC/Min	800 ± 10%
Sample Temperature	48.3	°C	48 ± 4
Bench Temperature	48.0	°C	48 ± 2
Wheel Temperature	68.2	°C	68 ± 2
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10
Photo-Drive	3041.4	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	04 September 2023	Brand :	API	Model :	300E
No.	CO-801	Serial No.	782		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	08 August 2023	Serial No. :	911		
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	%Diff	Analyzer Response	
Zero	0	0.10	-	0	
CO Span	40.00	39.93	-0.175	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4013.5	mV	2500-4800 mV		
CO Reference	3948.7	mV	2500-4800 mV		
Measure/Reference Ratio	1.179	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.7	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	806	CC/Min	800 ± 10%		
Sample Temperature	48.4	°C	48 ± 4		
Bench Temperature	48.2	°C	48 ± 2		
Wheel Temperature	68.5	°C	68 ± 2		
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3039.8	mV	250 mV to 4750 mV		
Slope	1.016	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 



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Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	05 October 2023	Brand :	API	Model :	300E
No.	CO-801	Serial No.	782		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	08 August 2023	Serial No. :	911		
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.	24.5 °C	% RH	49
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.04	0.100	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4014.4	mV	2500-4800 mV		
CO Reference	3947.7	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.5	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	808	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.0	°C	48 ± 2		
Wheel Temperature	68.2	°C	68 ± 2		
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3037.6	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 

Calibration Report Non-Dispersive Infrared CO Analyzer				
Date : 01 November 2023		Brand : API		Model : 300E
No. CO-B01		Serial No.		782
Calibrator (Dilution System)				
Brand : API		Model : 700		
Last Cal. Date : 08 August 2023		Serial No. : 911		
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. : 24.5 °C		% RH : 48	
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	39.95	-0.125	40.00
API Model 300E CO Analyzer Check List				
Parameter	Observed Value	Units	Nominal Range	
Range	50	PPM	0-1000 ppm	
Stability	0.10	PPM	± 1 ppm With Zero Air	
CO Measure	4015.8	mV	2500-4800 mV	
CO Reference	3947.3	mV	2500-4800 mV	
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air	
Sample Pressure	28.7	In-Hg-A	-2" < Ambient Absolute Pressure	
Sample Flow	811	CC/Min	800 ± 10%	
Sample Temperature	48.2	°C	48 ± 4	
Bench Temperature	48.0	°C	48 ± 2	
Wheel Temperature	68.4	°C	68 ± 2	
Box Temperature	30.9	°C	Ambient Temp + 7 ± 10	
Photo-Drive	3027.1	mV	250 mV to 4750 mV	
Slope	1.017	-	1.0 ± 0.3	
Offset	0.2	-	0 ± 0.3	

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 

Calibration Report Non-Dispersive Infrared CO Analyzer				
Date : 07 December 2023		Brand : API		Model : 300E
No. CO-B01		Serial No.		782
Calibrator (Dilution System)				
Brand : API		Model : 700		
Last Cal. Date : 08 August 2023		Serial No. : 911		
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. : 24.5 °C		% RH : 48	
Calibration Setting				
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	% Dif	Analyzer Response
Zero	0	0.11	-	0
CO Span	40.00	39.90	-0.250	40.00
API Model 300E CO Analyzer Check List				
Parameter	Observed Value	Units	Nominal Range	
Range	50	PPM	0-1000 ppm	
Stability	0.10	PPM	± 1 ppm With Zero Air	
CO Measure	4016.3	mV	2500-4800 mV	
CO Reference	3949.1	mV	2500-4800 mV	
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air	
Sample Pressure	28.6	In-Hg-A	-2" < Ambient Absolute Pressure	
Sample Flow	808	CC/Min	800 ± 10%	
Sample Temperature	48.4	°C	48 ± 4	
Bench Temperature	48.2	°C	48 ± 2	
Wheel Temperature	68.3	°C	68 ± 2	
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10	
Photo-Drive	3031.6	mV	250 mV to 4750 mV	
Slope	1.017	-	1.0 ± 0.3	
Offset	0.2	-	0 ± 0.3	

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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

ARCHEMICA LAB
บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature : _____ Date : Jan 4, 2023

(Mr. Channarong Khiao-Un)

Test Engineer



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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

ARCHEMICA LAB
บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature : _____ Date : Jul 3, 2023

(Mr.Nutdanai Laekhwan)

Applications Chemist



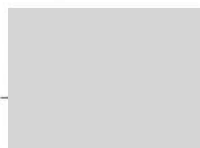
บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10900
/ Soi Phatolayothin 24, Phatolayothin Rd., Jomjol, Chulachak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@spscon.com, www.spscon.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 05 July 2023		Brand : HORIBA	Model : APHA-360CE
No. 801		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 04 August 2022		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH ₄)		Cylinder No. : D612165	
Certified Date : 25 February 2023		Expired Date : 25 February 2031	
Cylinder Conc. : 453 ppm			
Calibrating Condition			
Pressure : 1011 mmbar		Temp. : 24.6 °C	% RH : 49
Start Time : 2:00 PM			
Pre-Calibration Checks			
Change Particulate Filter : Yes		Station Temp : 25.0 °C	
Leak Test : Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.03	10
Calibration Setting (Final)			
Span Instrument Gain: 0.998		Finish Time: 3:00 PM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.7	mV	800-1,350
Signal (THC)	917.1	mV	800-1,350
Detector	77.9	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.2	kPa	8 - 25
NMC	259.5	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :



Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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/ Soi Phatolayothin 24, Phatolayothin Rd., Jomjol, Chulachak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@spscon.com, www.spscon.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 03 August 2023		Brand : HORIBA	Model : APHA-360CE
No. 801		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 04 August 2022		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH ₄)		Cylinder No. : D612165	
Certified Date : 25 February 2023		Expired Date : 25 February 2031	
Cylinder Conc. : 453 ppm			
Calibrating Condition			
Pressure : 1011 mmbar		Temp. : 24.5 °C	% RH : 49
Start Time : 10:00 AM			
Pre-Calibration Checks			
Change Particulate Filter : Yes		Station Temp : 25.0 °C	
Leak Test : Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.02	10
Calibration Setting (Final)			
Span Instrument Gain: 0.999		Finish Time: 11:00 AM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.3	mV	800-1,350
Signal (THC)	916.2	mV	800-1,350
Detector	78.1	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	kPa	8 - 25
NMC	258.8	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :

(Mr. Adul Dangklom)

Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jomote, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@spscon.com, www.spscon.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 05 September 2023		Brand : HORIBA	Model : APHA-360CE
No. 801		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 08 August 2023		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH ₄)		Cylinder No. : D612165	
Certified Date : 25 February 2023		Cylinder Conc. : 453 ppm	
Exp. Date : 25 February 2031			
Calibrating Condition			
Pressure : 1011 mmbar		Temp. : 24.6 °C	% RH : 49
Start Time : 1:00 PM			
Pre-Calibration Checks			
Change Particulate Filter : Yes		Station Temp : 25.0 °C	
Leak Test : Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.04	10
Calibration Setting (Final)			
Span Instrument Gain: 0.997		Finish Time: 2:00 PM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	910.9	mV	800-1,350
Signal (THC)	915.7	mV	800-1,350
Detector	77.9	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.1	kPa	8 - 25
NMC	259.1	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :

(Signature)

Approved by :

(Signature)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jomote, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@spscon.com, www.spscon.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 04 October 2023		Brand : HORIBA	Model : APHA-360CE
No. 801		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 08 August 2023		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH ₄)		Cylinder No. : D612165	
Certified Date : 25 February 2023		Cylinder Conc. : 453 ppm	
Exp. Date : 25 February 2031			
Calibrating Condition			
Pressure : 1011 mmbar		Temp. : 24.5 °C	% RH : 49
Start Time : 9:00 AM			
Pre-Calibration Checks			
Change Particulate Filter : Yes		Station Temp : 25.0 °C	
Leak Test : Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.02	10
Calibration Setting (Final)			
Span Instrument Gain: 0.998		Finish Time: 10:00 AM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.4	mV	800-1,350
Signal (THC)	916.7	mV	800-1,350
Detector	77.9	kPa	((Pressure Air/1013x100)-20 ± 4 kPa
Purifier	19.1	kPa	8 - 25
NMC	259.7	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :

(Signature)

Approved by :

(Signature)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 แขวงพหลโยธิน เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sale@spscn.com, www.spscn.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 02 November 2023		Brand : HORIBA	Model : APHA-360CE
No. 801		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 08 August 2023		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH ₄)		Cylinder No. : D612165	
Certified Date : 25 February 2023		Expired Date : 25 February 2031	
		Cylinder Conc. : 453 ppm	
Calibrating Condition			
Pressure 1011 mmbar		Temp. 24.6 °C	% RH 49
Start Time : 2:00 PM			
Pre-Calibration Checks			
Change Particulate Filter Yes		Station Temp : 25.0 °C	
Leak Test Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.10	0
Span	10	10.03	10
Calibration Setting (Final)			
Span Instrument Gain: 0.997		Finish Time: 3:00 PM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.8	mV	800-1,350
Signal (THC)	917.1	mV	800-1,350
Detector	77.8	kPa	((Pressure Air/101.3)(100)-20) ± 4 kPa
Purifier	19.0	kPa	8 - 25
NWC	259.2	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 แขวงพหลโยธิน เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sale@spscn.com, www.spscn.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 01 December 2023		Brand : HORIBA	Model : APHA-360CE
No. 801		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : API		Model : 700	
Last Cal. Date : 08 August 2023		Serial No. : 911	
Reference Standard Gas			
Standard Gas : Methane (CH ₄)		Cylinder No. : D612165	
Certified Date : 25 February 2023		Expired Date : 25 February 2031	
		Cylinder Conc. : 453 ppm	
Calibrating Condition			
Pressure 1011 mmbar		Temp. 24.5 °C	% RH 48
Start Time : 10:00 AM			
Pre-Calibration Checks			
Change Particulate Filter Yes		Station Temp : 25.0 °C	
Leak Test Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.11	0
Span	10	10.05	10
Calibration Setting (Final)			
Span Instrument Gain: 0.996		Finish Time: 11:00 AM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	912.2	mV	800-1,350
Signal (THC)	917.5	mV	800-1,350
Detector	78.0	kPa	((Pressure Air/101.3)(100)-20) ± 4 kPa
Purifier	19.2	kPa	8 - 25
NWC	259.7	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

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

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

Page 1 of 4



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>January 11, 2023</u>
1. MECHANICAL CHECKS	
A. Inspect and clean all fans and filters.	<input type="checkbox"/>
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/>
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/>
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/>
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/>
F. Clean the exterior of the instrument.	<input type="checkbox"/>
2. OPTICAL CHECKS	
A. Inspect and clean all optical components.	<input type="checkbox"/>
B. As required, check and replace all purgefilters.	<input type="checkbox"/>
C. Recheck optical alignment.	<input type="checkbox"/>
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/>
B. Flush out the chiller every year.	<input type="checkbox"/>
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	<input type="checkbox"/>
B. Wavelength Calibration.	<input type="checkbox"/>

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : <u>077C7042401</u>		DATE TESTED : <u>January 11, 2023</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00504
	Ni 231.604 nm	≤ 0.008	0.00646
	Ni 341.476 nm	≤ 0.012	0.00768
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01597
	Ba 455.403 nm	≤ 0.025	0.02185
Precision	As 193.656 nm	% RSD < 1.0	0.89 %
	Zn 213.856 nm	% RSD < 1.0	0.77 %
	Mn 257.610 nm	% RSD < 1.0	0.51 %
	La 379.478 nm	% RSD < 1.0	0.44 %
	Ba 455.403 nm	% RSD < 1.0	0.44 %
	Ba 493.408 nm	% RSD < 1.0	0.46 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	4.04 ppb
	As 193.696 nm	3(sd)	3.58 ppb
	Pb 220.353 nm	3(sd)	1.90 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	47.72 ppb
	Zn 213.856 nm	3(sd)	1.02 ppb
	Mn 257.610 nm	3(sd)	0.68 ppb
	La 379.478 nm	3(sd)	1.43 ppb
	Ba 455.403 nm	3(sd)	0.10 ppb
	Ba 493.408 nm	3(sd)	0.36 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	58.36
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	104142.80



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 11, 2023

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative: _____

(

Service Engineer



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 6, 2023</u>
Address : <u>7 Soi Phaholyothin 24</u>	Recommendation Recertification
<u>Paholyothin Road</u>	Period <u>6</u> Months
Jompoi Chatuchak, Bangkok 1090	Recertification Due: <u>January 6, 2024</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>January 11, 2023</u>
Phone: <u>083-9269252</u>	Visit Number: <u>1 of 2</u>
Fax: <u>02-513-4221</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
	PerkinElmer Fax: <u>02-318-5597</u>

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

Page 1 of 4



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>July 6, 2023</u>
1. MECHANICAL CHECKS	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
2. OPTICAL CHECKS	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every year.	<input type="checkbox"/> N/A
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : <u>077C7042401</u>		DATE TESTED : <u>July 6, 2023</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00534
	Ni 231.604 nm	≤ 0.008	0.00682
	Ni 341.476 nm	≤ 0.012	0.00794
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01613
	Ba 455.403 nm	≤ 0.025	0.02282
Precision	As 193.656 nm	% RSD < 1.0	0.23 %
	Zn 213.856 nm	% RSD < 1.0	0.09 %
	Mn 257.610 nm	% RSD < 1.0	0.58 %
	La 379.478 nm	% RSD < 1.0	0.38 %
	Ba 455.403 nm	% RSD < 1.0	0.42 %
	Ba 493.408 nm	% RSD < 1.0	0.41 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	2.37 ppb
	As 193.696 nm	3(sd)	6.78 ppb
	Pb 220.353 nm	3(sd)	0.82 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	23.56 ppb
	Zn 213.856 nm	3(sd)	2.85 ppb
	Mn 257.610 nm	3(sd)	3.66 ppb
	La 379.478 nm	3(sd)	5.10 ppb
	Ba 455.403 nm	3(sd)	0.12 ppb
	Ba 493.408 nm	3(sd)	1.17 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	117.07
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	22.09



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER	<u>077C7042401</u>	DATE TESTED	<u>July 6, 2023</u>
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Remarks :

Commissioning follow as commissioning performance sheets.

