

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัด

เอกสารแนบ 4-1	เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ
เอกสารแนบ 4-2	เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศจากปล่อง
เอกสารแนบ 4-3	เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำใต้ดิน
เอกสารแนบ 4-4	เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ
เอกสารแนบ 4-5	เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในสถานประกอบการ
เอกสารแนบ 4-6	เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียงในสถานประกอบการ

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ TSP	High Volume Air Sampler No. B22, B31, B35, B37, B44	Digital Balance
PM ₁₀	High Volume PM ₁₀ Air Sampler No. B06, B14, B15, B33, B34	Digital Balance
NO ₂	NO Analyzer No. B06, B11, B16, B19, B20	NO Analyzer No. B06, B11, B16, B19, B20
SO ₂	SO ₂ Analyzer No. B02, B08, B11, B12, B13	SO ₂ Analyzer No. B02, B08, B11, B12, B13
คุณภาพอากาศจากปล่องระบาย Particulate	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	Digital Balance
NO _x	Vacuum Gauge	Spectrophotometer
SO ₂	Personal Pump SKC No. B06, B16, B27 Rotameter No. H-B08, B09	Digital Balance
CO	Personal Pump SKC No. B06, B10, B16, B17, B18, B40 Rotameter No. H-B08, B09	CO Analyzer No. B01
HF	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	Ion Chromatography
HCl	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	Ion Chromatography
Total Hydrocarbon	Personal Pump SKC No. B17, B18, B40 Rotameter No. H-B08, B09	THC Analyzer No. B01
Lead	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Cadmium	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Mercury	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	AAS
Arsenic	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	AAS
Nickel	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Chromium	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Beryllium	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Antimony	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Copper	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศจากปล่องระบาย (ต่อ) Manganese	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Tin	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Cobalt	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
Total Sb, As, Cr, Co, Cu, Mn, Ni และ Sn	Console No. B04, B05 Pitot Tube No. B04, B35, B36, B49	ICP
VOCs	Personal Pump SKC No. B17, B18, B40 Rotameter No. L-B08, B09	GC/MS
Dioxin	Console No. B03 Pitot Tube No. B03	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-B03, B13, B15, B16, B18, B19, B21, B22, B26, B32, B37, B38, B39, B40, B44, B45, B46	

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ Total Dust	Personal Pump SKC No. B11, B56, B67, B68, B75, B82 Rotameter No. H-B04, B08, B09, B10	Digital Balance
Respirable Dust	Personal Pump SKC No. B09, B11, B51, B58, B65, B70 Rotameter No. H- B04, B08, B09, B10	Digital Balance
VOCs	Personal Pump SKC No. B09, B42, B53, B64, B78, B86 Rotameter No. L- B04, B08, B09, B10	GC/MS
ระดับเสียงในสถานประกอบการ Leq 8 hr Lmax	Acoustic Calibrator	-
	Sound Level Meter No. ACO- B13, B27, B33, B40	

เอกสารแนบ 4-1

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



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High Volume Air Sampler Calibration Report

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

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l/min)	R ²
B01	B01	01/02/2024	y = 1.224x-3.492	0.998
B02	B02	01/02/2024	y = 1.143x+1.630	0.999
B03	B03	01/02/2024	y = 1.180x-2.783	1.000
B04	B04	02/02/2024	y = 1.257x-5.884	0.997
B05	B05	03/02/2024	y = 1.261x-7.128	0.999
B06	B06	02/02/2024	y = 1.245x-6.024	0.999
B07	B07	03/02/2024	y = 1.209x-6.025	0.997
B08	B08	02/02/2024	y = 1.239x-5.848	0.997
B09	B09	02/02/2024	y = 1.244x-5.247	0.997
B10	B10	02/02/2024	y = 1.153x+0.064	0.998
B11	B11	01/02/2024	y = 1.110x-1.064	1.000
B12	B12	03/02/2024	y = 1.227x-6.093	0.999
B13	B13	01/02/2024	y = 1.286x-7.480	1.000
B14	B14	02/02/2024	y = 1.220x-5.066	0.999
B15	B15	02/02/2024	y = 1.150x-1.264	0.999
B16	B16	03/02/2024	y = 1.177x-3.231	0.996
B17	B17	02/02/2024	y = 1.235x-5.039	0.999
B18	B18	03/02/2024	y = 1.210x-5.028	0.998
B19	B19	03/02/2024	y = 1.215x-7.087	0.998
B20	B20	02/02/2024	y = 1.204x-4.119	0.996
B21	B21	02/02/2024	y = 1.190x-4.960	0.999
B22	B22	02/02/2024	y = 1.208x-7.133	0.996
B23	B23	01/02/2024	y = 1.217x-4.085	0.998
B24	B24	01/02/2024	y = 1.145x-2.502	1.000
B25	B25	02/02/2024	y = 1.090x+1.068	0.999
B26	B26	03/02/2024	y = 1.234x-5.493	0.998
B27	B27	01/02/2024	y = 1.168x-4.382	0.999
B28	B28	02/02/2024	y = 1.237x-7.982	0.999
B29	B29	03/02/2024	y = 1.186x-2.530	0.996
B30	B30	02/02/2024	y = 1.212x-4.090	0.997
B31	B31	02/02/2024	y = 1.195x-4.732	0.999
B32	B32	03/02/2024	y = 1.169x-0.802	0.996
B33	B33	03/02/2024	y = 1.203x-2.954	0.996
B34	B34	02/02/2024	y = 1.221x-5.796	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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High Volume Air Sampler Calibration Report

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

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l/min)	R ²
B35	B35	02/02/2024	y = 1.188x-3.435	0.996
B36	B36	01/02/2024	y = 1.201x-4.036	0.999
B37	B37	01/02/2024	y = 1.196x-2.671	0.998
B38	B38	02/02/2024	y = 1.232x-6.552	0.997
B39	B39	03/02/2024	y = 1.164x-0.902	0.997
B40	B40	01/02/2024	y = 1.225x-6.117	0.999
B41	B41	02/02/2024	y = 1.265x-6.140	0.999
B42	B42	02/02/2024	y = 1.187x-3.625	0.999
B43	B43	01/02/2024	y = 1.233x-2.707	0.997
B44	B44	01/02/2024	y = 1.202x-3.263	0.996
R01	R01	01/02/2024	y = 1.214x-4.512	0.999
R02	R02	02/02/2024	y = 1.222x-5.522	0.999
R03	R03	03/02/2024	y = 1.204x-5.785	0.999
R04	R04	01/02/2024	y = 1.220x-5.355	0.999
R05	R05	01/02/2024	y = 1.190x-5.262	0.997
R06	R06	02/02/2024	y = 1.223x-6.383	0.998
R07	R07	02/02/2024	y = 1.084x+0.577	0.999
R08	R08	01/02/2024	y = 1.157x-2.531	0.999
R09	R09	01/02/2024	y = 1.194x-3.227	0.998
R10	R10	02/02/2024	y = 1.198x-4.625	0.998
R11	R11	02/02/2024	y = 1.143x-2.176	1.000
R12	R12	02/02/2024	y = 1.165x-4.124	0.998
R13	R13	03/02/2024	y = 1.133x-1.833	0.997
R14	R14	01/02/2024	y = 1.216x-3.559	0.995
R15	R15	01/02/2024	y = 1.183x-5.143	0.999
R16	R16	01/02/2024	y = 1.227x-7.151	0.999
R17	R17	02/02/2024	y = 1.181x-3.964	0.996
R18	R18	02/02/2024	y = 1.195x-3.915	0.997
R19	R19	03/02/2024	y = 1.215x-6.609	1.000
R20	R20	03/02/2024	y = 1.208x-5.309	0.998

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l/min)	R ²
B01	B01	02/02/2024	y = 1.147x-0.194	0.996
B02	B02	01/02/2024	y = 1.060x+2.506	1.000
B03	B03	01/02/2024	y = 1.216x-3.895	0.996
B04	B04	01/02/2024	y = 1.224x-5.960	0.999
B05	B05	02/02/2024	y = 1.220x-5.384	0.999
B06	B06	02/02/2024	y = 1.197x-4.228	0.998
B07	B07	03/02/2024	y = 1.208x-4.865	0.996
B08	B08	01/02/2024	y = 1.171x-1.266	0.998
B09	B09	01/02/2024	y = 1.198x-5.197	0.997
B10	B10	01/02/2024	y = 1.219x-5.339	0.997
B11	B11	03/02/2024	y = 1.211x-3.765	0.999
B12	B12	05/02/2024	y = 1.203x-3.968	0.997
B13	B13	05/02/2024	y = 1.158x-1.909	0.996
B14	B14	03/02/2024	y = 1.190x-3.316	0.999
B15	B15	01/02/2024	y = 1.163x-1.150	0.999
B16	B16	01/02/2024	y = 1.170x+0.508	0.999
B17	B17	01/02/2024	y = 1.186x-2.843	0.997
B18	B18	01/02/2024	y = 1.207x-1.821	1.000
B19	B19	03/02/2024	y = 1.178x-2.990	0.999
B20	B20	02/02/2024	y = 1.206x-5.507	0.997
B21	B21	03/02/2024	y = 1.172x-0.702	0.999
B22	B22	02/02/2024	y = 1.175x-1.992	0.996
B23	B23	02/02/2024	y = 1.196x-3.382	0.998
B24	B24	01/02/2024	y = 1.181x-2.463	0.999
B25	B25	01/02/2024	y = 1.204x-3.960	0.997
B26	B26	01/02/2024	y = 1.218x-5.354	0.998
B27	B27	03/02/2024	y = 1.178x-4.891	0.997
B28	B28	02/02/2024	y = 1.226x-6.323	0.999
B29	B29	05/02/2024	y = 1.174x-3.753	0.997
B30	B30	03/02/2024	y = 1.179x-3.207	0.998
B31	B31	03/02/2024	y = 1.189x-1.040	0.997
B32	B32	01/02/2024	y = 1.222x-3.816	0.999
B33	B33	01/02/2024	y = 1.159x-1.689	0.996
B34	B34	01/02/2024	y = 1.191x-1.278	0.995