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

☒ meets
☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative: _____

(_____)

Service Engineer




PinAAcle 900T Preventive Maintenance Report

Company Name: SPS Consulting Service Co., Ltd.
Instrument Location: 7 Soi Phaholyothin 24, Phaholyothin Rd.
Jompol, Chatuchak, Bangkok, 10900
Instrument Serial No.: PTCS14111103
Date: 29-Jun-2023

PinAAcle 900T Preventive Maintenance (PM)

Company Name:	SPS Consulting Service Co., Ltd.		
Address (Instrument Location):	7 Soi Phaholyothin 24, Phaholyothin Rd. Jompol, Bangkok, 10900		
Serial Number:	PTCS14111103	PM Number:	2/2
Customer Name (if applicable):	K. Phenpha	Telephone Number:	083-926-9252
Customer Support Engineer Name:	K. Duang	Service Order Number:	WO-02419478
Date PM Performed: (DD-MMM-YYYY)	29-Jun-2023	Next PM Due Date: (DD-MMM-YYYY)	29-Dec-2023
Standard Labor Hours to Complete PM :		5 hours	

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Configuration Notes
A5900	A591S14B1002	Winlab32

Parts Lists

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

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	56-21CRY1	30-Jun-2023

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

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

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

3.1 Flame Technique

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

3.2 THGA Technique

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

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

7. Flame Interlock Check:

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

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

8. After PM Performance tests [Flame]:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9877	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1985	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0016	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

8.4 D₂ Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0044	Passed

8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0001	Passed

8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0013	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3421	Passed

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

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

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0005	Passed
Standard Deviation	≤ 0.005	0.0004	Passed

9.3 Chromium Characteristic Mass and Precision

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

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	≤ 7.0 pg/0.0044 A-s	5.8	Passed
Precision	≤ 2.0 %	1.18	Passed

9.4 Copper Characteristic Mass and Zeeman Ratio

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

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	13.6	Passed
Zeeman Ratio	0.52 ± 0.04	0.52	Passed

10. Review:

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

Additional Comments

Additional Comments Regarding the PM

Zeeman Ratio

Atomic Signal (Peak area)

Atomic Signal (Peak area) + Background Signal (Peak area)

0.1614

0.1614+0.1448

0.52

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.

This PinAAcle 900T

Passes

Fails

 the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:

Date:

06-Jun-2023

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

06-Jun-2023

(DD-MMM-YYYY)

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GC_MS_03_52_CN10925102
Organization Name: S.P.S Consulting service
Organization Location: 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900

Date: March 31, 2023 1:21:52 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

Front SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: -0.1 psi /5 minutes

Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front SSL

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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

Back SSL

Setpoint Status: Pass

Setpoint Actual
Inlet Pressure: 25.0 psi 25.2 psi

Accuracy: 0.2 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: 30.3 mL/min

Accuracy: 0.3 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)

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

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min **Measured Flow:** 396.2 mL/min

Accuracy: 3.8 mL/min

Agilent Recommended: ≤ 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:** 25.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ≤ 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: ≥ -1.0 % setpoint in K (-5.0 °C)
≤ 1.0 % setpoint in K (5.0 °C)

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.4 °C

Accuracy: 0.4 °C

Agilent Recommended: ≥ -1.0 % setpoint in K (-3.7 °C)
≤ 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: 100.0 100.3833 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID

Manual Injection

Name: Not applicable

Setpoint Status: Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Name: 7890

Setpoint Status: Pass

Base Signal: 89800 Ab

	ASTM Noise counts	Drift counts/Hr
Agilent Recommended:	285.31	96.04
Status:	<= 768.00	<= 19200.00

Pass

Overall Noise and Drift Test Status

Pass

Signal to Noise

Tested Combination1 Front SSL / Front FID

Manual Injection

Name: 7890

Setpoint Status: Pass

Signal to Noise: 3814254

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

Log Amp

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Amu: 1050 m/z

Drift After Five Minutes:

RFPA Voltage:

1 mV

479 mV

Agilent Recommended: >= -100 and <= 100 <= 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination2 Back SSL / External SQ

Name: 5975C

Source: EI - Inert Filament: 1

Setpoint Status: Pass

Signal to Noise: 425

Agilent Recommended: >= 180

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Source: EI - Inert

Filament: 2

Setpoint Status: Pass

Signal to Noise: 566

Agilent Recommended: >= 160

Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose
This section describes the as found system configuration.

Details

System	
System ID	GC_MS_03_52_CN10925102
Manufacturer	Agilent Technologies
Name	7890
Tested Combination1	
Injection Technique	Manual Injection
Sampler Identifier	Sampler 1
Inlet	Front
Detector	Front
LTM Included?	No
Tested Combination2	
Injection Technique	Manual Injection
Sampler Identifier	Sampler 2
Inlet	Back
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

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Detector 2

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C
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

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Electronic Signature

Purpose

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Details

Full Name of Signer: Saenguthai Tarak
Logged On User Name: saenguthai.tarak@non.agilent.com
Signature Creation Date: March 31, 2023
Reason for Signature: Executed protocol and published this original version of document

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ39KOMV
System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:12:26 AM Audit		SessionCreated	Session	None
March 31, 2023 9:12:28 AM Start		Configuration	Session	None
March 31, 2023 9:12:26 AM Audit		Entitlement	Licensing	User is Nonpaying and does not require an unlock code
March 31, 2023 9:20:14 AM Audit		EcpLoaded	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], Protocol Revision: [Gc.02.50] EQP details for hyphenated technique [GoMs] - File path: [ProtocolPacks/GoMs/Configurations/02.50/GoMs.02.50.eqp], EQP File Name: [GoMs.02.50.eqp], EQP Name: [AgilentRecommended]
March 31, 2023 9:20:17 AM End		Configuration	Session	None
March 31, 2023 9:20:27 AM Start		Qualification	Session	OQ
March 31, 2023 9:20:27 AM Start		Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 31, 2023 9:21:33 AM End		Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3S8KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:21:35 AM Start		Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 31, 2023 9:21:51 AM End		Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 31, 2023 9:21:54 AM Start		Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 31, 2023 9:21:59 AM End		Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 31, 2023 9:22:02 AM Start		Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 31, 2023 9:22:07 AM End		Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 31, 2023 9:22:09 AM Start		Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:29 AM End		Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:30 AM Start		Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:41 AM End		Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3S8KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:22:42 AM Start		Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:48 AM End		Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:49 AM Start		Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:23:31 AM 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 31, 2023 9:23:34 AM 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 31, 2023 9:23:37 AM Start		Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:26:00 AM 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 31, 2023 9:26:03 AM 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 31, 2023 9:26:05 AM Start		Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ38KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:26:42 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.3°C	None
March 31, 2023 9:27:39 AM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 31, 2023 9:27:46 AM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 31, 2023 9:27:51 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 31, 2023 9:54:35 AM	Start	Execution	Log Amp - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 9:55:59 AM	Start	Execution	RFPA - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 10:23:19 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 10:37:53 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:04 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:11 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 1 (Qualitative - No setpoints associated)	None

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ38KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 10:38:14 AM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:38:17 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 31, 2023 10:45:28 AM	Audit	Data	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : F:\Data\SC_FID.D\FID1A.ch
March 31, 2023 10:47:01 AM	End	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 31, 2023 10:58:27 AM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:58:52 AM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : F:\Data\ND_FID.D\FID1A.ch
March 31, 2023 11:00:53 AM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 31, 2023 11:02:02 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:14:32 AM	Audit	AccClosed	Session	None

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ38KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:15:13 AM	Audit	AceRestarted	Session	None
March 31, 2023 11:15:14 AM	Audit	SessionReloaded	Session	None
March 31, 2023 11:15:19 AM	Start	Qualification	Session	OQ
March 31, 2023 11:15:19 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:16:23 AM	Audit	AceClosed	Session	None
March 31, 2023 11:21:04 AM	Audit	AceRestarted	Session	None
March 31, 2023 11:21:04 AM	Audit	SessionReloaded	Session	None
March 31, 2023 11:21:09 AM	Start	Qualification	Session	OQ
March 31, 2023 11:21:09 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:22:15 AM	Audit	Data	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : F:\SN_FID.D\FID1A.ch
March 31, 2023 11:24:02 AM	End	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 31, 2023 11:24:17 AM	Start	Execution	Log Amp - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 11:24:31 AM	End	Execution	Log Amp - 5975C SQ: - Source: EI - Inert	Run Count : 1

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ38KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:24:33 AM	Start	Execution	RFPA - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 11:27:22 AM	End	Execution	RFPA - 5975C SQ: - Source: EI - Inert	Run Count : 1
March 31, 2023 11:27:25 AM	Start	Execution	Tune EI - 5975C SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
March 31, 2023 11:28:04 AM	End	Execution	Tune EI - 5975C SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 31, 2023 11:28:06 AM	Start	Execution	Tune EI - 5975C SQ: - Source: EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 31, 2023 11:28:26 AM	End	Execution	Tune EI - 5975C SQ: - Source: EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 31, 2023 11:28:28 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 12:59:45 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 1:00:09 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : F:\SN_F1_01.D\DATA9IM.MS
March 31, 2023 1:00:41 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Run Count : 1

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saenguthai.tarak
Hostname: LAPTOP-GQ3SKOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 1:00:43 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	None
March 31, 2023 1:01:52 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Data files Path : F:\SN_F2_01.D\DATASIM.MS
March 31, 2023 1:02:09 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Run Count : 1
March 31, 2023 1:02:13 PM	End	Qualification	Session	OQ
March 31, 2023 1:02:13 PM	Start	Reporting	Session	None
March 31, 2023 1:20:27 PM	Audit	Reporting	Session	Report Generated : Certificate

เอกสารแนบ 4-3

เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำใต้ดิน



CERTIFICATE No : 22E9693
REFERENCE No : 66476-1

PAGE : 1 OF 3

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 15-Sep-22

APPROVED BY :

ISSUED DATE : 15-Sep-22

RECEIVED DATE : 14-Sep-22



CERTIFICATE No : 22E9693

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH 04/56
RECEIVED DATE : 14-Sep-22
AMBIENT TEMPERATURE : 20 °C ± 1 °C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 15-Sep-22
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

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

5. THIS CERTIFICATE IS TRACEABLE TO SI UNIT MAINTAINED AT :-
- NATIONAL INSTITUTE OF STANDARD AND TECHNOLOGY, USA.
 - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

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

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



QUALITY CALIBRATION CO.,LTD.

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

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

CERTIFICATE No : 22E9693

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE):

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

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

3. DISPLAY UNIT WITH TEMPERATURE

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

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

**QUALITY CALIBRATION CO.,LTD.**

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



CERTIFICATE No : 23E8494
REFERENCE No : 70413-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER
MANUFACTURER : HANNA
MODEL : HI 3512
SERIAL No : TH118035
ID No : pH04/56
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 06-Sep-23

APPROVED BY : 

ISSUED DATE : 06-Sep-23

RECEIVED DATE : 31-Aug-23

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

F-G010 REV 03

**QUALITY CALIBRATION CO.,LTD.**

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

CERTIFICATE No : 23E8494

PAGE : 2 OF 3

Calibration Report

EQUIPMENT : pH METER
MANUFACTURER : HANNA
ID No : pH04/56
RECEIVED DATE : 31-Aug-23
AMBIENT TEMPERATURE : 23 ° C ± 3 ° C
MODEL : HI 3512
SERIAL NUMBER : TH118035
CALIBRATION DATE : 06-Sep-23
RELATIVE HUMIDITY : 50 % RH ± 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/ LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Apr-24
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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

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

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3

**QUALITY CALIBRATION CO.,LTD.**

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

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

CERTIFICATE No : 23E8494

PAGE : 3 OF 3

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

STANDARD pH BUFFER SOLUTION (pH)	UUC READING (pH)	CORRECTION (pH)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± pH)	COVERAGE FACTOR k
4.006	4.006	0.000	4.015	0.012	2.00
7.000	7.000	0.000	6.914	0.012	2.00
10.008	10.010	-0.002	9.996	0.014	2.00

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.005	25.0	0.005	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



CERTIFICATE No : 23M2442

REFERENCE No : 68471-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 10-Mar-23

APPROVED BY :

ISSUED DATE : 16-Mar-23

RECEIVED DATE : 10-Mar-23



CERTIFICATE No : 23M2442

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW

MANUFACTURER : SARTORIUS S/N : 36591843

ID No : BA 09/61 RECEIVED DATE : 10-Mar-23

AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23

AMBIENT TEMPERATURE : 23° C \pm 1° C RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

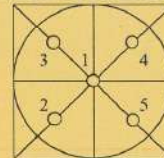
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP22018

Pages 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY

Condition As Found : GOOD

Customer : S.P.S. CONSULTING SERVICE CO., L.TD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.