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l/min)	R ²
R01	R01	02/02/2024	y = 1.206x-5.952	0.998
R02	R02	02/02/2024	y = 1.219x-3.961	0.997
R03	R03	01/02/2024	y = 1.203x-5.426	0.998
R04	R04	01/02/2024	y = 1.191x-6.027	0.997
R05	R05	01/02/2024	y = 1.199x-5.883	1.000
R06	R06	01/02/2024	y = 1.192x-3.038	0.998
R07	R07	02/02/2024	y = 1.169x-2.670	0.996
R08	R08	02/02/2024	y = 1.186x-4.195	0.997
R09	R09	03/02/2024	y = 1.184x-3.512	1.000
R10	R10	03/02/2024	y = 1.179x-3.695	0.999
R11	R11	03/02/2024	y = 1.202x-2.389	0.997
R12	R12	01/02/2024	y = 1.194x-5.194	0.998
R13	R13	01/02/2024	y = 1.173x-2.754	0.999
R14	R14	01/02/2024	y = 1.176x-2.291	0.997
R15	R15	02/02/2024	y = 1.188x-3.910	0.998
R16	R16	02/02/2024	y = 1.180x-3.568	0.998
R17	R17	02/02/2024	y = 1.195x-3.126	0.998
R18	R18	03/02/2024	y = 1.143x-2.749	1.000
R19	R19	01/02/2024	y = 1.154x-2.002	0.996
R20	R20	01/02/2024	y = 1.161x-4.362	0.998

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 53 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	04 March 2024	BRAND :	API	MODEL :	200E
NO.	NOX-B16	SERIAL NO.	249		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
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.	24.4	°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	1.004
NO _x Span	400	339.9	-15.025	400.0	1.007
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	103.2	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	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. Abdul Dangklom)

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	04 March 2024	BRAND :	API	MODEL :	200E
NO.	NOX-B19	SERIAL NO.	353		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
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.	24.4	°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	399.8	-0.050	400.0	1.009
NO _x Span	400	400.2	0.050	400.0	1.012
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	512	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.1	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.4	°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	1.012	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO _x Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :
(Mr. Abdul Dangklom)

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	04 March 2024	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B20	SERIAL NO.	N02782		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
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.	24.4	°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	400.1	0.025	400.0	1.010
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	669	V	420 ~ 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	8 ~ 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.8	°C	315 ± 5		
RCELL PRESS	8.3	IN-Hg-A	2 ~ 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 ~ 30 constant		
NO Span Conc	400	PPB	20 ~ 20,000		
NO _x Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.010	-	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 :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 March 2024	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B02	SERIAL NO.	1847		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
Cylinder Conc.	: 49.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°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	400.1	0.025	400.0	1.010
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	658	cc/min	650 ± 10%		
PMT	103.0	mV	-20-150 with Zero Air		
UV LAMP	3013.6	mV	1000-4900		
STR. LGT	61.9	PPB	<100		
DRK PMT	63.4	mV	-50 ~ 200		
DRK LMP	58.2	mV	-50 ~ 200		
HVPS	675	V	550-900 constant		
DCPS	2527	mV	2500 ± 200		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.5	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.010	-	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 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 March 2024	BRAND :	API	MODEL :	100A
NO.	SO ₂ -B08	SERIAL NO.	1003		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
			Cylinder Conc.	: 49.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°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	28.4	in-Hg	25-35		
SAMPLE FLOW	658	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	3036.1	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	63.1	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2517	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	1.007	-	1.0 ± 0.3		
SO ₂ Offset	21.7	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 March 2024	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO ₂ -B11	SERIAL NO.	S02187		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
			Cylinder Conc.	: 49.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°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	399.6	-0.100	400.0	1.005
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	653	cc/min	650 ± 10%		
PMT	103.1	mV	-20-150 with Zero Air		
UV LAMP	3018.4	mV	1000-4900		
STR. LGT	61.8	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	58.1	mV	-50 - 200		
HVPS	669	V	550-900 constant		
DCPS	2525	mV	2500 ± 200		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.0	°C	5-40		
PMT TEMP	7.2	°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	21.9	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 March 2024	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO ₂ -B12	SERIAL NO.	1886		
Calibrator (Dilution System)					
Brand	: API		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 49.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°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	400.2	0.050	400.0	1.012
API Model TML-50 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	103.4	mV	-20-150 with Zero Air		
UV LAMP	3040.8	mV	1000-4900		
STR. LGT	61.7	PPB	<100		
DRK PMT	63.2	mV	-50 - 200		
DRK LMP	57.9	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2521	mV	2500 ± 200		
RCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.4	°C	5-40		
PMT TEMP	7.3	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.012	-	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.Amrit Dangklom)

Approved by :

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 March 2024	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO ₂ -B13	SERIAL NO.	1891		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO ₂)		Cylinder No.	: A00814SK	
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 49.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°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	400.3	0.075	400.0	1.014
API Model TML-50 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	3027.5	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.7	mV	-50 - 200		
HVPS	674	V	550-900 constant		
DCPS	2518	mV	2500 ± 200		
RCELL TEMP	50.4	°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	1.014	-	1.0 ± 0.3		
SO ₂ Offset	21.6	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.Amrit Dangklom)

Approved by :

เอกสารแนบ 4-2

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศจากปล่อง



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

Console Calibration Report

Calibration Method



Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	γ	ΔH_g (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 ΔH_g (test) is 46.7 ± 6.4 (mmH₂O)

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



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Console Calibration Report

Calibration Method



Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	γ	ΔH_g (mmH ₂ O)
B01	1563	01/03/2024	1.003	50.38
B02	8002514	04/03/2024	1.002	49.73
B03	1503016	02/03/2024	0.997	50.45
B04	00006659	01/03/2024	1.004	49.97
B05	00007428	02/03/2024	0.996	49.65
R01	1561	02/03/2024	0.999	50.18
R02	8002513	01/03/2024	1.005	50.04
R03	1570	03/03/2024	0.998	49.82
R04	8002519	02/03/2024	1.004	49.58
R05	1503015	03/03/2024	1.002	50.33

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

Accept Value of ΔH_g (test) is 46.7 ± 6.4 (mmH₂O)

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



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Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	ΔH_g (mmH ₂ O)
B01	1563	03/06/2024	0.996	50.07
B02	8002514	04/06/2024	0.995	49.98
B03	1503016	04/06/2024	0.994	50.19
B04	00006659	03/06/2024	0.995	50.28
B05	00007428	03/06/2024	0.997	49.75
R01	1561	05/06/2024	0.994	50.23
R02	8002513	04/06/2024	0.993	50.35
R03	1570	03/06/2024	0.994	50.12
R04	8002519	05/06/2024	0.993	49.89
R05	1503015	04/06/2024	0.996	49.92