Location : ORGANIC LABORATORY IV

Ambient Temperature : (24.4 ± 5) °C

Relative Humidity : (60.1 ± 25) %

Received Date : 30 AUGUST 2022

Calibration Date : 30 AUGUST 2022

Date of Issue : 31 AUGUST 2022

Calibrated by : Nathakorn Pisutnaisan

Approved by : (Thanakul Petchurai)

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

SITHIPORN
associates

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

Pages : 2 of 3

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

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

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0524	1.0539	0.0015	0.0028	2.00
		29914	0.7	0.7454	0.7459	0.0005	0.0029	2.00
		29381	0.5	0.5426	0.5426	0.0000	0.0028	2.00
	546.1	29360	1.0	0.9822	0.9810	-0.0012	0.0028	2.00
		29914	0.7	0.6962	0.6960	-0.0002	0.0028	2.00
		29381	0.5	0.5076	0.5070	-0.0006	0.0029	2.00
	590.0	29360	1.0	1.0221	1.0202	-0.0019	0.0028	2.00
		29914	0.7	0.7238	0.7230	-0.0008	0.0029	2.00
		29381	0.5	0.5364	0.5360	-0.0004	0.0031	2.00
	635.0	29360	1.0	0.9751	0.9732	-0.0019	0.0028	2.00
		29914	0.7	0.6912	0.6902	-0.0010	0.0029	2.00
		29381	0.5	0.5214	0.5210	-0.0004	0.0032	2.00

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
RM-0204060810	235.0	20	0.2436	0.2419	-0.0017	0.0101	2.00
		40	0.4905	0.4855	-0.0050	0.0115	2.00
		60	0.7453	0.7388	-0.0065	0.0067	2.00
		80	0.9920	0.9839	-0.0081	0.0071	2.00
		100	1.2487	1.2414	-0.0073	0.0073	2.00

UUC* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.0001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

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

**Specific Acceptance :

Transmission ≤ 1.0 T(%), Absorbance ≥ 2.0 A

**Stray light not ITSI Accredited

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

End of Calibration Certificate

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

Calibration Certificate

Equipment : UV-VIS SPECTROPHOTOMETER
Manufacturer : PERKINELMER
Model : LAMBDA 25
Serial No.: 501S14123010
ID No.: SP03/58
Calibration Mode : WAVELENGTH ACCURACY
PHOTOMETRIC ACCURACY
Condition As Found : GOOD
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD,
CHOMPHON, CHATUCHAK,
BANGKOK 10900, THAILAND.
Location : ORGANIC LABORATORY IV
Ambient Temperature : (25.0 ± 5) °C
Relative Humidity : (48.4 ± 25) %
Received Date : 30 AUGUST 2023
Calibration Date : 30 AUGUST 2023
Date of Issue : 31 AUGUST 2023

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

(Thanakul Petchurai)

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

SITHIPORN
associates

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0090-22	08/04/2024

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

Material	Certified Values of Reference Material (nm)	UUC* Reading (nm)	Error (nm)	Uncertainty ± (nm)	k Factor
RM-HL	278.13	278.3	0.17	0.16	2.00
	361.25	361.3	0.05	0.16	2.00
	467.82	468.0	0.18	0.16	2.00
	536.56	536.6	0.04	0.16	2.00
	640.50	640.4	-0.10	0.16	2.00
RM-DL	740.09	740.0	-0.09	0.16	2.00
	864.94	865.0	0.06	0.16	2.00

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

Cert. No. : SP23016
Job No. : VC66SP0014
Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422	0.2462	0.0040	0.0101	2.00	
		40	0.4866	0.4900	0.0034	0.0115	2.00	
		60	0.7414	0.7390	-0.0024	0.0068	2.00	
		80	0.9858	0.9871	0.0013	0.0093	2.00	
		100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC* = Unit Under Calibration

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

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

Stray Light** UUC* Reading at 220 nm	
Transmission T(%)	Absorbance(A)
0.0111	3.9564

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate



WO-01756957/2022

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

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

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

Page 1 of 4



WO-01756957/2022

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>July 11, 2022</u>
1. MECHANICAL CHECKS	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
2. OPTICAL CHECKS	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every year.	<input type="checkbox"/> N/A
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : <u>077C7042401</u>		DATE TESTED : <u>July 11, 2022</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00544
	Ni 231.604 nm	≤ 0.008	0.00709
	Ni 341.476 nm	≤ 0.012	0.00757
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01638
	Ba 455.403 nm	≤ 0.025	0.02391
Precision	As 193.656 nm	% RSD < 1.0	0.91 %
	Zn 213.856 nm	% RSD < 1.0	0.87 %
	Mn 257.610 nm	% RSD < 1.0	0.76 %
	La 379.478 nm	% RSD < 1.0	0.59 %
	Ba 455.403 nm	% RSD < 1.0	0.53 %
	Ba 493.408 nm	% RSD < 1.0	0.55 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	5.51 ppb
	As 193.696 nm	3(sd)	8.59 ppb
	Pb 220.353 nm	3(sd)	0.50 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	2.17 ppb
	Zn 213.856 nm	3(sd)	0.03 ppb
	Mn 257.610 nm	3(sd)	0.01 ppb
	La 379.478 nm	3(sd)	0.04 ppb
	Ba 455.403 nm	3(sd)	0.01 ppb
	Ba 493.408 nm	3(sd)	0.00 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	12.46
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	30.82



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED July 11, 2022

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative: _____

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WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

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

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

Page 1 of 4



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>January 11, 2023</u>
1. MECHANICAL CHECKS	
A. Inspect and clean all fans and filters.	<input type="checkbox"/>
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/>
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/>
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/>
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/>
F. Clean the exterior of the instrument.	<input type="checkbox"/>
2. OPTICAL CHECKS	
A. Inspect and clean all optical components.	<input type="checkbox"/>
B. As required, check and replace all purgefilters.	<input type="checkbox"/>
C. Recheck optical alignment.	<input type="checkbox"/>
3. COOLING SYSTEM CHECKS	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/>
B. Flush out the chiller every year.	<input type="checkbox"/>
4. PERFORMANCE CHECKS	
A. Torch View Alignment.	<input type="checkbox"/>
B. Wavelength Calibration.	<input type="checkbox"/>

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : <u>077C7042401</u>		DATE TESTED : <u>January 11, 2023</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00504
	Ni 231.604 nm	≤ 0.008	0.00646
	Ni 341.476 nm	≤ 0.012	0.00768
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01597
	Ba 455.403 nm	≤ 0.025	0.02185
Precision	As 193.656 nm	% RSD < 1.0	0.89 %
	Zn 213.856 nm	% RSD < 1.0	0.77 %
	Mn 257.610 nm	% RSD < 1.0	0.51 %
	La 379.478 nm	% RSD < 1.0	0.44 %
	Ba 455.403 nm	% RSD < 1.0	0.44 %
	Ba 493.408 nm	% RSD < 1.0	0.46 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	4.04 ppb
	As 193.696 nm	3(sd)	3.58 ppb
	Pb 220.353 nm	3(sd)	1.90 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	47.72 ppb
	Zn 213.856 nm	3(sd)	1.02 ppb
	Mn 257.610 nm	3(sd)	0.68 ppb
	La 379.478 nm	3(sd)	1.43 ppb
	Ba 455.403 nm	3(sd)	0.10 ppb
	Ba 493.408 nm	3(sd)	0.36 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	58.36
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	104142.80



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 11, 2023

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:

Service Engineer



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 6, 2023</u>
Address : <u>7 Soi Phaholyothin 24</u>	Recommendation Recertification
<u>Paholyothin Road</u>	Period <u>6</u> Months
Jompoi Chatuchak, Bangkok 1090	Recertification Due: <u>January 6, 2024</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>January 11, 2023</u>
Phone: <u>083-9269252</u>	Visit Number: <u>1 of 2</u>
Fax: <u>02-513-4221</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
	PerkinElmer Fax: <u>02-318-5597</u>

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

Page 1 of 4



WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>July 6, 2023</u>
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- MECHANICAL CHECKS**
 - A. Inspect and clean all fans and filters. ☐
 - B. Inspect and replace as necessary, all torch components including the RF coil. ☐
 - C. Inspect all tubing for sign of clacking or leaking. ☐
 - D. Adjust water and gas pressure regulator settings. ☐
 - E. Inspect and leak check pneumatics drawers. ☐
 - F. Clean the exterior of the instrument. ☐
- OPTICAL CHECKS**
 - A. Inspect and clean all optical components. ☐
 - B. As required, check and replace all purgefilters. ☐
 - C. Recheck optical alignment. ☐
- COOLING SYSTEM CHECKS**
 - A. Perform preventive maintenance on chiller. ☐
 - B. Flush out the chiller every year. ☐
- PERFORMANCE CHECKS**
 - A. Torch View Alignment. ☐
 - B. Wavelength Calibration. ☐

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : <u>077C7042401</u>		DATE TESTED : <u>July 6, 2023</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00534
	Ni 231.604 nm	≤ 0.008	0.00682
	Ni 341.476 nm	≤ 0.012	0.00794
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01613
	Ba 455.403 nm	≤ 0.025	0.02282
Precision	As 193.656 nm	% RSD < 1.0	0.23 %
	Zn 213.856 nm	% RSD < 1.0	0.09 %
	Mn 257.610 nm	% RSD < 1.0	0.58 %
	La 379.478 nm	% RSD < 1.0	0.38 %
	Ba 455.403 nm	% RSD < 1.0	0.42 %
	Ba 493.408 nm	% RSD < 1.0	0.41 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	2.37 ppb
	As 193.696 nm	3(sd)	6.78 ppb
	Pb 220.353 nm	3(sd)	0.82 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	23.56 ppb
	Zn 213.856 nm	3(sd)	2.85 ppb
	Mn 257.610 nm	3(sd)	3.66 ppb
	La 379.478 nm	3(sd)	5.10 ppb
	Ba 455.403 nm	3(sd)	0.12 ppb
	Ba 493.408 nm	3(sd)	1.17 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	117.07
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	22.09



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER	<u>077C7042401</u>	DATE TESTED	<u>July 6, 2023</u>
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Remarks :

Commissioning follow as commissioning performance sheets.

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

☒ meets
☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative: _____

(_____)

Service Engineer



PinAAcle 900T Preventive Maintenance Report

Company Name: SPS Consulting Service Co., Ltd.
Instrument Location: 7 Soi Phaholyothin 24, Phaholyothin Rd.
Jompol, Chatuchak, Bangkok, 10900
Instrument Serial No.: PTCS14111103
Date: 29-Jun-2023

PinAAcle 900T Preventive Maintenance (PM)

Company Name:	SPS Consulting Service Co., Ltd.		
Address (Instrument Location):	7 Soi Phaholyothin 24, Phaholyothin Rd. Jompol, Bangkok, 10900		
Serial Number:	PTCS14111103	PM Number:	2/2
Customer Name (if applicable):	K. Phenpha	Telephone Number:	083-926-9252
Customer Support Engineer Name:	K. Duang	Service Order Number:	WO-02419478
Date PM Performed: (DD-MMM-YYYY)	29-Jun-2023	Next PM Due Date: (DD-MMM-YYYY)	29-Dec-2023
Standard Labor Hours to Complete PM :		5 hours	

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Configuration Notes
A5900	A591S14B1002	Winlab32

Parts Lists

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

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	26-87CUY1	30-Jan-2024
N9300244	GFAAS Mixed Standard	AR	56-21CRY1	30-Jun-2023

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

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

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

3.1 Flame Technique

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

3.2 THGA Technique

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

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

7. Flame Interlock Check:

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

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

8. After PM Performance tests [Flame]:

8.1 Detector Linearity with Barium

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

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9798	0.9877	Passed
0.2 A ND Filter	± 5% from Cert.	0.2042	0.1985	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0016	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

8.4 D₂ Background Compensation with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0044	Passed

8.5 AA-BG Baseline Noise with Copper

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0001	Passed

8.6 AA-BG Baseline Noise with Arsenic

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

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0013	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	NA	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.3421	Passed

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

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

9.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	≤ 0.005 Abs.	0.0005	Passed
Standard Deviation	≤ 0.005	0.0004	Passed

9.3 Chromium Characteristic Mass and Precision

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

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	≤ 7.0 pg/0.0044 A-s	5.8	Passed
Precision	≤ 2.0 %	1.18	Passed

9.4 Copper Characteristic Mass and Zeeman Ratio

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

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	13.6	Passed
Zeeman Ratio	0.52 ± 0.04	0.52	Passed

10. Review:

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

Additional Comments

Additional Comments Regarding the PM	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1614}{0.1614 + 0.1448}$ $= 0.52$

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.</i>	
<i>This PinAAcle 900T Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative:	<div>Date: 06-Jun-2023 (DD-MMM-YYYY)</div>
Authorized Customer Representative:	<div>Date: 06-Jun-2023 (DD-MMM-YYYY)</div>

เอกสารแนบ 4-4

เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

CALIBRATION CERTIFICATE

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

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

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

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.