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

Accept Value of ΔH_g (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

(Mr. Abdul 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 :  (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	01/11/2023	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. 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	01/02/2024	0.84	0.83
B04	S	0.99	02/02/2024	0.85	0.84
B05	S	0.99	02/02/2024	0.84	0.84
B07	S	0.99	01/02/2024	0.84	0.85
B08	S	0.99	01/02/2024	0.83	0.84
B09	S	0.99	03/02/2024	0.84	0.85
B11	S	0.99	03/02/2024	0.84	0.84
B16	S	0.99	01/02/2024	0.83	0.84
B18	S	0.99	02/02/2024	0.84	0.84
B19	S	0.99	02/02/2024	0.84	0.83
B21	S	0.99	01/02/2024	0.84	0.85
B24	S	0.99	02/02/2024	0.85	0.84
B27	S	0.99	01/02/2024	0.84	0.84
B30	S	0.99	02/02/2024	0.84	0.83
B31	S	0.99	02/02/2024	0.84	0.85
B33	S	0.99	01/02/2024	0.84	0.84
B35	S	0.99	01/02/2024	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
B36	S	0.99	02/02/2024	0.84	0.83
B37	S	0.99	02/02/2024	0.84	0.84
B38	S	0.99	01/02/2024	0.84	0.84
B39	S	0.99	02/02/2024	0.85	0.84
B40	S	0.99	02/02/2024	0.84	0.83
B41	S	0.99	01/02/2024	0.84	0.85
B44	S	0.99	01/02/2024	0.85	0.84
B45	S	0.99	02/02/2024	0.83	0.84
B46	S	0.99	01/02/2024	0.84	0.85
B47	S	0.99	03/02/2024	0.84	0.84
B48	S	0.99	03/02/2024	0.84	0.85
B49	S	0.99	01/02/2024	0.83	0.84
B54	S	0.99	01/02/2024	0.84	0.85
B56	S	0.99	02/02/2024	0.84	0.84
B57	S	0.99	01/02/2024	0.83	0.84
B58	S	0.99	02/02/2024	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
B03	S	0.99	06/05/2024	0.84	0.84
B04	S	0.99	06/05/2024	0.84	0.85
B05	S	0.99	07/05/2024	0.84	0.83
B07	S	0.99	07/05/2024	0.84	0.84
B08	S	0.99	07/05/2024	0.84	0.85
B09	S	0.99	07/05/2024	0.83	0.84
B11	S	0.99	07/05/2024	0.84	0.85
B16	S	0.99	08/05/2024	0.84	0.84
B18	S	0.99	08/05/2024	0.85	0.84
B19	S	0.99	08/05/2024	0.84	0.85
B21	S	0.99	07/05/2024	0.84	0.84
B24	S	0.99	07/05/2024	0.84	0.84
B27	S	0.99	06/05/2024	0.85	0.84
B30	S	0.99	09/05/2024	0.84	0.84
B31	S	0.99	09/05/2024	0.84	0.84
B33	S	0.99	09/05/2024	0.83	0.84
B35	S	0.99	07/05/2024	0.84	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
B36	S	0.99	07/05/2024	0.84	0.84
B37	S	0.99	07/05/2024	0.84	0.83
B38	S	0.99	07/05/2024	0.85	0.84
B39	S	0.99	09/05/2024	0.84	0.84
B40	S	0.99	09/05/2024	0.84	0.83
B41	S	0.99	09/05/2024	0.84	0.84
B44	S	0.99	08/05/2024	0.83	0.84
B45	S	0.99	08/05/2024	0.84	0.84
B46	S	0.99	08/05/2024	0.84	0.84
B47	S	0.99	08/05/2024	0.85	0.84
B48	S	0.99	10/05/2024	0.84	0.84
B49	S	0.99	06/05/2024	0.84	0.84
B54	S	0.99	06/05/2024	0.85	0.84
B56	S	0.99	07/05/2024	0.83	0.84
B57	S	0.99	10/05/2024	0.84	0.84
B58	S	0.99	10/05/2024	0.85	0.84

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

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.

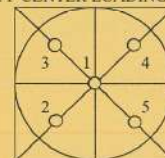
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

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

END OF CALIBRATION REPORT



CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY :

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 53 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT



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[64-220066-3]
CLID. NO. : 212201114
JOB CONTROL NO. : 230725081569

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. Q23081569

F3-011-04/01-12

page 1 of 3



@clccalibration



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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[64-220066-3]
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. Q23081569

F3-011-04/01-12

page 2 of 3



@clccalibration



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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 (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	-16.66	-16.69	-4.9	-4.9	+0.1	+0.1
-10	-33.79	-33.79	-10.0	-10.0	0.0	0.0
-15	-50.76	-50.76	-15.0	-15.0	0.0	0.0
-20	-67.79	-67.82	-20.0	-20.0	0.0	0.0
-25	-84.68	-84.72	-25.0	-25.0	0.0	0.0
-30	-101.51	-101.51	-30.0	-30.0	0.0	0.0

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

Certificate No. Q23081569

F3-011-04/01-12

page 3 of 3



@clccalibration

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



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 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	03/01/2024	1,000	1,500	2,000	993	1,497	1,998	1.002x - 4.467	1.000
B02	SKC	224-PCXR4	626166	03/01/2024	1,000	1,500	2,000	1,003	1,505	2,001	1.009x - 19.803	0.999
B03	SKC	224-PCXR4	612968	03/01/2024	1,000	1,500	2,000	996	1,494	2,001	1.006x - 12.799	1.000
B04	SKC	224-PCXR4	602804	04/01/2024	1,000	1,500	2,000	1,000	1,502	1,994	0.999x + 0.239	1.000
B05	SKC	224-PCXR4	612693	04/01/2024	1,000	1,500	2,000	1,003	1,500	2,002	1.011x - 21.266	0.999
B06	SKC	224-PCXR4	262188	05/01/2024	1,000	1,500	2,000	1,002	1,508	2,006	1.007x - 12.077	0.999
B07	SKC	224-PCXR4	626262	05/01/2024	1,000	1,500	2,000	998	1,492	1,997	0.994x + 4.810	1.000
B08	SKC	224-PCXR4	626100	04/01/2024	1,000	1,500	2,000	1,002	1,500	2,003	1.013x - 24.585	0.999
B09	SKC	224-PCXR4	626479	05/01/2024	1,000	1,500	2,000	998	1,490	1,994	0.993x + 3.837	1.000
B10	SKC	224-PCXR4	091950	04/01/2024	1,000	1,500	2,000	993	1,502	2,001	1.017x - 34.867	0.999
B11	SKC	224-PCXR8	564315	05/01/2024	1,000	1,500	2,000	996	1,492	1,999	1.004x - 7.965	1.000
B12	SKC	224-PCXR4	034656	05/01/2024	1,000	1,500	2,000	1,003	1,502	2,003	1.010x - 19.683	0.999
B13	SKC	224-PCXR4	602073	04/01/2024	1,000	1,500	2,000	997	1,500	1,998	1.000x - 0.862	1.000
B14	SKC	224-PCXR4	626313	03/01/2024	1,000	1,500	2,000	999	1,492	1,989	0.991x + 8.479	1.000
B15	SKC	224-PCXR4	626474	03/01/2024	1,000	1,500	2,000	1,002	1,502	2,005	1.012x - 21.697	0.999
B16	SKC	224-PCXR4	626477	04/01/2024	1,000	1,500	2,000	995	1,504	2,001	1.007x - 16.807	1.000
B17	SKC	224-PCXR4	626860	04/01/2024	1,000	1,500	2,000	997	1,494	1,991	0.997x + 0.331	1.000
B18	SKC	224-PCXR4	691484	05/01/2024	1,000	1,500	2,000	1,003	1,500	2,002	1.009x - 17.214	0.999
B19	SKC	224-PCXR4	691599	05/01/2024	1,000	1,500	2,000	993	1,503	1,999	1.005x - 6.906	1.000
B20	SKC	224-PCXR4	691587	05/01/2024	1,000	1,500	2,000	991	1,504	2,000	1.016x - 33.407	0.999
B21	SKC	224-PCXR4	691531	04/01/2024	1,000	1,500	2,000	993	1,499	1,995	1.001x - 5.540	1.000
B22	SKC	224-PCXR4	691654	03/01/2024	1,000	1,500	2,000	1,003	1,501	2,004	1.011x - 19.966	0.999
B23	SKC	224-PCXR4	798393	03/01/2024	1,000	1,500	2,000	993	1,507	2,002	1.017x - 33.276	0.999
B24	SKC	224-PCXR4	626363	03/01/2024	1,000	1,500	2,000	1,000	1,502	2,001	1.012x - 23.859	0.999
B25	SKC	224-PCXR4	798489	03/01/2024	1,000	1,500	2,000	1,001	1,492	2,001	0.998x + 0.694	1.000
B26	SKC	224-PCXR4	798479	04/01/2024	1,000	1,500	2,000	1,000	1,500	1,993	0.996x + 4.204	1.000
B27	SKC	224-PCXR4	691673	04/01/2024	1,000	1,500	2,000	994	1,503	2,002	1.016x - 30.902	0.999
B28	SKC	224-PCXR4	691570	05/01/2024	1,000	1,500	2,000	1,003	1,500	2,001	1.009x - 18.263	0.999
B29	SKC	224-PCXR4	626472	04/01/2024	1,000	1,500	2,000	1,002	1,498	2,000	1.002x - 3.909	1.000
B30	SKC	224-PCXR4	691489	04/01/2024	1,000	1,500	2,000	1,003	1,509	2,006	1.008x - 11.399	1.000
B31	SKC	224-PCXR4	691509	03/01/2024	1,000	1,500	2,000	993	1,494	1,997	1.005x - 11.275	1.000
B32	SKC	224-PCXR4	091567	03/01/2024	1,000	1,500	2,000	991	1,503	2,000	1.015x - 30.886	0.999
B33	SKC	224-PCXR4	091756	05/01/2024	1,000	1,500	2,000	993	1,498	1,992	0.999x - 2.317	1.000
B34	SKC	224-PCXR4	612962	05/01/2024	1,000	1,500	2,000	1,002	1,501	2,002	1.007x - 13.995	1.000
B35	SKC	224-PCXR4	602682	05/01/2024	1,000	1,500	2,000	996	1,498	1,996	1.006x - 5.285	1.000
B36	SKC	224-PCXR4	626164	04/01/2024	1,000	1,500	2,000	999	1,510	1,999	1.004x - 10.131	0.999
B37	SKC	224-PCXR4	626256	05/01/2024	1,000	1,500	2,000	994	1,506	1,999	1.013x - 28.454	0.999
B38	SKC	224-PCXR4	626167	03/01/2024	1,000	1,500	2,000	997	1,498	1,998	1.003x - 5.983	1.000
B39	SKC	224-PCXR4	034637	03/01/2024	1,000	1,500	2,000	1,005	1,501	2,001	1.006x - 15.188	0.999
B40	SKC	224-PCXR4	798349	05/01/2024	1,000	1,500	2,000	994	1,505	2,000	1.014x - 29.004	0.999