Ambient Environment

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

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

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

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 : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

1/2

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

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

FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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

Nominal Output of Unit Under Test = 94 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.94	-0.06	± 0.10	$\pm 0.40 \text{ dB}$

2. Frequency

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

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Kludya)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Ref : 2011266032701228001

End of Certificate

2 / 2

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

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

FM.BLMTC.002 Rev.4

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Noise B_295/23

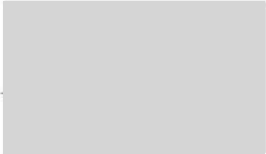
Sound Level Meter Calibration Report

Acoustic Calibrator Data						
Brand	ACO		Number	AC 03/56		
Model	2127		Serial No.	130006		
Calibration Range	94 dB, 1000 Hz		Last Calibration	29 March 2023		
			Due Date	29 March 2024		

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B22	ACO	6236	00172060	20 July 2023	94.0	94.0
ACO-B27	ACO	6236	00182008	20 July 2023	94.0	94.0
ACO-B37	ACO	6236	00192028	20 July 2023	93.9	94.0
ACO-B40	ACO	6236	00192031	20 July 2023	94.0	94.0

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)	93.94 ± 0.10 dB
--	-----------------

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 

Noise B_322/23

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	29 March 2023		
			Due Date	29 March 2024		

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B04	ACO	6236	00222298	15 August 2023	94.0	94.0
ACO-B13	ACO	6236	00152084	15 August 2023	94.0	94.0
ACO-B15	ACO	6236	00222300	15 August 2023	94.0	94.0
ACO-B26	ACO	6236	00182007	15 August 2023	93.9	94.0
ACO-B27	ACO	6236	00182008	15 August 2023	93.9	94.0
ACO-B39	ACO	6236	00222301	15 August 2023	94.1	94.0
ACO-B44	ACO	6236	00222302	15 August 2023	94.1	94.0
ACO-B46	ACO	6236	00222305	15 August 2023	94.0	94.0

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)	93.94 ± 0.10 dB
--	-----------------

Calibrated by : 
(Mr. Adul Dangklom)

Approved by : 

Noise B_366/23

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	29 March 2023		
			Due Date	29 March 2024		

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B13	ACO	6236	00152084	11 September 2023	94.0	94.0
ACO-B22	ACO	6236	00172060	11 September 2023	94.1	94.0
ACO-B26	ACO	6236	00182007	11 September 2023	94.0	94.0
ACO-B33	ACO	6236	00182015	11 September 2023	94.1	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr. Anon Dangsom)

Approved by :

Noise B_395/23

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	29 March 2023		
			Due Date	29 March 2024		

Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B29	ACO	6236	00182011	17 October 2023	94.0	94.0
ACO-B37	ACO	6236	00192028	17 October 2023	94.0	94.0
ACO-B40	ACO	6236	00192031	17 October 2023	93.9	94.0
ACO-B41	ACO	6236	00192032	17 October 2023	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr. Anon Dangsom)

Approved by :

Noise B_419/23

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	29 March 2023
		Due Date	29 March 2024

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B12	ACO	6236	00152081	02 November 2023	94.0	94.0
ACO-B19	ACO	6236	00172057	02 November 2023	94.0	94.0
ACO-B22	ACO	6236	00172060	02 November 2023	93.9	94.0
ACO-B40	ACO	6236	00192031	02 November 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

Noise B_459/23

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	29 March 2023
		Due Date	29 March 2024

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B17	ACO	6236	00172042	4 December 2023	94.1	94.0
ACO-B21	ACO	6236	00172059	4 December 2023	94.1	94.0
ACO-B28	ACO	6236	00182009	4 December 2023	94.0	94.0
ACO-B30	ACO	6236	00182012	4 December 2023	93.9	94.0
ACO-B31	ACO	6236	00182013	4 December 2023	94.0	94.0
ACO-B37	ACO	6236	00192028	4 December 2023	93.9	94.0
ACO-B38	ACO	6236	00192029	4 December 2023	94.0	94.0
ACO-B39	ACO	6236	00222301	4 December 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

เอกสารแนบ 4-5

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในสถานประกอบการ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
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 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)					
					1	2	3	1	2	3	y	R ²	
B01	SKC	224-PCXR4	262101	04/04/2023	1,000	1,500	2,000	994	1,498	2,003	1.006x - 7.897	1.000	
B02	SKC	224-PCXR4	626166	04/04/2023	1,000	1,500	2,000	1,004	1,503	2,003	1.010x - 19.866	0.999	
B03	SKC	224-PCXR4	612968	07/04/2023	1,000	1,500	2,000	995	1,496	2,001	1.007x - 13.684	1.000	
B04	SKC	224-PCXR4	602804	05/04/2023	1,000	1,500	2,000	998	1,499	1,994	0.999x - 1.611	1.000	
B05	SKC	224-PCXR4	612693	07/04/2023	1,000	1,500	2,000	1,002	1,501	2,004	1.014x - 24.856	0.999	
B06	SKC	224-PCXR4	262188	07/04/2023	1,000	1,500	2,000	994	1,509	2,006	1.012x - 21.589	0.999	
B07	SKC	224-PCXR4	626262	04/04/2023	1,000	1,500	2,000	997	1,490	1,996	0.994x + 3.494	1.000	
B08	SKC	224-PCXR4	626100	04/04/2023	1,000	1,500	2,000	1,001	1,499	2,005	1.015x - 27.137	0.999	
B09	SKC	224-PCXR4	620479	05/04/2023	1,000	1,500	2,000	997	1,492	1,994	0.994x + 2.386	1.000	
B10	SKC	224-PCXR4	091960	03/04/2023	1,000	1,500	2,000	993	1,504	2,005	1.013x - 23.779	1.000	
B11	SKC	224-PCXR8	564315	10/04/2023	1,000	1,500	2,000	995	1,492	1,998	1.002x - 7.259	1.000	
B12	SKC	224-PCXR4	634656	04/04/2023	1,000	1,500	2,000	1,002	1,504	2,001	1.009x - 17.609	0.999	
B13	SKC	224-PCXR4	602073	04/04/2023	1,000	1,500	2,000	997	1,501	2,000	1.004x - 7.022	1.000	
B14	SKC	224-PCXR4	626313	03/04/2023	1,000	1,500	2,000	997	1,492	1,991	0.996x + 1.699	1.000	
B15	SKC	224-PCXR4	626474	07/04/2023	1,000	1,500	2,000	1,003	1,503	2,006	1.013x - 33.245	0.999	
B16	SKC	224-PCXR4	626477	03/04/2023	1,000	1,500	2,000	995	1,506	2,003	1.011x - 22.132	0.999	
B17	SKC	224-PCXR4	626560	04/04/2023	1,000	1,500	2,000	996	1,493	1,993	1.000x - 4.627	1.000	
B18	SKC	224-PCXR4	691484	04/04/2023	1,000	1,500	2,000	1,001	1,496	2,002	1.010x - 21.179	0.999	
B19	SKC	224-PCXR4	691599	04/04/2023	1,000	1,500	2,000	994	1,504	2,000	1.006x - 10.498	1.000	
B20	SKC	224-PCXR4	691587	03/04/2023	1,000	1,500	2,000	991	1,502	2,000	1.016x - 35.102	0.999	
B21	SKC	224-PCXR4	691531	04/04/2023	1,000	1,500	2,000	994	1,501	1,995	1.001x - 5.153	1.000	
B22	SKC	224-PCXR4	691654	07/04/2023	1,000	1,500	2,000	1,000	1,502	2,004	1.014x - 25.574	0.999	
B23	SKC	224-PCXR4	798393	05/04/2023	1,000	1,500	2,000	990	1,508	2,004	1.013x - 23.994	1.000	
B24	SKC	224-PCXR4	626363	03/04/2023	1,000	1,500	2,000	1,002	1,503	1,999	1.009x - 18.837	0.999	
B25	SKC	224-PCXR4	798489	07/04/2023	1,000	1,500	2,000	1,002	1,494	2,000	0.997x + 3.494	1.000	
B26	SKC	224-PCXR4	798479	07/04/2023	1,000	1,500	2,000	1,001	1,501	1,994	0.995x + 5.564	1.000	
B27	SKC	224-PCXR4	691673	04/04/2023	1,000	1,500	2,000	995	1,505	2,004	1.013x - 25.091	0.999	
B28	SKC	224-PCXR4	691570	04/04/2023	1,000	1,500	2,000	1,003	1,501	2,001	1.010x - 19.922	0.999	
B29	SKC	224-PCXR4	626472	05/04/2023	1,000	1,500	2,000	1,001	1,498	2,000	0.999x - 1.891	1.000	
B30	SKC	224-PCXR4	691489	04/04/2023	1,000	1,500	2,000	1,002	1,507	2,003	1.009x - 13.936	0.999	
B31	SKC	224-PCXR4	691509	07/04/2023	1,000	1,500	2,000	994	1,496	1,997	1.004x - 9.680	1.000	
B32	SKC	224-PCXR4	691567	10/04/2023	1,000	1,500	2,000	992	1,506	2,001	1.013x - 25.542	0.999	
B33	SKC	224-PCXR4	091756	05/04/2023	1,000	1,500	2,000	993	1,498	1,992	0.998x - 1.121	1.000	
B34	SKC	224-PCXR4	612962	07/04/2023	1,000	1,500	2,000	1,002	1,503	2,003	1.008x - 14.753	0.999	
B35	SKC	224-PCXR4	602682	05/04/2023	1,000	1,500	2,000	991	1,497	1,996	1.003x - 11.598	1.000	
B36	SKC	224-PCXR4	626164	05/04/2023	1,000	1,500	2,000	997	1,495	1,998	1.002x - 8.097	1.000	
B37	SKC	224-PCXR4	626256	07/04/2023	1,000	1,500	2,000	993	1,505	1,996	1.012x - 27.161	0.999	
B38	SKC	224-PCXR4	626167	07/04/2023	1,000	1,500	2,000	998	1,493	1,997	1.003x - 8.613	1.000	
B39	SKC	224-PCXR4	034637	10/04/2023	1,000	1,500	2,000	1,003	1,500	2,003	1.013x - 23.125	0.999	
B40	SKC	224-PCXR4	798349	07/04/2023	1,000	1,500	2,000	993	1,507	1,998	1.015x - 30.204	0.999	

Calibrated by :

(Mr. Anut Dangsom)

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	07/04/2023	1,000	1,500	2,000	997	1,496	1,991	0.998x - 1.396	1.000
B42	SKC	224-PCXR4	626041	10/04/2023	1,000	1,500	2,000	1,006	1,496	1,992	0.988x + 14.223	1.000
B43	SKC	224-PCXR4	034636	07/04/2023	1,000	1,500	2,000	1,001	1,503	1,993	0.992x + 8.810	1.000
B44	SKC	224-PCXR8	529341	10/04/2023	1,000	1,500	2,000	1,000	1,499	2,005	1.008x - 14.358	1.000
B45	SKC	224-PCXR8	529594	10/04/2023	1,000	1,500	2,000	998	1,506	1,987	0.990x + 12.580	1.000
B46	SKC	224-PCXR8	566743	05/04/2023	1,000	1,500	2,000	996	1,502	2,000	1.012x - 26.902	0.999
B47	SKC	224-PCXR8	566747	07/04/2023	1,000	1,500	2,000	998	1,501	2,002	1.014x - 27.552	0.999
B48	SKC	224-PCXR8	566753	10/04/2023	1,000	1,500	2,000	998	1,493	1,996	0.997x - 0.359	1.000
B49	SKC	224-PCXR8	566780	05/04/2023	1,000	1,500	2,000	1,007	1,501	2,007	1.011x - 19.156	0.999
B50	SKC	224-PCXR8	500400	07/04/2023	1,000	1,500	2,000	1,004	1,495	2,004	1.000x - 1.663	1.000
B51	SKC	224-PCXR8	500363	04/04/2023	1,000	1,500	2,000	997	1,502	1,998	1.008x - 21.322	0.999
B52	SKC	224-PCXR8	093186	05/04/2023	1,000	1,500	2,000	993	1,493	1,995	1.000x - 6.106	1.000
B53	SKC	224-PCXR8	707670	05/04/2023	1,000	1,500	2,000	1,000	1,498	2,002	1.009x - 18.883	0.999
B54	SKC	224-PCXR3	509821	05/04/2023	1,000	1,500	2,000	995	1,500	2,001	1.016x - 32.482	0.999
B55	SKC	224-PCXR3	510710	10/04/2023	1,000	1,500	2,000	998	1,497	1,992	0.996x - 0.191	1.000
B56	SKC	224-PCXR3	511450	05/04/2023	1,000	1,500	2,000	1,003	1,501	2,003	1.005x - 8.081	1.000
B57	SKC	224-PCXR3	510798	05/04/2023	1,000	1,500	2,000	999	1,490	2,000	1.001x - 2.920	1.000
B58	SKC	224-PCXR3	509852	10/04/2023	1,000	1,500	2,000	1,002	1,496	1,998	1.004x - 15.922	0.999
B59	SKC	224-PCXR3	509862	10/04/2023	1,000	1,500	2,000	998	1,501	1,996	0.996x + 4.471	1.000
B60	SKC	224-PCXR3	512655	07/04/2023	1,000	1,500	2,000	1,003	1,499	2,004	1.005x - 9.971	1.000
B61	SKC	224-PCXR3	503915	10/04/2023	1,000	1,500	2,000	993	1,488	1,999	1.007x - 15.934	1.000
B62	SKC	224-PCXR3	505975	10/04/2023	1,000	1,500	2,000	1,001	1,495	1,997	1.000x - 4.802	1.000
B63	SKC	224-PCXR3	511432	07/04/2023	1,000	1,500	2,000	993	1,500	2,000	1.015x - 32.709	0.999
B64	SKC	224-PCXR3	508302	05/04/2023	1,000	1,500	2,000	998	1,491	1,987	0.989x + 9.855	1.000
B65	SKC	224-PCXR3	508310	10/04/2023	1,000	1,500	2,000	998	1,502	2,005	1.012x - 20.596	1.000
B66	SKC	224-PCXR3	509861	10/04/2023	1,000	1,500	2,000	1,000	1,492	1,992	0.990x + 10.912	1.000
B67	SKC	224-PCXR3	506295	07/04/2023	1,000	1,500	2,000	993	1,506	2,002	1.007x - 13.999	1.000
B68	SKC	224-PCXR3	505872	05/04/2023	1,000	1,500	2,000	998	1,488	1,997	0.996x - 1.743	1.000
B69	SKC	224-PCXR3	508375	04/04/2023	1,000	1,500	2,000	1,004	1,502	2,002	1.009x - 18.897	0.999
B70	SKC	224-PCXR3	510623	05/04/2023	1,000	1,500	2,000	994	1,505	1,998	1.004x - 8.846	1.000
B71	SKC	224-PCXR3	505307	10/04/2023	1,000	1,500	2,000	994	1,503	2,003	1.011x - 23.444	0.999
B72	SKC	224-PCXR3	505977	10/04/2023	1,000	1,500	2,000	1,005	1,493	1,992	0.988x + 12.309	1.000
B73	SKC	224-PCXR3	512606	05/04/2023	1,000	1,500	2,000	1,000	1,504	2,004	1.008x - 14.506	1.000
B74	SKC	224-PCXR3	505993	05/04/2023	1,000	1,500	2,000	997	1,497	1,996	1.001x - 7.514	1.000
B75	SKC	224-PCXR3	509820	07/04/2023	1,000	1,500	2,000	997	1,496	1,995	0.997x + 0.195	1.000
B76	SKC	224-PCXR3	509811	05/04/2023	1,000	1,500	2,000	995	1,498	1,999	1.004x - 11.212	1.000
B77	SKC	224-PCXR3	508301	10/04/2023	1,000	1,500	2,000	1,002	1,502	2,004	1.013x - 23.811	0.999
B78	SKC	224-PCXR3	510677	04/04/2023	1,000	1,500	2,000	997	1,505	2,000	1.007x - 16.113	0.999
B79	SKC	224-PCXR3	510920	10/04/2023	1,000	1,500	2,000	996	1,495	1,993	0.998x - 1.232	1.000



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-II

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 ²
B80	SKC	224-PCXR3	504669	05/04/2023	1,000	1,500	2,000	1,003	1,498	2,003	1.011x - 22.431	0.999
B81	SKC	224-PCXR3	503480	05/04/2023	1,000	1,500	2,000	995	1,500	2,001	1.016x - 32.797	0.999
B82	SKC	224-PCXR3	505673	05/04/2023	1,000	1,500	2,000	995	1,496	1,997	1.003x - 7.259	1.000
B83	SKC	224-PCXR3	510785	05/04/2023	1,000	1,500	2,000	1,007	1,498	2,001	1.006x - 13.816	0.999
B84	SKC	224-PCXR3	508333	10/04/2023	1,000	1,500	2,000	995	1,498	1,993	0.998x - 1.970	1.000
B85	SKC	224-PCXR3	505757	10/04/2023	1,000	1,500	2,000	996	1,500	2,000	1.004x - 12.009	1.000
B86	SKC	224-PCXR3	512525	05/04/2023	1,000	1,500	2,000	1,011	1,501	2,006	1.002x - 3.877	0.999
B87	SKC	224-PCXR3	504324	05/04/2023	1,000	1,500	2,000	999	1,495	1,998	0.999x + 0.606	1.000
B88	SKC	224-PCXR3	508307	05/04/2023	1,000	1,500	2,000	997	1,497	1,992	0.994x + 4.682	1.000
B89	SKC	224-PCXR3	509860	05/04/2023	1,000	1,500	2,000	1,001	1,498	2,002	1.007x - 13.392	1.000
B90	SKC	224-PCXR3	508366	05/04/2023	1,000	1,500	2,000	995	1,507	1,998	1.004x - 9.640	1.000
B91	SKC	224-PCXR3	510919	04/04/2023	1,000	1,500	2,000	1,003	1,500	1,995	0.988x + 13.505	1.000
B92	SKC	224-PCXR3	510967	05/04/2023	1,000	1,500	2,000	1,003	1,503	1,998	0.997x + 5.125	1.000
B93	SKC	224-PCXR3	509845	10/04/2023	1,000	1,500	2,000	996	1,498	2,003	1.007x - 13.628	1.000
B94	SKC	224-PCXR8	A127871	04/04/2023	1,000	1,500	2,000	1,001	1,495	2,003	1.006x - 18.746	0.999
B95	SKC	224-PCXR8	A127921	03/04/2023	1,000	1,500	2,000	995	1,504	2,001	1.013x - 26.112	0.999
B96	SKC	224-PCXR8	A127942	07/04/2023	1,000	1,500	2,000	999	1,499	1,997	1.000x - 2.010	1.000
B97	SKC	224-PCXR8	A127955	07/04/2023	1,000	1,500	2,000	1,006	1,503	2,005	1.011x - 18.638	0.999
B98	SKC	224-PCXR8	A127956	07/04/2023	1,000	1,500	2,000	994	1,497	1,998	1.005x - 11.436	1.000

Calibrated by :

(Mr. Adul Dungkum)

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)								
					Setting			Actual (Q std.)			Value From Calibration Curve		
					1	2	3	1	2	3	y	R ²	
B01	SKC	224-PCXR4	262101	03/07/2023	1,000	1,500	2,000	992	1,495	1,996	1.001x - 4.542	1.000	
B02	SKC	224-PCXR4	626166	03/07/2023	1,000	1,500	2,000	1,002	1,504	1,999	1.009x - 20.101	0.999	
B03	SKC	224-PCXR4	612968	10/07/2023	1,000	1,500	2,000	995	1,493	1,999	1.005x - 12.388	1.000	
B04	SKC	224-PCXR4	602804	05/07/2023	1,000	1,500	2,000	999	1,501	1,992	0.998x - 0.040	1.000	
B05	SKC	224-PCXR4	612693	03/07/2023	1,000	1,500	2,000	1,002	1,498	2,000	1.010x - 21.803	0.999	
B06	SKC	224-PCXR4	262188	05/07/2023	1,000	1,500	2,000	994	1,506	2,004	1.011x - 20.811	1.000	
B07	SKC	224-PCXR4	626262	10/07/2023	1,000	1,500	2,000	997	1,490	1,993	0.992x + 6.399	1.000	
B08	SKC	224-PCXR4	626100	07/07/2023	1,000	1,500	2,000	1,002	1,498	2,005	1.013x - 26.473	0.999	
B09	SKC	224-PCXR4	626479	05/07/2023	1,000	1,500	2,000	996	1,489	1,991	0.993x + 1.797	1.000	
B10	SKC	224-PCXR4	091950	06/07/2023	1,000	1,500	2,000	991	1,501	1,999	1.017x - 36.784	0.999	
B11	SKC	224-PCXR8	564315	10/07/2023	1,000	1,500	2,000	995	1,489	1,997	1.003x - 8.260	1.000	
B12	SKC	224-PCXR4	034656	07/07/2023	1,000	1,500	2,000	1,002	1,501	2,003	1.004x - 7.152	1.000	
B13	SKC	224-PCXR4	602073	05/07/2023	1,000	1,500	2,000	994	1,499	1,996	1.000x - 3.092	1.000	
B14	SKC	224-PCXR4	626313	07/07/2023	1,000	1,500	2,000	998	1,491	1,987	0.991x + 8.312	1.000	
B15	SKC	224-PCXR4	626474	07/07/2023	1,000	1,500	2,000	1,000	1,500	2,003	1.009x - 17.930	0.999	
B16	SKC	224-PCXR4	626477	04/07/2023	1,000	1,500	2,000	993	1,502	1,999	1.014x - 31.373	0.999	
B17	SKC	224-PCXR4	626860	04/07/2023	1,000	1,500	2,000	996	1,493	1,989	0.996x - 0.944	1.000	
B18	SKC	224-PCXR4	691484	04/07/2023	1,000	1,500	2,000	1,002	1,499	1,999	1.008x - 17.894	0.999	
B19	SKC	224-PCXR4	691599	06/07/2023	1,000	1,500	2,000	992	1,501	1,997	1.005x - 10.491	1.000	
B20	SKC	224-PCXR4	691587	03/07/2023	1,000	1,500	2,000	990	1,502	1,998	1.009x - 21.896	1.000	
B21	SKC	224-PCXR4	691531	10/07/2023	1,000	1,500	2,000	992	1,476	1,993	1.000x - 11.272	1.000	
B22	SKC	224-PCXR4	691654	05/07/2023	1,000	1,500	2,000	1,002	1,500	2,002	1.011x - 21.141	0.999	
B23	SKC	224-PCXR4	798393	10/07/2023	1,000	1,500	2,000	992	1,505	2,000	1.017x - 53.720	0.999	
B24	SKC	224-PCXR4	626363	05/07/2023	1,000	1,500	2,000	999	1,501	1,997	1.003x - 8.933	1.000	
B25	SKC	224-PCXR4	798489	10/07/2023	1,000	1,500	2,000	1,000	1,491	1,998	0.996x + 1.689	1.000	
B26	SKC	224-PCXR4	798479	04/07/2023	1,000	1,500	2,000	999	1,498	1,991	0.993x + 6.351	1.000	
B27	SKC	224-PCXR4	691673	10/07/2023	1,000	1,500	2,000	993	1,502	2,000	1.015x - 32.306	0.999	
B28	SKC	224-PCXR4	691570	04/07/2023	1,000	1,500	2,000	1,002	1,498	1,999	1.005x - 12.188	1.000	
B29	SKC	224-PCXR4	626472	04/07/2023	1,000	1,500	2,000	999	1,496	1,998	1.002x - 6.471	1.000	
B30	SKC	224-PCXR4	691489	06/07/2023	1,000	1,500	2,000	1,002	1,508	2,004	1.002x - 7.722	0.999	
B31	SKC	224-PCXR4	691509	10/07/2023	1,000	1,500	2,000	991	1,475	1,995	0.999x - 10.348	1.000	
B32	SKC	224-PCXR4	091567	05/07/2023	1,000	1,500	2,000	990	1,501	1,998	1.011x - 24.321	1.000	
B33	SKC	224-PCXR4	091756	05/07/2023	1,000	1,500	2,000	992	1,496	1,990	0.991x + 4.498	1.000	
B34	SKC	224-PCXR4	612962	10/07/2023	1,000	1,500	2,000	1,001	1,499	2,000	1.006x - 14.460	0.999	
B35	SKC	224-PCXR4	602682	05/07/2023	1,000	1,500	2,000	992	1,497	1,994	1.002x - 9.742	1.000	
B36	SKC	224-PCXR4	626164	05/07/2023	1,000	1,500	2,000	998	1,496	1,999	1.000x - 6.056	1.000	
B37	SKC	224-PCXR4	626256	03/07/2023	1,000	1,500	2,000	993	1,505	1,997	1.005x - 13.443	1.000	
B38	SKC	224-PCXR4	626167	03/07/2023	1,000	1,500	2,000	996	1,496	1,996	1.001x - 3.347	1.000	
B39	SKC	224-PCXR4	034637	10/07/2023	1,000	1,500	2,000	1,004	1,499	1,999	1.009x - 18.599	0.999	
B40	SKC	224-PCXR4	798349	06/07/2023	1,000	1,500	2,000	993	1,504	1,997	1.013x - 26.094	0.999	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	10/07/2023	1,000	1,500	2,000	998	1,495	1,989	0.995x + 1.833	1.000
B42	SKC	224-PCXR4	626041	10/07/2023	1,000	1,500	2,000	1,003	1,496	1,989	0.985x + 18.950	1.000
B43	SKC	224-PCXR4	034636	05/07/2023	1,000	1,500	2,000	999	1,500	1,990	0.990x + 11.352	1.000
B44	SKC	224-PCXR8	529341	10/07/2023	1,000	1,500	2,000	1,001	1,500	2,000	1.003x - 8.128	1.000
B45	SKC	224-PCXR8	529594	06/07/2023	1,000	1,500	2,000	998	1,500	1,985	0.988x + 13.443	1.000
B46	SKC	224-PCXR8	566743	04/07/2023	1,000	1,500	2,000	994	1,504	2,000	1.006x - 14.882	1.000
B47	SKC	224-PCXR8	566747	04/07/2023	1,000	1,500	2,000	1,001	1,500	2,002	1.012x - 24.217	0.999
B48	SKC	224-PCXR8	566753	10/07/2023	1,000	1,500	2,000	999	1,491	1,996	1.002x - 11.236	1.000
B49	SKC	224-PCXR8	566780	04/07/2023	1,000	1,500	2,000	1,002	1,501	2,004	1.012x - 23.640	0.999
B50	SKC	224-PCXR8	900400	10/07/2023	1,000	1,500	2,000	1,000	1,506	2,000	0.997x + 1.566	1.000
B51	SKC	224-PCXR8	500363	04/07/2023	1,000	1,500	2,000	995	1,502	1,998	1.010x - 25.405	0.999
B52	SKC	224-PCXR8	093186	10/07/2023	1,000	1,500	2,000	993	1,494	1,990	0.995x + 0.992	1.000
B53	SKC	224-PCXR8	707670	05/07/2023	1,000	1,500	2,000	1,001	1,499	2,000	1.007x - 16.304	0.999
B54	SKC	224-PCXR3	509821	03/07/2023	1,000	1,500	2,000	992	1,500	2,000	1.017x - 35.039	0.999
B55	SKC	224-PCXR3	510710	10/07/2023	1,000	1,500	2,000	999	1,493	1,990	0.993x + 2.638	1.000
B56	SKC	224-PCXR3	511450	04/07/2023	1,000	1,500	2,000	1,001	1,498	1,999	1.004x - 9.108	1.000
B57	SKC	224-PCXR3	510798	10/07/2023	1,000	1,500	2,000	996	1,490	1,997	1.005x - 13.675	1.000
B58	SKC	224-PCXR3	509852	05/07/2023	1,000	1,500	2,000	999	1,497	1,997	1.006x - 19.133	0.999
B59	SKC	224-PCXR3	509862	06/07/2023	1,000	1,500	2,000	995	1,501	1,995	1.001x - 5.136	1.000
B60	SKC	224-PCXR3	512655	06/07/2023	1,000	1,500	2,000	1,001	1,498	2,015	1.017x - 25.660	1.000
B61	SKC	224-PCXR3	503915	05/07/2023	1,000	1,500	2,000	992	1,488	1,997	1.004x - 13.766	1.000
B62	SKC	224-PCXR3	505975	06/07/2023	1,000	1,500	2,000	998	1,493	1,994	0.996x + 0.183	1.000
B63	SKC	224-PCXR3	511432	04/07/2023	1,000	1,500	2,000	989	1,499	1,998	1.010x - 24.150	1.000
B64	SKC	224-PCXR3	508302	03/07/2023	1,000	1,500	2,000	997	1,491	1,987	0.990x + 8.411	1.000
B65	SKC	224-PCXR3	508310	10/07/2023	1,000	1,500	2,000	1,011	1,499	2,000	0.998x + 0.263	0.999
B66	SKC	224-PCXR3	509861	10/07/2023	1,000	1,500	2,000	1,001	1,489	1,990	0.987x + 13.691	1.000
B67	SKC	224-PCXR3	506295	04/07/2023	1,000	1,500	2,000	994	1,506	2,009	1.012x - 20.281	1.000
B68	SKC	224-PCXR3	505872	04/07/2023	1,000	1,500	2,000	1,001	1,489	1,996	0.994x + 3.757	1.000
B69	SKC	224-PCXR3	508375	04/07/2023	1,000	1,500	2,000	1,001	1,498	1,998	1.008x - 19.635	0.999
B70	SKC	224-PCXR3	510623	05/07/2023	1,000	1,500	2,000	991	1,502	1,994	1.001x - 5.451	1.000
B71	SKC	224-PCXR3	508367	10/07/2023	1,000	1,500	2,000	991	1,504	2,000	1.016x - 35.155	0.999
B72	SKC	224-PCXR3	505977	05/07/2023	1,000	1,500	2,000	1,000	1,498	1,992	0.992x + 7.080	1.000
B73	SKC	224-PCXR3	512606	05/07/2023	1,000	1,500	2,000	1,000	1,499	2,002	1.000x - 7.240	0.999
B74	SKC	224-PCXR3	505993	05/07/2023	1,000	1,500	2,000	995	1,495	1,992	0.996x - 2.446	1.000
B75	SKC	224-PCXR3	509820	05/07/2023	1,000	1,500	2,000	995	1,495	1,989	0.995x + 1.829	1.000
B76	SKC	224-PCXR3	509811	04/07/2023	1,000	1,500	2,000	992	1,497	1,997	1.005x - 14.428	1.000
B77	SKC	224-PCXR3	508301	04/07/2023	1,000	1,500	2,000	999	1,499	2,001	1.008x - 21.556	0.999
B78	SKC	224-PCXR3	510677	05/07/2023	1,000	1,500	2,000	994	1,502	1,997	1.012x - 28.449	0.999
B79	SKC	224-PCXR3	510920	03/07/2023	1,000	1,500	2,000	993	1,492	1,992	1.000x - 5.853	1.000