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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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	05/04/2024	1,000	1,500	2,000	993	1,496	1,998	1.001x - 3.430	1.000
B02	SKC	224-PCXR4	626166	05/04/2024	1,000	1,500	2,000	1,004	1,506	2,000	1.007x - 16.572	0.999
B03	SKC	224-PCXR4	612968	09/04/2024	1,000	1,500	2,000	997	1,498	2,004	1.008x - 13.756	1.000
B04	SKC	224-PCXR4	602804	08/04/2024	1,000	1,500	2,000	1,001	1,511	1,993	0.997x + 4.427	1.000
B05	SKC	224-PCXR4	612693	08/04/2024	1,000	1,500	2,000	1,005	1,510	2,002	1.009x - 16.400	0.999
B06	SKC	224-PCXR4	262188	08/04/2024	1,000	1,500	2,000	1,003	1,510	2,004	1.005x - 6.687	0.999
B07	SKC	224-PCXR4	626262	05/04/2024	1,000	1,500	2,000	997	1,500	1,996	0.995x + 4.930	1.000
B08	SKC	224-PCXR4	626100	04/04/2024	1,000	1,500	2,000	1,003	1,508	2,002	1.011x - 19.679	0.999
B09	SKC	224-PCXR4	626479	08/04/2024	1,000	1,500	2,000	996	1,499	1,994	0.994x + 3.159	1.000
B10	SKC	224-PCXR4	091950	04/04/2024	1,000	1,500	2,000	995	1,512	2,000	1.015x - 30.041	0.998
B11	SKC	224-PCXR8	564315	08/04/2024	1,000	1,500	2,000	994	1,494	2,000	1.006x - 10.717	1.000
B12	SKC	224-PCXR4	034656	08/04/2024	1,000	1,500	2,000	1,005	1,511	2,002	1.008x - 14.857	0.999
B13	SKC	224-PCXR4	602073	05/04/2024	1,000	1,500	2,000	998	1,501	1,997	0.998x + 2.728	1.000
B14	SKC	224-PCXR4	626313	04/04/2024	1,000	1,500	2,000	998	1,491	1,991	0.994x + 4.411	1.000
B15	SKC	224-PCXR4	626474	04/04/2024	1,000	1,500	2,000	1,004	1,505	2,003	1.009x - 16.951	0.999
B16	SKC	224-PCXR4	626477	04/04/2024	1,000	1,500	2,000	997	1,502	2,000	1.005x - 13.936	1.000
B17	SKC	224-PCXR4	626860	05/04/2024	1,000	1,500	2,000	998	1,495	1,990	0.995x + 3.681	1.000
B18	SKC	224-PCXR4	691484	05/04/2024	1,000	1,500	2,000	1,004	1,506	2,001	1.007x - 12.627	0.999
B19	SKC	224-PCXR4	691599	08/04/2024	1,000	1,500	2,000	994	1,507	1,997	1.003x - 4.519	1.000
B20	SKC	224-PCXR4	691587	08/04/2024	1,000	1,500	2,000	993	1,514	1,999	1.013x - 27.943	0.998
B21	SKC	224-PCXR4	691531	08/04/2024	1,000	1,500	2,000	997	1,498	1,993	0.996x - 1.121	1.000
B22	SKC	224-PCXR4	691654	08/04/2024	1,000	1,500	2,000	1,002	1,500	2,005	1.013x - 23.316	0.999
B23	SKC	224-PCXR4	798393	09/04/2024	1,000	1,500	2,000	995	1,506	1,999	1.014x - 28.370	0.999
B24	SKC	224-PCXR4	626363	04/04/2024	1,000	1,500	2,000	997	1,505	2,003	1.016x - 28.805	0.999
B25	SKC	224-PCXR4	798489	04/04/2024	1,000	1,500	2,000	1,000	1,494	2,002	0.999x - 1.300	1.000
B26	SKC	224-PCXR4	798479	05/04/2024	1,000	1,500	2,000	1,001	1,501	1,997	0.998x + 2.010	1.000
B27	SKC	224-PCXR4	691673	08/04/2024	1,000	1,500	2,000	995	1,505	2,001	1.014x - 28.031	0.999
B28	SKC	224-PCXR4	691570	08/04/2024	1,000	1,500	2,000	1,004	1,498	2,000	1.007x - 15.352	0.999
B29	SKC	224-PCXR4	626472	08/04/2024	1,000	1,500	2,000	1,003	1,496	2,003	1.003x - 5.903	1.000
B30	SKC	224-PCXR4	691489	05/04/2024	1,000	1,500	2,000	1,005	1,511	2,005	1.007x - 8.527	0.999
B31	SKC	224-PCXR4	691509	09/04/2024	1,000	1,500	2,000	991	1,495	1,998	1.006x - 14.067	1.000
B32	SKC	224-PCXR4	091567	05/04/2024	1,000	1,500	2,000	993	1,504	1,999	1.013x - 26.659	0.999
B33	SKC	224-PCXR4	091756	05/04/2024	1,000	1,500	2,000	994	1,500	1,995	1.000x - 2.836	1.000
B34	SKC	224-PCXR4	612962	08/04/2024	1,000	1,500	2,000	1,004	1,503	2,001	1.006x - 11.243	0.999
B35	SKC	224-PCXR4	602682	08/04/2024	1,000	1,500	2,000	997	1,496	1,995	0.998x - 2.772	1.000
B36	SKC	224-PCXR4	626164	05/04/2024	1,000	1,500	2,000	997	1,506	2,000	1.006x - 14.159	0.999
B37	SKC	224-PCXR4	626256	04/04/2024	1,000	1,500	2,000	997	1,507	1,998	1.010x - 23.269	0.999
B38	SKC	224-PCXR4	626167	04/04/2024	1,000	1,500	2,000	996	1,496	1,997	1.004x - 7.259	1.000
B39	SKC	224-PCXR4	034637	04/04/2024	1,000	1,500	2,000	1,007	1,499	2,000	1.003x - 11.120	0.999
B40	SKC	224-PCXR4	798349	04/04/2024	1,000	1,500	2,000	995	1,506	2,001	1.013x - 26.810	0.999

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	04/01/2024	500	1,000	2,000	506.5	991.1	1974.3	0.989x + 9.286	1.000
H-B02	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	496.7	997.6	1996.1	0.994x + 4.509	1.000
H-B03	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	497.6	988.8	2009.6	1.004x - 14.177	0.999
H-B04	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.6	998.7	2006.5	0.997x - 0.777	1.000
H-B05	Dwyer	VFB-65	05/01/2024	500	1,000	2,000	500.4	997.3	1974.3	0.980x + 21.602	0.999
H-B06	Dwyer	VFB-65	05/01/2024	500	1,000	2,000	504.9	994.8	1984.0	1.003x - 5.213	1.000
H-B07	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	502.6	990.6	2016.7	1.001x - 0.998	1.000
H-B08	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	499.7	998.7	1979.8	0.996x + 3.580	0.999
H-B09	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	504.1	1004.3	2010.7	0.993x + 13.998	1.000
H-B10	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	496.2	999.3	2009.2	0.996x + 3.860	1.000

Calibrated by :

(Mr. ADUL Dangklorn)

Approved by :

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	04/01/2024	50	100	200	50.7	98.5	198.9	0.986x + 0.884	1.000
L-B02	Dwyer	VFA-21	04/01/2024	50	100	200	50.6	99.2	198.7	0.997x + 0.603	0.999
L-B03	Dwyer	VFA-21	04/01/2024	50	100	200	50.1	99.2	198.3	1.010x - 1.750	1.000
L-B04	Dwyer	VFA-21	03/01/2024	50	100	200	49.2	102.0	200.5	1.011x - 0.502	1.000
L-B05	Dwyer	VFA-21	05/01/2024	50	100	200	50.5	99.4	200.8	0.999x + 0.948	0.999
L-B06	Dwyer	VFA-21	05/01/2024	50	100	200	50.5	99.0	202.3	1.010x - 0.360	1.000
L-B07	Dwyer	VFA-21	03/01/2024	50	100	200	49.5	100.3	200.1	1.013x - 1.486	1.000
L-B08	Dwyer	VFA-21	04/01/2024	50	100	200	50.7	101.2	199.3	1.000x + 0.298	1.000
L-B09	Dwyer	VFA-21	04/01/2024	50	100	200	50.5	99.0	200.2	0.992x + 1.365	1.000
L-B10	Dwyer	VFA-21	03/01/2024	50	100	200	50.7	98.5	203.2	0.998x + 1.334	0.999

Calibrated by :

(Mr. ADUL Dangklorn)

Approved by :