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B80	SKC	224-PCXR3	504569	03/07/2023	1,000	1,500	2,000	1,001	1,497	2,000	1.003x - 8.782	1.000
B81	SKC	224-PCXR3	503480	07/07/2023	1,000	1,500	2,000	995	1,498	1,998	1.013x - 30.294	0.999
B82	SKC	224-PCXR3	505673	05/07/2023	1,000	1,500	2,000	993	1,497	1,994	0.999x - 4.901	1.000
B83	SKC	224-PCXR3	510785	06/07/2023	1,000	1,500	2,000	1,009	1,498	1,999	1.001x - 4.996	0.999
B84	SKC	224-PCXR3	508333	06/07/2023	1,000	1,500	2,000	996	1,497	1,989	0.992x + 4.965	1.000
B85	SKC	224-PCXR3	505757	06/07/2023	1,000	1,500	2,000	993	1,500	2,000	1.008x - 18.691	1.000
B86	SKC	224-PCXR3	512625	03/07/2023	1,000	1,500	2,000	1,013	1,501	2,002	0.998x + 2.223	0.999
B87	SKC	224-PCXR3	504324	07/07/2023	1,000	1,500	2,000	997	1,494	1,998	0.992x + 6.303	1.000
B88	SKC	224-PCXR3	508307	07/07/2023	1,000	1,500	2,000	994	1,497	1,991	0.996x + 0.893	1.000
B89	SKC	224-PCXR3	509860	07/07/2023	1,000	1,500	2,000	999	1,498	2,000	0.999x - 6.614	0.999
B90	SKC	224-PCXR3	508366	04/07/2023	1,000	1,500	2,000	992	1,507	1,998	1.006x - 13.854	1.000
B91	SKC	224-PCXR3	510919	04/07/2023	1,000	1,500	2,000	999	1,497	1,995	0.991x + 7.076	1.000
B92	SKC	224-PCXR3	510987	04/07/2023	1,000	1,500	2,000	1,001	1,500	1,997	1.002x + 7.550	1.000
B93	SKC	224-PCXR3	509845	04/07/2023	1,000	1,500	2,000	995	1,495	2,002	1.000x - 7.598	0.999
B94	SKC	224-PCXR8	A127871	03/07/2023	1,000	1,500	2,000	999	1,518	2,005	1.004x - 7.809	0.999
B95	SKC	224-PCXR8	A127921	05/07/2023	1,000	1,500	2,000	992	1,501	2,000	1.015x - 32.023	0.999
B96	SKC	224-PCXR8	A127942	03/07/2023	1,000	1,500	2,000	997	1,497	1,994	0.999x - 3.203	1.000
B97	SKC	224-PCXR8	A127955	03/07/2023	1,000	1,500	2,000	1,002	1,500	2,001	1.010x - 20.261	0.999
B98	SKC	224-PCXR8	A127956	03/07/2023	1,000	1,500	2,000	995	1,495	1,996	1.002x - 6.403	1.000

Calibrated by :

Approved by :




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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter Model : Defender 510-H S/N : 136164

Environmental Conditions
Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data					Calibration Data							
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)			y	R ²
					1	2	3	1	2	3		
B01	SKC	224-PCXR4	262101	02/10/2023	1,000	1,500	2,000	997	1,494	1,995	0.998x - 5.198	1.000
B02	SKC	224-PCXR4	626166	02/10/2023	1,000	1,500	2,000	995	1,491	1,987	0.995x - 0.239	1.000
B03	SKC	224-PCXR4	612968	02/10/2023	1,000	1,500	2,000	994	1,498	1,996	1.004x - 17.211	0.999
B04	SKC	224-PCXR4	602804	03/10/2023	1,000	1,500	2,000	1,001	1,502	1,997	0.999x - 3.961	1.000
B05	SKC	224-PCXR4	612693	03/10/2023	1,000	1,500	2,000	1,000	1,500	1,998	1.008x - 19.564	0.999
B06	SKC	224-PCXR4	262188	04/10/2023	1,000	1,500	2,000	999	1,497	1,998	1.005x - 13.275	1.000
B07	SKC	224-PCXR4	626262	04/10/2023	1,000	1,500	2,000	997	1,491	1,992	0.995x + 0.103	1.000
B08	SKC	224-PCXR4	626100	03/10/2023	1,000	1,500	2,000	995	1,490	1,994	0.999x - 3.152	1.000
B09	SKC	224-PCXR4	626479	04/10/2023	1,000	1,500	2,000	1,012	1,500	2,001	0.998x + 1.604	0.999
B10	SKC	224-PCXR4	091590	05/10/2023	1,000	1,500	2,000	992	1,486	1,994	1.002x - 11.842	1.000
B11	SKC	224-PCXR8	564315	05/10/2023	1,000	1,500	2,000	993	1,501	1,996	1.010x - 26.335	0.999
B12	SKC	224-PCXR4	034656	05/10/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.007x - 17.721	0.999
B13	SKC	224-PCXR4	602073	04/10/2023	1,000	1,500	2,000	1,000	1,488	1,987	0.986x + 13.398	1.000
B14	SKC	224-PCXR4	626513	04/10/2023	1,000	1,500	2,000	996	1,493	1,996	0.999x - 2.380	1.000
B15	SKC	224-PCXR4	626474	06/10/2023	1,000	1,500	2,000	1,000	1,498	1,998	1.007x - 16.567	0.999
B16	SKC	224-PCXR4	626477	06/10/2023	1,000	1,500	2,000	1,001	1,498	1,999	1.010x - 21.673	0.999
B17	SKC	224-PCXR4	626860	06/10/2023	1,000	1,500	2,000	1,000	1,492	1,998	0.997x - 1.859	1.000
B18	SKC	224-PCXR4	691484	03/10/2023	1,000	1,500	2,000	995	1,494	1,992	1.000x - 5.493	1.000
B19	SKC	224-PCXR4	691599	02/10/2023	1,000	1,500	2,000	991	1,500	1,998	1.015x - 32.922	0.999
B20	SKC	224-PCXR4	691587	02/10/2023	1,000	1,500	2,000	1,001	1,496	1,999	1.010x - 23.222	0.999
B21	SKC	224-PCXR4	691531	03/10/2023	1,000	1,500	2,000	994	1,491	1,997	1.004x - 12.881	1.000
B22	SKC	224-PCXR4	691654	03/10/2023	1,000	1,500	2,000	991	1,492	1,994	1.002x - 9.860	1.000
B23	SKC	224-PCXR4	798393	02/10/2023	1,000	1,500	2,000	991	1,498	1,997	1.014x - 33.810	0.999
B24	SKC	224-PCXR4	626363	02/10/2023	1,000	1,500	2,000	1,001	1,499	2,001	1.011x - 23.676	0.999
B25	SKC	224-PCXR4	798489	04/10/2023	1,000	1,500	2,000	996	1,497	1,989	0.991x + 6.619	1.000
B26	SKC	224-PCXR4	798479	05/10/2023	1,000	1,500	2,000	996	1,492	1,990	0.996x - 1.146	1.000
B27	SKC	224-PCXR4	691673	09/10/2023	1,000	1,500	2,000	989	1,506	1,998	1.016x - 34.646	0.999
B28	SKC	224-PCXR4	691570	09/10/2023	1,000	1,500	2,000	992	1,487	1,996	1.006x - 16.996	1.000
B29	SKC	224-PCXR4	626472	09/10/2023	1,000	1,500	2,000	998	1,495	1,992	0.997x - 0.693	1.000
B30	SKC	224-PCXR4	691489	03/10/2023	1,000	1,500	2,000	993	1,490	1,990	0.999x - 7.320	1.000
B31	SKC	224-PCXR4	691509	03/10/2023	1,000	1,500	2,000	1,001	1,497	1,997	1.007x - 18.788	0.999
B32	SKC	224-PCXR4	091567	04/10/2023	1,000	1,500	2,000	998	1,499	1,996	1.009x - 22.760	0.999
B33	SKC	224-PCXR4	091756	05/10/2023	1,000	1,500	2,000	1,000	1,489	1,994	0.995x - 0.223	1.000
B34	SKC	224-PCXR4	612962	05/10/2023	1,000	1,500	2,000	992	1,501	1,997	1.013x - 31.362	0.999
B35	SKC	224-PCXR4	602682	03/10/2023	1,000	1,500	2,000	998	1,496	1,998	0.998x - 7.157	0.999
B36	SKC	224-PCXR4	626164	07/10/2023	1,000	1,500	2,000	995	1,487	1,990	0.991x + 3.901	1.000
B37	SKC	224-PCXR4	626256	02/10/2023	1,000	1,500	2,000	990	1,500	1,993	1.000x - 6.520	1.000
B38	SKC	224-PCXR4	626167	03/10/2023	1,000	1,500	2,000	989	1,498	1,995	1.015x - 35.470	0.999
B39	SKC	224-PCXR4	034637	09/10/2023	1,000	1,500	2,000	991	1,495	1,994	1.004x - 14.572	1.000
B40	SKC	224-PCXR4	798349	07/10/2023	1,000	1,500	2,000	999	1,497	1,996	1.008x - 21.576	0.999

Calibrated by :  Approved by : 



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter Model : Defender 510-H S/N : 136164