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	08/04/2024	500	1,000	2,000	504.3	992.1	1976.8	0.991x + 6.353	1.000
H-B02	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	496.5	998.8	1996.7	0.995x + 4.247	1.000
H-B03	Dwyer	VFB-65	05/04/2024	500	1,000	2,000	498.6	991.4	2011.0	1.003x - 12.161	0.999
H-B04	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	501.4	1000.9	2008.3	0.998x - 1.566	1.000
H-B05	Dwyer	VFB-65	08/04/2024	500	1,000	2,000	502.9	999.5	1974.5	0.979x + 24.520	0.999
H-B06	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	504.7	996.0	1984.4	1.005x - 6.145	1.000
H-B07	Dwyer	VFB-65	05/04/2024	500	1,000	2,000	502.2	992.8	2017.1	1.000x - 0.160	1.000
H-B08	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	500.3	1000.7	1980.2	0.995x + 5.203	0.999
H-B09	Dwyer	VFB-65	09/04/2024	500	1,000	2,000	503.3	1005.0	2011.1	0.994x + 13.348	1.000
H-B10	Dwyer	VFB-65	08/04/2024	500	1,000	2,000	498.2	1001.7	2008.8	0.995x + 5.854	1.000

Calibrated by :

(WIRAJOL UANGKUMI)

Approved by :

(WIRAJOL UANGKUMI)



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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.)				
				1	2	3	1	2	3	y	R ²
L-B01	Dwyer	VFA-21	08/04/2024	50	100	200	50.7	98.8	199.3	0.987x + 1.039	1.000
L-B02	Dwyer	VFA-21	04/04/2024	50	100	200	50.2	98.8	198.3	0.998x + 0.180	0.999
L-B03	Dwyer	VFA-21	05/04/2024	50	100	200	50.5	98.8	197.9	1.012x - 1.915	1.000
L-B04	Dwyer	VFA-21	04/04/2024	50	100	200	49.8	101.6	201.9	1.010x - 0.036	1.000
L-B05	Dwyer	VFA-21	08/04/2024	50	100	200	50.9	99.0	201.2	0.998x + 0.999	1.000
L-B06	Dwyer	VFA-21	04/04/2024	50	100	200	50.1	99.4	202.7	1.011x - 0.423	1.000
L-B07	Dwyer	VFA-21	05/04/2024	50	100	200	50.3	99.9	200.5	1.009x - 0.861	1.000
L-B08	Dwyer	VFA-21	04/04/2024	50	100	200	50.6	100.8	198.9	1.002x - 0.189	1.000
L-B09	Dwyer	VFA-21	09/04/2024	50	100	200	50.1	99.4	200.6	0.997x + 0.731	1.000
L-B10	Dwyer	VFA-21	08/04/2024	50	100	200	51.0	98.9	202.8	0.996x + 1.709	0.999

Calibrated by :

(WIRAJOL UANGKUMI)

Approved by :

(WIRAJOL UANGKUMI)



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

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	03 January 2024	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.	24.4	°C
		% RH		69	
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	39.94	-0.150	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	± 1 ppm With Zero Air		
CO Measure	4015.7	mV	2500-4800 mV		
CO Reference	3948.4	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.4	In-Hg-A	~2" ± Ambient Absolute Pressure		
Sample Flow	805	CC/Min	800 ± 10%		
Sample Temperature	48.2	°C	48 ± 4		
Bench Temperature	48.0	°C	48 ± 2		
Wheel Temperature	68.5	°C	68 ± 2		
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3034.2	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 :	01 February 2024	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		50	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	39.91	-0.225	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	4014.8	mV	2500-4800 mV		
CO Reference	3948.1	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	808	CC/Min	800 ± 10%		
Sample Temperature	48.4	°C	48 ± 4		
Bench Temperature	48.2	°C	48 ± 2		
Wheel Temperature	68.2	°C	68 ± 2		
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3032.7	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 March 2024	Brand :	API	Model :
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. :
Calibrating Condition				
Pressure	1011	mmbar	Temp.	24.4 °C
			% RH	49
Calibration Setting				
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	-	0
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	4015.1	mV	2500-4800 mV	
CO Reference	3948.7	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	811	CC/Min	800 ± 10%	
Sample Temperature	48.2	°C	48 ± 4	
Bench Temperature	48.0	°C	48 ± 2	
Wheel Temperature	68.3	°C	68 ± 2	
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10	
Photo-Drive	3033.8	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 :	02 April 2024	Brand :	API	Model :
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. :	D71839	
Certified Date :	14 March 2024	Expired Date :	14 March 2032	Cylinder Conc. :
Calibrating Condition				
Pressure	1011	mmbar	Temp.	24.6 °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	39.93	-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	4015.7	mV	2500-4800 mV	
CO Reference	3949.2	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	809	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	3036.5	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) 939-4370-73, Fax : (662) 513-4371, E-mail : sales@spsc.com, www.spsc.com

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	06 May 2024	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. :	D711839		
Certified Date :	14 March 2024	Expired Date :	14 March 2032	Cylinder Conc. :	4,580 ppm
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	48	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM		
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	
Zero	0	0.11	-	0	
CO Span	40.00	39.94	-0.150	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	± 1 ppm With Zero Air		
CO Measure	4014.8	mV	2500-4800 mV		
CO Reference	3948.5	mV	2500-4800 mV		
Measure/Reference Ratio	1.179	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.6	In-Hg-A	~2" ± Ambient Absolute Pressure		
Sample Flow	810	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.1	°C	48 ± 2		
Wheel Temperature	68.4	°C	68 ± 2		
Box Temperature	30.9	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3038.2	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 :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 แขวงพหลโยธิน เขตพญาไท กรุงเทพมหานคร 10900
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Tel : (662) 939-4370-73, Fax : (662) 513-4371, E-mail : sales@spsc.com, www.spsc.com

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	04 June 2024	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. :	D711839		
Certified Date :	14 March 2024	Expired Date :	14 March 2032	Cylinder Conc. :	4,580 ppm
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	50	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM		
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	
Zero	0	0.11	-	0	
CO Span	40.00	40.05	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	4015.6	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	28.4	In-Hg-A	~2" ± Ambient Absolute Pressure		
Sample Flow	807	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	3039.5	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 : Jul 3, 2023

(Mr.Nutdanai Laekhwan)

Applications Chemist



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

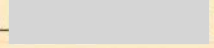
AQUION S/N : 190840059

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



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

Calibration Report Total Hydrocarbon Analyzer			
Date : 05 January 2024	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. 24.4 °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)	Analyzer Response (PPM)	Final Reading (After Adj)
Zero	0	-0.10	0
Span	10	10.03	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)	911.6	mV	800-1,350
Signal (THC)	916.3	mV	800-1,350
Detector	77.9	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	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 :

(Mr.Adul Dangklom)

Approved by :



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

Calibration Report Total Hydrocarbon Analyzer			
Date : 02 February 2024	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 50	
	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)	Analyzer Response (PPM)	Final Reading (After Adj)
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)	912.3	mV	800-1,350
Signal (THC)	917.1	mV	800-1,350
Detector	77.8	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.2	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 :



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

Calibration Report Total Hydrocarbon Analyzer			
Date :	01 March 2024	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	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.	24.4 °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 Ad)		Final Reading (After Ad)
	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:	3:00 PM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.6	mV	800-1,350
Signal (THC)	916.4	mV	800-1,350
Detector	78.0	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.1	kPa	8 ± 25
NMC	258.5	°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 : 



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

Calibration Report Total Hydrocarbon Analyzer			
Date :	05 April 2024	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	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	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 Ad)		Final Reading (After Ad)
	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:	11:00 AM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.2	mV	800-1,350
Signal (THC)	915.9	mV	800-1,350
Detector	77.9	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.2	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 : 



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Tel : (662) 939-8370-72, Fax : (662) 513-4321, E-mail : sales@spscs.com, www.spscs.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 08 May 2024		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 : 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
Span Instrument Gain: 0.999		Calibration Setting (Final)	
		Finish Time: 10:00 AM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.7	mV	800-1,350
Signal (THC)	916.4	mV	800-1,350
Detector	78.0	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.1	kPa	8 ± 25
NMC	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 :



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Tel : (662) 939-8370-72, Fax : (662) 513-4321, E-mail : sales@spscs.com, www.spscs.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 05 June 2024		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. : 26.6 °C	% RH : 50
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
Span Instrument Gain: 0.996		Calibration Setting (Final)	
		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	78.2	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.3	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 :

(Mr.Adul Dangklom)

Approved by :



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 4, 2024</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 4, 2024</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>July 6, 2023</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>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>February 28, 2024</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>January 4, 2024</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 : 077C7042401 DATE TESTED : January 4, 2024

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 4, 2024

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:

(Mr. Wiphan Promlumda)

Service Engineer



PinAAcle 900T Preventive Maintenance Report

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

Instrument Location: AAS Room

Instrument Serial No.: PTCS14111103

Date: 04-Jan-2024

PinAAcle 900T Preventive Maintenance (PM)

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

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

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

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

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO 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	N/A
B0505495	Test Jig	1	N/A
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	1-2416--040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

3.1 Flame Technique

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

3.2 THGA Technique

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

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

7. Flame Interlock Check:

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

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C 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.		0.1789	Passed
0.2 A ND Filter	± 5% from Cert.		1.0186	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

8.4 D₂ Background Compensation with Copper

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

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

8.5 AA-BG Baseline Noise with Copper

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

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

8.6 AA-BG Baseline Noise with Arsenic

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

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

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

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

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

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

9.2 Chromium Baseline Noise

Description: Signal to noise check.

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

9.3 Chromium Characteristic Mass and Precision

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

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	≤ 7.0 pg/0.0044 A-s	6.2	Passed
Precision	≤ 2.0 %	0.61	Passed

9.4 Copper Characteristic Mass and Zeeman Ratio

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

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	13.6	Passed
Zeeman Ratio	0.52 ± 0.04	0.544	Passed

10. Review:

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

Additional Comments

Additional Comments Regarding the PM

Zeeman Ratio

Atomic Signal (Peak area)

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

=

0.1602

0.2940

=

0.544

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:

04-Jan-2024

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

04-Jan-2024

(DD-MMM-YYYY)

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

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-01852714
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2023	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2023

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the Turbomass/Clarus MS SQ8 MS by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3	
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

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

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



Procedure Checklist

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

General:

- ☒ Column type Elite 5ms
- ☒ Carrier gas flow rate 1 ml/min.
- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Check incoming AC line voltage for proper levels and grounding.

Mechanical:

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

Electrical:

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

Operational Tests:

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



PC Maintenance:

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


Review:

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

Additional Comments


Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.</i>		
<i>This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.</i>		
Review of Preventive Maintenance:		
Authorized PerkinElmer Representative Monchai Kitcharoenkeat		Date: 22-Feb-2023 (DD-MMM-YYYY)
Authorized Customer Representative:		Date: 22-Feb-2023 (DD-MMM-YYYY)

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

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-02760693
Date PM Performed: (DD-MMM-YYY)	22-Feb-2024	Next PM Due Date: (DD-MMM-YYY)	22-Aug-2024

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the Turbomass/Clarus MS SQ8 MS by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3.1	PSS,PSS,FID
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX 1.0	

Parts lists

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

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
N/A				

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

Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

เอกสารแนบ 4-3

เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำใต้ดิน

**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.**

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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 RT/F = 59 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, Bangkai, 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 : 24M2229
REFERENCE No : 72448-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
MODEL : BSA224S-CW
SERIAL No : 36591843
ID No : BA 09/61
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY :

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2229

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 08-Mar-24
AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 55 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

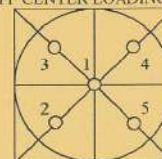
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000082
0.1	0.1000	0.0000	0.000083
0.2	0.2000	0.0000	0.000083
0.5	0.5000	0.0000	0.000083
1.0	1.0000	0.0000	0.000084
2.0	2.0000	0.0000	0.000084
5.0	5.0000	0.0000	0.000086
10.0	10.0000	0.0000	0.000089
20.0	20.0001	-0.0001	0.000094
50.0	50.0000	0.0000	0.00012
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0000
4	100.0000
5	100.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT

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



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 4, 2024</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 4, 2024</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>July 6, 2023</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>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>February 28, 2024</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>January 4, 2024</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 : 077C7042401 DATE TESTED : January 4, 2024

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 4, 2024

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:

(Mr. Wiphan Promlumda)

Service Engineer



PinAAcle 900T Preventive Maintenance Report

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

Instrument Location: AAS Room

Instrument Serial No.: PTCS14111103

Date: 04-Jan-2024

PinAAcle 900T Preventive Maintenance (PM)

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

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

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

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

Additional Reagents and Standards Required for PM (Customer Support Solution)				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO 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	N/A
B0505495	Test Jig	1	N/A
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	1-2416--040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

3.1 Flame Technique

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

3.2 THGA Technique

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

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

7. Flame Interlock Check:

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

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C 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.		0.1789	Passed
0.2 A ND Filter	± 5% from Cert.		1.0186	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

8.4 D₂ Background Compensation with Copper

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

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

8.5 AA-BG Baseline Noise with Copper

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

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

8.6 AA-BG Baseline Noise with Arsenic

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

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

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

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

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

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

9.2 Chromium Baseline Noise

Description: Signal to noise check.

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

9.3 Chromium Characteristic Mass and Precision

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

Parameter	Specification	Results	Pass/Fail
Cr m ₀ Results	≤ 7.0 pg/0.0044 A-s	6.2	Passed
Precision	≤ 2.0 %	0.61	Passed

9.4 Copper Characteristic Mass and Zeeman Ratio

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

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	13.6	Passed
Zeeman Ratio	0.52 ± 0.04	0.544	Passed

10. Review:

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

Additional Comments

Additional Comments Regarding the PM

Zeeman Ratio

Atomic Signal (Peak area)

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

0.1602

0.2940

0.544

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:

04-Jan-2024

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

04-Jan-2024

(DD-MMM-YYYY)

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 :

Ambient Environment

Description : Sound Calibrator

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

Manufacturer : ACO

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

Model : 2127

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

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.

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 HzAcoustic 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

2 / 2

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FM.BLMTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 /

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

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FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 0.10	±0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 0.50	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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FM.BL.MTC.002 Rev.4

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

Noise B_006/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data						
Brand		ACO		Number		AC 03/56
Model		2127		Serial No.		130006
Calibration Range		94 dB, 1000 Hz		Last Calibration		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-B15	ACO	6236	00222300	16 January 2024	94.0	94.0
ACO-B19	ACO	6236	00172057	16 January 2024	93.9	94.0
ACO-B39	ACO	6236	00222301	16 January 2024	93.9	94.0
ACO-B44	ACO	6236	00222302	16 January 2024	94.1	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_016/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data						
Brand		ACO		Number		AC 03/56
Model		2127		Serial No.		130006
Calibration Range		94 dB, 1000 Hz		Last Calibration		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	05 February 2024	94.0	94.0
ACO-B21	ACO	6236	00172059	05 February 2024	94.0	94.0
ACO-B22	ACO	6236	00172060	05 February 2024	93.9	94.0
ACO-B32	ACO	6236	00182014	05 February 2024	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_059/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	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-B39	ACO	6236	00222301	04 March 2024	94.0	94.0
ACO-B44	ACO	6236	00222302	04 March 2024	94.0	94.0
ACO-B45	ACO	6236	00222304	04 March 2024	93.9	94.0
ACO-B46	ACO	6236	00222305	04 March 2024	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_095/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B13	ACO	6236	00152084	02 April 2024	93.9	93.9
ACO-B16	ACO	6236	00172039	02 April 2024	94.0	93.9
ACO-B18	ACO	6236	00172048	02 April 2024	94.0	93.9
ACO-B26	ACO	6236	00182007	02 April 2024	94.0	93.9
ACO-B27	ACO	6236	00182008	02 April 2024	93.9	93.9
ACO-B33	ACO	6236	00182015	02 April 2024	93.9	93.9
ACO-B37	ACO	6236	00192028	02 April 2024	94.0	93.9
ACO-B40	ACO	6236	00192031	02 April 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

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@spsccn.com, www.spsccn.com

Noise B_142/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	06 May 2024	94.0	93.9
ACO-B19	ACO	6236	00172057	06 May 2024	93.9	93.9
ACO-B44	ACO	6236	00222302	06 May 2024	94.0	93.9
ACO-B45	ACO	6236	00222304	06 May 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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Noise B_213/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B03	ACO	6236	00222297	06 June 2024	94.0	93.9
ACO-B15	ACO	6236	00222300	06 June 2024	93.9	93.9
ACO-B38	ACO	6236	00192029	06 June 2024	93.9	93.9
ACO-B40	ACO	6236	00192031	06 June 2024	94.1	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