Environmental Conditions
Temperature : 25 ± 3 °C
Pressure : 1010 ± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	10/10/2023	1,000	1,500	2,000	999	1,491	1,993	0.994x + 2.802	1.000
B42	SKC	224-PCXR4	626041	10/10/2023	1,000	1,500	2,000	994	1,490	1,989	0.995x - 1.759	1.000
B43	SKC	224-PCXR4	034636	07/10/2023	1,000	1,500	2,000	995	1,488	1,989	0.991x + 2.866	1.000
B44	SKC	224-PCXR8	529341	07/10/2023	1,000	1,500	2,000	992	1,503	1,998	1.009x - 23.051	0.999
B45	SKC	224-PCXR8	529594	10/10/2023	1,000	1,500	2,000	1,000	1,495	1,989	0.989x + 10.094	1.000
B46	SKC	224-PCXR8	566743	02/10/2023	1,000	1,500	2,000	1,000	1,500	1,998	1.008x - 19.564	0.999
B47	SKC	224-PCXR8	566747	02/10/2023	1,000	1,500	2,000	994	1,502	1,996	1.011x - 27.787	0.999
B48	SKC	224-PCXR8	566753	03/10/2023	1,000	1,500	2,000	1,000	1,495	2,000	1.005x - 13.577	1.000
B49	SKC	224-PCXR8	566780	02/10/2023	1,000	1,500	2,000	998	1,498	2,000	1.010x - 21.853	0.999
B50	SKC	224-PCXR8	500400	07/10/2023	1,000	1,500	2,000	999	1,495	1,989	0.993x + 5.640	1.000
B51	SKC	224-PCXR8	500363	07/10/2023	1,000	1,500	2,000	993	1,501	1,996	1.009x - 24.941	0.999
B52	SKC	224-PCXR8	093186	07/10/2023	1,000	1,500	2,000	994	1,500	1,991	0.996x + 2.910	1.000
B53	SKC	224-PCXR8	707670	06/10/2023	1,000	1,500	2,000	990	1,498	1,996	1.014x - 33.838	0.999
B54	SKC	224-PCXR3	509821	05/10/2023	1,000	1,500	2,000	991	1,499	1,995	1.012x - 30.494	0.999
B55	SKC	224-PCXR3	510710	05/10/2023	1,000	1,500	2,000	996	1,493	1,996	0.999x - 2.301	1.000
B56	SKC	224-PCXR3	511450	05/10/2023	1,000	1,500	2,000	992	1,487	1,996	1.006x - 16.797	1.000
B57	SKC	224-PCXR3	510798	04/10/2023	1,000	1,500	2,000	989	1,493	1,994	1.001x - 9.175	1.000
B58	SKC	224-PCXR3	509852	04/10/2023	1,000	1,500	2,000	1,000	1,497	1,997	1.009x - 21.172	0.999
B59	SKC	224-PCXR3	509862	04/10/2023	1,000	1,500	2,000	995	1,495	1,988	0.993x + 2.723	1.000
B60	SKC	224-PCXR3	512655	07/10/2023	1,000	1,500	2,000	992	1,498	1,997	1.013x - 31.979	0.999
B61	SKC	224-PCXR3	503915	07/10/2023	1,000	1,500	2,000	1,000	1,502	1,997	1.007x - 20.065	0.999
B62	SKC	224-PCXR3	505975	07/10/2023	1,000	1,500	2,000	996	1,489	1,991	0.990x + 6.791	1.000
B63	SKC	224-PCXR3	511432	07/10/2023	1,000	1,500	2,000	993	1,500	1,995	1.003x - 8.208	1.000
B64	SKC	224-PCXR3	508302	05/10/2023	1,000	1,500	2,000	991	1,496	1,988	0.998x - 5.262	1.000
B65	SKC	224-PCXR3	508310	05/10/2023	1,000	1,500	2,000	993	1,492	1,991	0.999x - 4.884	1.000
B66	SKC	224-PCXR3	509861	06/10/2023	1,000	1,500	2,000	996	1,493	1,985	0.992x + 2.675	1.000
B67	SKC	224-PCXR3	506295	04/10/2023	1,000	1,500	2,000	1,000	1,498	1,998	1.009x - 21.534	0.999
B68	SKC	224-PCXR3	505872	04/10/2023	1,000	1,500	2,000	994	1,493	1,987	0.993x + 3.176	1.000
B69	SKC	224-PCXR3	508375	07/10/2023	1,000	1,500	2,000	999	1,495	1,996	1.005x - 19.592	0.999
B70	SKC	224-PCXR3	510623	04/10/2023	1,000	1,500	2,000	992	1,486	1,995	1.002x - 11.762	1.000
B71	SKC	224-PCXR3	508367	05/10/2023	1,000	1,500	2,000	999	1,497	1,996	1.008x - 21.646	0.999
B72	SKC	224-PCXR3	505977	05/10/2023	1,000	1,500	2,000	993	1,490	1,990	0.997x - 4.295	1.000
B73	SKC	224-PCXR3	512606	05/10/2023	1,000	1,500	2,000	995	1,495	1,989	0.994x + 1.210	1.000
B74	SKC	224-PCXR3	505993	05/10/2023	1,000	1,500	2,000	997	1,496	1,986	0.987x + 12.602	1.000
B75	SKC	224-PCXR3	509820	05/10/2023	1,000	1,500	2,000	994	1,490	1,991	0.998x - 5.143	1.000
B76	SKC	224-PCXR3	509811	06/10/2023	1,000	1,500	2,000	1,000	1,497	1,999	1.010x - 23.063	0.999
B77	SKC	224-PCXR3	508301	06/10/2023	1,000	1,500	2,000	992	1,501	1,998	1.013x - 32.023	0.999
B78	SKC	224-PCXR3	510677	05/10/2023	1,000	1,500	2,000	1,001	1,498	1,997	1.007x - 18.549	0.999
B79	SKC	224-PCXR3	510920	03/10/2023	1,000	1,500	2,000	999	1,509	1,997	0.996x + 0.999	1.000



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Personal Pump Calibration Report		
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Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164
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Environmental Conditions		
Temperature	25	± 3 °C
Pressure	1010	± 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B80	SKC	224-PCXR3	504569	07/10/2023	1,000	1,500	2,000	1,001	1,497	2,000	1.007x - 19.202	0.999
B81	SKC	224-PCXR3	503480	07/10/2023	1,000	1,500	2,000	994	1,496	1,996	1.006x - 17.526	1.000
B82	SKC	224-PCXR3	505673	05/10/2023	1,000	1,500	2,000	992	1,495	1,992	1.002x - 11.742	1.000
B83	SKC	224-PCXR3	510785	05/10/2023	1,000	1,500	2,000	994	1,497	1,998	1.005x - 15.177	1.000
B84	SKC	224-PCXR3	508333	04/10/2023	1,000	1,500	2,000	1,000	1,498	1,999	1.003x - 16.041	0.999
B85	SKC	224-PCXR3	505757	04/10/2023	1,000	1,500	2,000	999	1,498	1,999	1.010x - 23.715	0.999
B86	SKC	224-PCXR3	512625	02/10/2023	1,000	1,500	2,000	1,000	1,493	1,989	0.994x + 1.568	1.000
B87	SKC	224-PCXR3	504324	09/10/2023	1,000	1,500	2,000	1,001	1,500	1,996	1.006x - 16.049	0.999
B88	SKC	224-PCXR3	508307	09/10/2023	1,000	1,500	2,000	1,000	1,496	1,990	0.990x + 9.617	1.000
B89	SKC	224-PCXR3	509860	05/10/2023	1,000	1,500	2,000	999	1,496	1,998	0.997x - 5.214	0.999
B90	SKC	224-PCXR3	508366	03/10/2023	1,000	1,500	2,000	992	1,495	1,992	0.999x - 5.095	1.000
B91	SKC	224-PCXR3	510919	10/10/2023	1,000	1,500	2,000	998	1,496	1,993	0.995x - 1.847	1.000
B92	SKC	224-PCXR3	510987	04/10/2023	1,000	1,500	2,000	1,001	1,496	1,997	1.009x - 22.028	0.999
B93	SKC	224-PCXR3	509845	04/10/2023	1,000	1,500	2,000	997	1,491	1,990	0.993x + 2.516	1.000
B94	SKC	224-PCXR8	A127871	04/10/2023	1,000	1,500	2,000	998	1,495	1,995	1.005x - 19.074	0.999
B95	SKC	224-PCXR8	A127921	09/10/2023	1,000	1,500	2,000	998	1,498	1,999	1.012x - 25.793	0.999
B96	SKC	224-PCXR8	A127942	09/10/2023	1,000	1,500	2,000	999	1,495	1,989	0.991x + 5.720	1.000
B97	SKC	224-PCXR8	A127955	09/10/2023	1,000	1,500	2,000	994	1,496	1,996	1.011x - 28.512	0.999
B98	SKC	224-PCXR8	A127956	10/10/2023	1,000	1,500	2,000	995	1,489	1,987	0.994x + 1.218	1.000

Calibrated by :		Approved by :	
	(Mr. Adit Dangklom)		



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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.)			y	R ²
				1	2	3	1	2	3		
H-B01	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	508.9	990.3	1974.3	$0.989x + 9.271$	1.000
H-B02	Dwyer	VFB-65	04/04/2023	500	1,000	2,000	495.3	999.1	1996.1	$0.994x + 4.127$	1.000
H-B03	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	497.3	988.1	2009.6	$1.003x - 14.485$	0.999
H-B04	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	501.2	1000.3	2006.5	$0.997x + 1.216$	1.000
H-B05	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	500.2	999.6	1974.3	$0.980x + 21.307$	0.999
H-B06	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	504.3	996.2	1984.0	$1.004x - 6.770$	1.000
H-B07	Dwyer	VFB-65	04/04/2023	500	1,000	2,000	502.3	990.7	2016.7	$1.001x - 1.154$	1.000
H-B08	Dwyer	VFB-65	05/04/2023	500	1,000	2,000	500.2	1000.6	1979.8	$0.995x + 5.040$	0.999
H-B09	Dwyer	VFB-65	07/04/2023	500	1,000	2,000	504.4	1007.4	2010.7	$0.993x + 15.376$	1.000
H-B10	Dwyer	VFB-65	10/04/2023	500	1,000	2,000	495.7	1001.6	2009.2	$0.996x + 3.956$	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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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 ²
				1	2	3	1	2	3		
L-B01	Dwyer	VFA-21	05/04/2023	50	100	200	50.3	98.7	198.9	$0.986x + 0.859$	1.000
L-B02	Dwyer	VFA-21	04/04/2023	50	100	200	50.6	99.8	198.3	$0.995x + 0.956$	0.999
L-B03	Dwyer	VFA-21	07/04/2023	50	100	200	50.4	99.6	197.9	$1.009x - 1.350$	1.000
L-B04	Dwyer	VFA-21	07/04/2023	50	100	200	49.5	102.0	200.7	$1.012x - 0.487$	1.000
L-B05	Dwyer	VFA-21	07/04/2023	50	100	200	50.9	98.9	201.2	$0.998x + 1.040$	0.999
L-B06	Dwyer	VFA-21	07/04/2023	50	100	200	50.8	99.7	202.8	$1.009x + 0.150$	1.000
L-B07	Dwyer	VFA-21	04/04/2023	50	100	200	49.0	101.2	200.5	$1.014x - 1.381$	1.000
L-B08	Dwyer	VFA-21	05/04/2023	50	100	200	50.2	102.1	197.7	$0.997x + 0.307$	1.000
L-B09	Dwyer	VFA-21	07/04/2023	50	100	200	50.8	99.6	201.1	$0.990x + 2.095$	0.999
L-B10	Dwyer	VFA-21	10/04/2023	50	100	200	51.0	99.0	203.2	$1.005x + 0.453$	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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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 ²
H-801	Dwyer	VFB-65	04/07/2023	500	1,000	2,000	503.2	990.1	1974.7	0.990x + 7.225	1.000
H-802	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	495.6	994.6	1994.1	0.995x + 2.972	1.000
H-803	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	497.1	989.8	2007.6	1.002x - 12.719	0.999
H-804	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	500.3	999.5	2004.4	0.996x - 0.709	1.000
H-805	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	499.3	990.7	1972.3	0.982x + 17.213	0.999
H-806	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	504.0	991.4	1982.0	0.988x + 8.755	1.000
H-807	Dwyer	VFB-65	04/07/2023	500	1,000	2,000	501.3	989.4	2014.7	0.999x - 0.490	1.000
H-808	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	499.2	996.1	1977.8	0.993x + 2.247	0.999
H-809	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	504.0	1006.4	2008.7	0.991x + 16.313	1.000
H-810	Dwyer	VFB-65	10/07/2023	500	1,000	2,000	495.7	993.0	2011.6	1.000x - 1.820	1.000

Calibrated by :

(Mr.Adul Dangklorn)

Approved by :



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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

Rotameter Data

Calibration Data

No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
L-801	Dwyer	VFA-21	04/07/2023	50	100	200	50.2	99.7	198.7	$0.994x + 0.959$	0.999
L-802	Dwyer	VFA-21	07/07/2023	50	100	200	49.1	98.9	198.5	$0.999x - 0.773$	1.000
L-803	Dwyer	VFA-21	07/07/2023	50	100	200	49.1	99.5	198.1	$1.006x - 0.411$	1.000
L-804	Dwyer	VFA-21	06/07/2023	50	100	200	49.2	100.7	202.6	$1.005x - 0.435$	1.000
L-805	Dwyer	VFA-21	07/07/2023	50	100	200	50.1	98.9	198.0	$0.999x - 0.013$	0.999
L-806	Dwyer	VFA-21	06/07/2023	50	100	200	50.4	99.9	200.4	$1.007x - 0.221$	1.000
L-807	Dwyer	VFA-21	04/07/2023	50	100	200	50.5	99.6	199.1	$0.995x + 1.029$	0.999
L-808	Dwyer	VFA-21	05/07/2023	50	100	200	49.4	101.7	197.5	$1.001x - 0.332$	1.000
L-809	Dwyer	VFA-21	07/07/2023	50	100	200	49.7	98.5	199.6	$1.003x - 0.786$	1.000
L-810	Dwyer	VFA-21	10/07/2023	50	100	200	49.9	98.4	200.4	$1.007x - 1.164$	1.000

Calibrated by :

(Mr.Adul Dangklorn)

Approved by :