เอกสารแนบ 4-5

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในสถานประกอบการ



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)					
					1	2	3	1	2	3	y	R ²	
B01	SKC	224-PCXR4	262101	03/01/2024	1,000	1,500	2,000	993	1,497	1,998	1.002x - 4.467	1.000	
B02	SKC	224-PCXR4	626166	03/01/2024	1,000	1,500	2,000	1,003	1,505	2,001	1.009x - 19.803	0.999	
B03	SKC	224-PCXR4	612968	03/01/2024	1,000	1,500	2,000	996	1,494	2,001	1.006x - 12.799	1.000	
B04	SKC	224-PCXR4	602804	04/01/2024	1,000	1,500	2,000	1,000	1,502	1,994	0.999x + 0.239	1.000	
B05	SKC	224-PCXR4	612693	04/01/2024	1,000	1,500	2,000	1,003	1,500	2,002	1.011x - 21.266	0.999	
B06	SKC	224-PCXR4	262188	05/01/2024	1,000	1,500	2,000	1,002	1,508	2,006	1.007x - 12.077	0.999	
B07	SKC	224-PCXR4	626262	05/01/2024	1,000	1,500	2,000	998	1,492	1,997	0.994x + 4.810	1.000	
B08	SKC	224-PCXR4	626100	04/01/2024	1,000	1,500	2,000	1,002	1,500	2,003	1.013x - 24.585	0.999	
B09	SKC	224-PCXR4	626479	05/01/2024	1,000	1,500	2,000	998	1,490	1,994	0.993x + 3.837	1.000	
B10	SKC	224-PCXR4	091950	04/01/2024	1,000	1,500	2,000	993	1,502	2,001	1.017x - 34.867	0.999	
B11	SKC	224-PCXR8	564315	05/01/2024	1,000	1,500	2,000	996	1,492	1,999	1.004x - 7.965	1.000	
B12	SKC	224-PCXR4	034656	05/01/2024	1,000	1,500	2,000	1,003	1,502	2,003	1.010x - 19.683	0.999	
B13	SKC	224-PCXR4	602073	04/01/2024	1,000	1,500	2,000	997	1,500	1,998	1.000x - 0.862	1.000	
B14	SKC	224-PCXR4	626313	03/01/2024	1,000	1,500	2,000	999	1,492	1,989	0.991x + 8.479	1.000	
B15	SKC	224-PCXR4	626474	03/01/2024	1,000	1,500	2,000	1,002	1,502	2,005	1.012x - 21.697	0.999	
B16	SKC	224-PCXR4	626477	04/01/2024	1,000	1,500	2,000	995	1,504	2,001	1.007x - 16.807	1.000	
B17	SKC	224-PCXR4	626860	04/01/2024	1,000	1,500	2,000	997	1,494	1,991	0.997x + 0.331	1.000	
B18	SKC	224-PCXR4	691484	05/01/2024	1,000	1,500	2,000	1,003	1,500	2,002	1.009x - 17.214	0.999	
B19	SKC	224-PCXR4	691599	05/01/2024	1,000	1,500	2,000	993	1,503	1,999	1.005x - 8.906	1.000	
B20	SKC	224-PCXR4	691587	05/01/2024	1,000	1,500	2,000	991	1,504	2,000	1.016x - 33.407	0.999	
B21	SKC	224-PCXR4	691531	04/01/2024	1,000	1,500	2,000	993	1,499	1,995	1.001x - 5.540	1.000	
B22	SKC	224-PCXR4	691654	03/01/2024	1,000	1,500	2,000	1,003	1,501	2,004	1.011x - 19.966	0.999	
B23	SKC	224-PCXR4	798393	03/01/2024	1,000	1,500	2,000	993	1,507	2,002	1.017x - 33.276	0.999	
B24	SKC	224-PCXR4	626363	03/01/2024	1,000	1,500	2,000	1,000	1,502	2,001	1.012x - 23.859	0.999	
B25	SKC	224-PCXR4	798489	03/01/2024	1,000	1,500	2,000	1,001	1,492	2,001	0.998x + 0.694	1.000	
B26	SKC	224-PCXR4	798479	04/01/2024	1,000	1,500	2,000	1,000	1,500	1,993	0.996x + 4.204	1.000	
B27	SKC	224-PCXR4	691673	04/01/2024	1,000	1,500	2,000	994	1,503	2,002	1.016x - 30.902	0.999	
B28	SKC	224-PCXR4	691570	05/01/2024	1,000	1,500	2,000	1,003	1,500	2,001	1.009x - 18.263	0.999	
B29	SKC	224-PCXR4	626472	04/01/2024	1,000	1,500	2,000	1,002	1,498	2,000	1.002x - 3.909	1.000	
B30	SKC	224-PCXR4	691489	04/01/2024	1,000	1,500	2,000	1,003	1,509	2,006	1.008x - 11.399	1.000	
B31	SKC	224-PCXR4	691509	03/01/2024	1,000	1,500	2,000	993	1,494	1,997	1.005x - 11.275	1.000	
B32	SKC	224-PCXR4	091567	03/01/2024	1,000	1,500	2,000	991	1,503	2,000	1.015x - 30.886	0.999	
B33	SKC	224-PCXR4	091756	05/01/2024	1,000	1,500	2,000	993	1,498	1,992	0.999x - 2.317	1.000	
B34	SKC	224-PCXR4	612962	05/01/2024	1,000	1,500	2,000	1,002	1,501	2,002	1.007x - 13.995	1.000	
B35	SKC	224-PCXR4	602682	05/01/2024	1,000	1,500	2,000	996	1,498	1,996	1.000x - 5.285	1.000	
B36	SKC	224-PCXR4	626164	04/01/2024	1,000	1,500	2,000	999	1,510	1,999	1.004x - 10.131	0.999	
B37	SKC	224-PCXR4	626256	05/01/2024	1,000	1,500	2,000	994	1,506	1,999	1.013x - 28.454	0.999	
B38	SKC	224-PCXR4	626167	03/01/2024	1,000	1,500	2,000	997	1,498	1,998	1.003x - 5.983	1.000	
B39	SKC	224-PCXR4	034637	03/01/2024	1,000	1,500	2,000	1,005	1,501	2,001	1.006x - 15.188	0.999	
B40	SKC	224-PCXR4	798349	05/01/2024	1,000	1,500	2,000	994	1,505	2,000	1.014x - 29.004	0.999	

Calibrated by :

(Mr. Adul Ungsom)

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 \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
B41	SKC	224-PCXR4	612669	05/01/2024	1,000	1,500	2,000	999	1,496	1,991	0.996x + 1.914	1.000
B42	SKC	224-PCXR4	626041	03/01/2024	1,000	1,500	2,000	1,004	1,498	1,991	0.986x + 19.248	1.000
B43	SKC	224-PCXR4	034636	03/01/2024	1,000	1,500	2,000	1,000	1,501	1,992	0.991x + 11.682	1.000
B44	SKC	224-PCXR8	529341	03/01/2024	1,000	1,500	2,000	1,002	1,502	2,002	1.004x - 6.860	1.000
B45	SKC	224-PCXR8	529594	03/01/2024	1,000	1,500	2,000	1,001	1,501	1,987	0.987x + 16.026	1.000
B46	SKC	224-PCXR8	566743	04/01/2024	1,000	1,500	2,000	995	1,506	2,002	1.013x - 27.915	0.999
B47	SKC	224-PCXR8	566747	04/01/2024	1,000	1,500	2,000	1,002	1,502	2,004	1.010x - 21.769	0.999
B48	SKC	224-PCXR8	566753	04/01/2024	1,000	1,500	2,000	1,000	1,493	1,998	0.997x + 0.239	1.000
B49	SKC	224-PCXR8	566780	04/01/2024	1,000	1,500	2,000	1,003	1,502	2,006	1.011x - 21.550	0.999
B50	SKC	224-PCXR8	500400	03/01/2024	1,000	1,500	2,000	1,001	1,496	2,002	1.001x - 2.900	1.000
B51	SKC	224-PCXR8	500365	03/01/2024	1,000	1,500	2,000	996	1,502	2,000	1.011x - 25.709	0.999
B52	SKC	224-PCXR8	093186	03/01/2024	1,000	1,500	2,000	994	1,496	1,992	0.995x + 1.751	1.000
B53	SKC	224-PCXR8	707670	05/01/2024	1,000	1,500	2,000	1,002	1,501	2,002	1.008x - 16.042	0.999
B54	SKC	224-PCXR3	509821	05/01/2024	1,000	1,500	2,000	995	1,501	2,002	1.016x - 32.282	0.999
B55	SKC	224-PCXR3	510710	05/01/2024	1,000	1,500	2,000	1,004	1,495	1,992	0.991x + 7.666	1.000
B56	SKC	224-PCXR3	511450	05/01/2024	1,000	1,500	2,000	1,002	1,500	2,001	1.005x - 8.559	1.000
B57	SKC	224-PCXR3	510798	03/01/2024	1,000	1,500	2,000	997	1,492	1,999	0.999x - 2.122	1.000
B58	SKC	224-PCXR3	509852	03/01/2024	1,000	1,500	2,000	1,000	1,500	1,999	1.007x - 19.073	0.999
B59	SKC	224-PCXR3	509862	04/01/2024	1,000	1,500	2,000	995	1,503	1,995	0.998x + 2.118	1.000
B60	SKC	224-PCXR3	512655	04/01/2024	1,000	1,500	2,000	1,004	1,510	2,004	1.005x - 6.421	0.999
B61	SKC	224-PCXR3	503915	04/01/2024	1,000	1,500	2,000	993	1,492	1,999	1.003x - 11.706	1.000
B62	SKC	224-PCXR3	505975	03/01/2024	1,000	1,500	2,000	999	1,494	1,996	0.996x + 0.822	1.000
B63	SKC	224-PCXR3	511432	03/01/2024	1,000	1,500	2,000	990	1,501	2,000	1.017x - 36.259	0.999
B64	SKC	224-PCXR3	508302	03/01/2024	1,000	1,500	2,000	998	1,492	1,989	0.990x + 10.175	1.000
B65	SKC	224-PCXR3	508310	03/01/2024	1,000	1,500	2,000	1,002	1,501	2,002	1.007x - 13.537	1.000
B66	SKC	224-PCXR3	509861	04/01/2024	1,000	1,500	2,000	1,002	1,491	1,992	0.988x + 13.744	1.000
B67	SKC	224-PCXR3	506295	04/01/2024	1,000	1,500	2,000	995	1,508	2,004	1.007x - 12.843	1.000
B68	SKC	224-PCXR3	505872	04/01/2024	1,000	1,500	2,000	1,002	1,491	1,998	0.995x + 4.040	1.000
B69	SKC	224-PCXR3	508375	04/01/2024	1,000	1,500	2,000	1,003	1,499	2,000	1.009x - 18.977	0.999
B70	SKC	224-PCXR3	510623	05/01/2024	1,000	1,500	2,000	992	1,493	1,996	1.002x - 7.730	1.000
B71	SKC	224-PCXR3	508367	05/01/2024	1,000	1,500	2,000	994	1,506	2,002	1.015x - 31.561	0.999
B72	SKC	224-PCXR3	505977	03/01/2024	1,000	1,500	2,000	1,003	1,499	1,994	0.991x + 9.042	1.000
B73	SKC	224-PCXR3	512606	04/01/2024	1,000	1,500	2,000	1,001	1,501	2,004	1.008x - 14.346	1.000
B74	SKC	224-PCXR3	505993	04/01/2024	1,000	1,500	2,000	996	1,497	1,995	1.001x - 7.036	1.000
B75	SKC	224-PCXR3	509820	05/01/2024	1,000	1,500	2,000	996	1,496	1,991	0.996x + 1.432	1.000
B76	SKC	224-PCXR3	509811	05/01/2024	1,000	1,500	2,000	993	1,499	1,999	1.006x - 14.283	1.000
B77	SKC	224-PCXR3	508301	05/01/2024	1,000	1,500	2,000	1,001	1,501	2,003	1.013x - 25.406	0.999
B78	SKC	224-PCXR3	510677	05/01/2024	1,000	1,500	2,000	995	1,503	1,999	1.012x - 27.520	0.999
B79	SKC	224-PCXR3	510920	05/01/2024	1,000	1,500	2,000	994	1,494	1,994	1.001x - 6.178	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	05/01/2024	1,000	1,500	2,000	1,002	1,498	2,002	1.012x - 24.186	0.999
B81	SKC	224-PCXR3	503480	05/01/2024	1,000	1,500	2,000	996	1,499	2,000	1.014x - 30.165	0.999
B82	SKC	224-PCXR3	505673	04/01/2024	1,000	1,500	2,000	994	1,498	1,996	1.000x - 4.746	1.000
B83	SKC	224-PCXR3	510785	04/01/2024	1,000	1,500	2,000	1,010	1,500	1,999	1.003x - 7.793	0.999
B84	SKC	224-PCXR3	508333	04/01/2024	1,000	1,500	2,000	997	1,498	1,991	0.993x + 4.810	1.000
B85	SKC	224-PCXR3	505757	05/01/2024	1,000	1,500	2,000	994	1,502	1,998	1.006x - 14.562	1.000
B86	SKC	224-PCXR3	512625	03/01/2024	1,000	1,500	2,000	1,015	1,503	2,004	0.999x + 3.063	0.999
B87	SKC	224-PCXR3	504324	03/01/2024	1,000	1,500	2,000	1,000	1,496	2,000	1.000x - 0.710	1.000
B88	SKC	224-PCXR3	508307	03/01/2024	1,000	1,500	2,000	995	1,498	1,993	0.997x + 0.574	1.000
B89	SKC	224-PCXR3	509860	03/01/2024	1,000	1,500	2,000	1,000	1,499	2,004	1.010x - 17.509	1.000
B90	SKC	224-PCXR3	508366	04/01/2024	1,000	1,500	2,000	995	1,508	2,000	1.005x - 10.091	1.000
B91	SKC	224-PCXR3	510919	04/01/2024	1,000	1,500	2,000	1,000	1,500	1,997	0.992x + 7.522	1.000
B92	SKC	224-PCXR3	510987	04/01/2024	1,000	1,500	2,000	1,002	1,501	1,999	0.999x + 1.097	1.000
B93	SKC	224-PCXR3	509845	04/01/2024	1,000	1,500	2,000	996	1,496	2,004	1.009x - 15.822	1.000
B94	SKC	224-PCXR8	A127871	05/01/2024	1,000	1,500	2,000	1,000	1,499	2,002	1.007x - 19.184	0.999
B95	SKC	224-PCXR8	A127921	05/01/2024	1,000	1,500	2,000	994	1,502	2,002	1.015x - 30.559	0.999
B96	SKC	224-PCXR8	A127942	04/01/2024	1,000	1,500	2,000	998	1,499	1,996	1.001x - 3.486	1.000
B97	SKC	224-PCXR8	A127955	05/01/2024	1,000	1,500	2,000	1,003	1,501	2,003	1.010x - 20.082	0.999
B98	SKC	224-PCXR8	A127956	05/01/2024	1,000	1,500	2,000	996	1,497	1,998	1.003x - 6.330	1.000