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	02/10/2023	500	1,000	2,000	500.1	992.7	1979.6	0.993x + 4.560	1.000
H-B02	Dwyer	VFB-65	03/10/2023	500	1,000	2,000	503.6	989.1	1983.1	0.991x + 6.131	1.000
H-B03	Dwyer	VFB-65	02/10/2023	500	1,000	2,000	498.7	991.6	2006.8	0.999x - 9.214	0.999
H-B04	Dwyer	VFB-65	04/10/2023	500	1,000	2,000	502.3	986.1	2003.7	1.000x - 2.013	1.000
H-B05	Dwyer	VFB-65	03/10/2023	500	1,000	2,000	497.8	989.1	1971.6	0.981x + 16.401	0.999
H-B06	Dwyer	VFB-65	05/10/2023	500	1,000	2,000	499.3	995.9	1979.0	0.988x + 11.304	1.000
H-B07	Dwyer	VFB-65	04/10/2023	500	1,000	2,000	495.1	995.6	1991.3	0.997x - 1.222	1.000
H-B08	Dwyer	VFB-65	05/10/2023	500	1,000	2,000	500.7	998.7	1975.8	0.990x + 5.555	0.999
H-B09	Dwyer	VFB-65	03/10/2023	500	1,000	2,000	496.9	998.5	1979.0	0.989x + 10.735	1.000
H-B10	Dwyer	VFB-65	07/10/2023	500	1,000	2,000	499.4	997.5	2004.6	0.998x - 1.062	1.000

Calibrated by :

นางสาวสุภาวดี ดาญรัมย์

Approved 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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

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 ²
L-B01	Dwyer	VFA-21	02/10/2023	50	100	200	50.2	100.3	202.6	0.997x + 0.475	0.999
L-B02	Dwyer	VFA-21	03/10/2023	50	100	200	50.5	98.9	201.1	1.001x - 0.121	1.000
L-B03	Dwyer	VFA-21	02/10/2023	50	100	200	50.1	100.7	200.2	1.007x - 1.206	0.999
L-B04	Dwyer	VFA-21	04/10/2023	50	100	200	50.4	99.6	201.9	1.006x - 0.142	1.000
L-B05	Dwyer	VFA-21	03/10/2023	50	100	200	49.7	101.1	197.7	0.997x - 0.218	1.000
L-B06	Dwyer	VFA-21	05/10/2023	50	100	200	50.3	101.5	200.1	1.003x - 0.332	0.999
L-B07	Dwyer	VFA-21	04/10/2023	50	100	200	50.9	100.4	202.4	0.990x + 2.441	1.000
L-B08	Dwyer	VFA-21	05/10/2023	50	100	200	50.7	99.8	197.9	1.005x - 1.343	0.999
L-B09	Dwyer	VFA-21	03/10/2023	50	100	200	50.2	100.3	203.0	1.007x + 0.375	1.000
L-B10	Dwyer	VFA-21	07/10/2023	50	100	200	49.5	99.4	200.3	1.009x - 1.182	1.000

Calibrated by :

นางสาวสุภาวดี ดาญรัมย์

Approved by :



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
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 : ATSAWIN Y.
CALIBRATION DATE : 10-Mar-23
APPROVED BY :
ISSUED DATE : 16-Mar-23
RECEIVED DATE : 10-Mar-23

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 10-Mar-23
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23
AMBIENT TEMPERATURE : 23°C \pm 1°C RELATIVE HUMIDITY : 49%RH \pm 10% RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

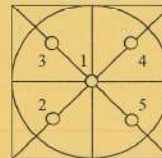
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000039
0.02	0.02000	0.00000	0.000039
0.10	0.10000	0.00000	0.000039
0.20	0.20001	-0.00001	0.000040
0.50	0.50001	-0.00001	0.000040
1.00	1.00000	0.00000	0.000041
2.00	2.00003	-0.00003	0.000042
5.00	5.00001	-0.00001	0.000046
10.00	10.00003	-0.00003	0.000053
20.00	20.00005	-0.00005	0.000067
50.00	50.0001	-0.0001	0.00011
100.00	100.0001	-0.0001	0.00019
200.00	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0001
3	50.0000
4	50.0000
5	49.9999
OFF-CENTER LOADING	0.0001

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

END OF CALIBRATION REPORT

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GC_MS_03_52_CN10925102
Organization Name: S.P.S Consulting service
Organization Location: 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900

Date: March 31, 2023 1:21:52 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

Front SSL

Setpoint Status: Pass

Pressure: 25.0 psi

Pressure Change: -0.1 psi /5 minutes

Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front SSL

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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

Back SSL

Setpoint Status: Pass

Setpoint Actual
Inlet Pressure: 25.0 psi 25.2 psi

Accuracy: 0.2 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: 30.3 mL/min

Accuracy: 0.3 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)

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

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Setpoint Status: Pass

Flow Type: Oxidizer

Setpoint: 400.0 mL/min **Measured Flow:** 396.2 mL/min

Accuracy: 3.8 mL/min

Agilent Recommended: ≤ 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:** 25.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ≤ 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: ≥ -1.0 % setpoint in K (-5.0 °C)
≤ 1.0 % setpoint in K (5.0 °C)

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.4 °C

Accuracy: 0.4 °C

Agilent Recommended: ≥ -1.0 % setpoint in K (-3.7 °C)
≤ 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: 100.0 100.3833 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID

Manual Injection

Name: Not applicable

Setpoint Status: Completed

Injection Volume on Column: 1.0 µL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Name: 7890

Setpoint Status: Pass

Base Signal: 89800 Ab

ASTM Noise counts	Drift counts/Hr
285.31	96.04
Agilent Recommended: ≤ 768.00	Agilent Recommended: ≤ 19200.00

Status: Pass

Overall Noise and Drift Test Status

Pass

Signal to Noise

Tested Combination1 Front SSL / Front FID

Manual Injection

Name: 7890

Setpoint Status: Pass

Signal to Noise: 3814254

Agilent Recommended: ≥ 300000

Overall Signal to Noise Test Status

Pass

Log Amp

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Amu: 1050 m/z Drift After Five Minutes: 1 mV RFPA Voltage: 479 mV

Agilent Recommended: ≥ -100 and ≤ 100 ≤ 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination2 Back SSL / External SQ

Name: 5975C

Source: EI - Inert Filament: 1

Setpoint Status: Pass

Signal to Noise: 425

Agilent Recommended: ≥ 180 Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Source: EI - Inert

Filament: 2

Setpoint Status: Pass

Signal to Noise: 566

Agilent Recommended: >= 160

Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose
This section describes the as found system configuration.

Details

System

System IDGC_MS_03_52_CN10925102

ManufacturerAgilent Technologies

Name7890

Tested Combination1

Injection TechniqueManual Injection

Sampler IdentifierSampler 1

InletFront

DetectorFront

LTM Included?No

Tested Combination2

Injection TechniqueManual Injection

Sampler IdentifierSampler 2

InletBack

DetectorExternal

LTM Included?No

Sampler 1

ManufacturerAgilent Technologies

TypeManual Injection

UsageSample Injection

Syringe Volume (µL)10

Sampler 2

ManufacturerAgilent Technologies

TypeManual Injection

UsageSample 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

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Detector 2

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C
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

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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 31, 2023
Reason for Signature: Executed protocol and published this original version of document

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ39KOMV
System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:12:26 AM Audit		SessionCreated	Session	None
March 31, 2023 9:12:28 AM Start		Configuration	Session	None
March 31, 2023 9:12:26 AM Audit		Entitlement	Licensing	User is Nonpaying and does not require an unlock code
March 31, 2023 9:20:14 AM Audit		EcpLoaded	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], Protocol Revision: [Gc.02.50] EQP details for hyphenated technique [GoMs] - File path: [ProtocolPacks/GoMs/Configurations/02.50/GoMs.02.50.eqp], EQP File Name: [GoMs.02.50.eqp], EQP Name: [AgilentRecommended]
March 31, 2023 9:20:17 AM End		Configuration	Session	None
March 31, 2023 9:20:27 AM Start		Qualification	Session	OQ
March 31, 2023 9:20:27 AM Start		Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 31, 2023 9:21:33 AM End		Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3S8KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:21:35 AM Start		Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 31, 2023 9:21:51 AM End		Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 31, 2023 9:21:54 AM Start		Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 31, 2023 9:21:59 AM End		Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 31, 2023 9:22:02 AM Start		Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 31, 2023 9:22:07 AM End		Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 31, 2023 9:22:09 AM Start		Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:29 AM End		Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:30 AM Start		Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:41 AM End		Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3S8KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:22:42 AM Start		Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:48 AM End		Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:49 AM Start		Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:23:31 AM 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 31, 2023 9:23:34 AM 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 31, 2023 9:23:37 AM Start		Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:26:00 AM 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 31, 2023 9:26:03 AM 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 31, 2023 9:26:05 AM Start		Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ38KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:26:42 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.3°C	None
March 31, 2023 9:27:39 AM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 31, 2023 9:27:46 AM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 31, 2023 9:27:51 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 31, 2023 9:54:35 AM	Start	Execution	Log Amp - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 9:55:59 AM	Start	Execution	RFPA - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 10:23:19 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 10:37:53 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:04 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:11 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 1 (Qualitative - No setpoints associated)	None

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ38KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 10:38:14 AM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:38:17 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 31, 2023 10:45:28 AM	Audit	Data	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : F:\Data\SC_FID.D\FID1A.ch
March 31, 2023 10:47:01 AM	End	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 31, 2023 10:58:27 AM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:58:52 AM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : F:\Data\ND_FID.D\FID1A.ch
March 31, 2023 11:00:53 AM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 31, 2023 11:02:02 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:14:32 AM	Audit	AccClosed	Session	None

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ38KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:15:13 AM	Audit	AceRestarted	Session	None
March 31, 2023 11:15:14 AM	Audit	SessionReloaded	Session	None
March 31, 2023 11:15:19 AM	Start	Qualification	Session	OQ
March 31, 2023 11:15:19 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:16:23 AM	Audit	AceClosed	Session	None
March 31, 2023 11:21:04 AM	Audit	AceRestarted	Session	None
March 31, 2023 11:21:04 AM	Audit	SessionReloaded	Session	None
March 31, 2023 11:21:09 AM	Start	Qualification	Session	OQ
March 31, 2023 11:21:09 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:22:15 AM	Audit	Data	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : F:\SN_FID.D\FID1A.ch
March 31, 2023 11:24:02 AM	End	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 31, 2023 11:24:17 AM	Start	Execution	Log Amp - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 11:24:31 AM	End	Execution	Log Amp - 5975C SQ: - Source: EI - Inert	Run Count : 1

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ38KOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:24:33 AM	Start	Execution	RFPA - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 11:27:22 AM	End	Execution	RFPA - 5975C SQ: - Source: EI - Inert	Run Count : 1
March 31, 2023 11:27:25 AM	Start	Execution	Tune EI - 5975C SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
March 31, 2023 11:28:04 AM	End	Execution	Tune EI - 5975C SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 31, 2023 11:28:06 AM	Start	Execution	Tune EI - 5975C SQ: - Source: EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 31, 2023 11:28:26 AM	End	Execution	Tune EI - 5975C SQ: - Source: EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 31, 2023 11:28:28 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 12:59:45 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 1:00:09 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : F:\SN_F1_01.D\DATA9IM.MS
March 31, 2023 1:00:41 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Run Count : 1

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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saenguthai.tarak
Hostname: LAPTOP-GQ3SKOMV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 1:00:43 PM Start		Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	None
March 31, 2023 1:01:52 PM Audit		Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Data files Path : F:\SN_F2_01.D\DATASIM.MS
March 31, 2023 1:02:09 PM End		Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Run Count : 1
March 31, 2023 1:02:13 PM End		Qualification	Session	OQ
March 31, 2023 1:02:13 PM Start		Reporting	Session	None
March 31, 2023 1:20:27 PM Audit		Reporting	Session	Report Generated : Certificate

เอกสารแนบ 4-6

เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

CALIBRATION CERTIFICATE

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

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

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

: Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

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.

Ambient Environment

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

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

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

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 : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

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

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

FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

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

Nominal Output of Unit Under Test = 94 dB re 20 μPa at 1000 Hz

Acoustic Output in dB re 20 μPa , Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.94	-0.06	± 0.10	$\pm 0.40 \text{ dB}$

2. Frequency

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

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.80	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Kludya)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Ref : 2011266032701228001

End of Certificate

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

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

FM.BLMTC.002 Rev.4

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E-mail : sumalee@tistr.or.th

Noise B_322/23

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	29 March 2023
		Due Date	29 March 2024

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B04	ACO	6236	00222298	15 August 2023	94.0	94.0
ACO-B13	ACO	6236	00152084	15 August 2023	94.0	94.0
ACO-B15	ACO	6236	00222300	15 August 2023	94.0	94.0
ACO-B26	ACO	6236	00182007	15 August 2023	93.9	94.0
ACO-B27	ACO	6236	00182008	15 August 2023	93.9	94.0
ACO-B39	ACO	6236	00222301	15 August 2023	94.1	94.0
ACO-B44	ACO	6236	00222302	15 August 2023	94.1	94.0
ACO-B46	ACO	6236	00222305	15 August 2023	94.0	94.0

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)

93.94 ± 0.10 dB

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

Noise B_459/23

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	29 March 2023
		Due Date	29 March 2024

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B17	ACO	6236	00172042	4 December 2023	94.1	94.0
ACO-B21	ACO	6236	00172059	4 December 2023	94.1	94.0
ACO-B28	ACO	6236	00182009	4 December 2023	94.0	94.0
ACO-B30	ACO	6236	00182012	4 December 2023	93.9	94.0
ACO-B31	ACO	6236	00182013	4 December 2023	94.0	94.0
ACO-B37	ACO	6236	00192028	4 December 2023	93.9	94.0
ACO-B38	ACO	6236	00192029	4 December 2023	94.0	94.0
ACO-B39	ACO	6236	00222301	4 December 2023	94.0	94.0

Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)

93.94 ± 0.10 dB

Calibrated by :

(Mr. Adul Dangklom)

Approved by :