Calibrated by :

[Signature]

SALE, PUMP, CALIBRATION

Approved by :

[Signature]



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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	05/04/2024	1,000	1,500	2,000	993	1,496	1,998	1.001x - 3.430	1.000
B02	SKC	224-PCXR4	626166	05/04/2024	1,000	1,500	2,000	1,004	1,506	2,000	1.007x - 16.572	0.999
B03	SKC	224-PCXR4	612968	05/04/2024	1,000	1,500	2,000	997	1,498	2,004	1.008x - 13.756	1.000
B04	SKC	224-PCXR4	602804	08/04/2024	1,000	1,500	2,000	1,001	1,511	1,993	0.997x + 4.427	1.000
B05	SKC	224-PCXR4	612693	08/04/2024	1,000	1,500	2,000	1,005	1,510	2,002	1.009x - 16.400	0.999
B06	SKC	224-PCXR4	262188	08/04/2024	1,000	1,500	2,000	1,003	1,510	2,004	1.005x - 8.687	0.999
B07	SKC	224-PCXR4	626262	05/04/2024	1,000	1,500	2,000	997	1,500	1,996	0.995x + 4.930	1.000
B08	SKC	224-PCXR4	626100	04/04/2024	1,000	1,500	2,000	1,003	1,508	2,002	1.011x - 19.679	0.999
B09	SKC	224-PCXR4	626479	08/04/2024	1,000	1,500	2,000	996	1,499	1,994	0.994x + 3.159	1.000
B10	SKC	224-PCXR4	091950	04/04/2024	1,000	1,500	2,000	995	1,512	2,000	1.015x - 30.041	0.998
B11	SKC	224-PCXR8	564315	08/04/2024	1,000	1,500	2,000	994	1,494	2,000	1.006x - 10.717	1.000
B12	SKC	224-PCXR4	034656	08/04/2024	1,000	1,500	2,000	1,005	1,511	2,002	1.008x - 14.857	0.999
B13	SKC	224-PCXR4	602073	05/04/2024	1,000	1,500	2,000	998	1,501	1,997	0.998x + 2.728	1.000
B14	SKC	224-PCXR4	626313	04/04/2024	1,000	1,500	2,000	998	1,491	1,991	0.994x + 4.411	1.000
B15	SKC	224-PCXR4	626474	04/04/2024	1,000	1,500	2,000	1,004	1,505	2,003	1.009x - 16.951	0.999
B16	SKC	224-PCXR4	626477	04/04/2024	1,000	1,500	2,000	997	1,502	2,000	1.005x - 13.936	1.000
B17	SKC	224-PCXR4	626860	05/04/2024	1,000	1,500	2,000	998	1,495	1,990	0.995x + 3.681	1.000
B18	SKC	224-PCXR4	691484	05/04/2024	1,000	1,500	2,000	1,004	1,506	2,001	1.007x - 12.627	0.999
B19	SKC	224-PCXR4	691599	08/04/2024	1,000	1,500	2,000	994	1,507	1,997	1.003x - 4.519	1.000
B20	SKC	224-PCXR4	691587	08/04/2024	1,000	1,500	2,000	993	1,514	1,999	1.013x - 27.943	0.998
B21	SKC	224-PCXR4	691531	08/04/2024	1,000	1,500	2,000	997	1,498	1,993	0.996x - 1.121	1.000
B22	SKC	224-PCXR4	691654	08/04/2024	1,000	1,500	2,000	1,002	1,500	2,005	1.013x - 23.316	0.999
B23	SKC	224-PCXR4	798393	09/04/2024	1,000	1,500	2,000	995	1,506	1,999	1.014x - 28.370	0.999
B24	SKC	224-PCXR4	626363	04/04/2024	1,000	1,500	2,000	997	1,505	2,003	1.016x - 28.805	0.999
B25	SKC	224-PCXR4	798489	04/04/2024	1,000	1,500	2,000	1,000	1,494	2,002	0.999x - 1.300	1.000
B26	SKC	224-PCXR4	798479	05/04/2024	1,000	1,500	2,000	1,001	1,501	1,997	0.998x + 2.010	1.000
B27	SKC	224-PCXR4	691673	08/04/2024	1,000	1,500	2,000	995	1,505	2,001	1.014x - 28.031	0.999
B28	SKC	224-PCXR4	691570	08/04/2024	1,000	1,500	2,000	1,004	1,498	2,000	1.007x - 15.352	0.999
B29	SKC	224-PCXR4	626472	08/04/2024	1,000	1,500	2,000	1,003	1,496	2,003	1.003x - 5.903	1.000
B30	SKC	224-PCXR4	691489	05/04/2024	1,000	1,500	2,000	1,005	1,511	2,005	1.007x - 8.527	0.999
B31	SKC	224-PCXR4	691509	09/04/2024	1,000	1,500	2,000	991	1,495	1,998	1.006x - 14.067	1.000
B32	SKC	224-PCXR4	091567	05/04/2024	1,000	1,500	2,000	993	1,504	1,999	1.013x - 26.659	0.999
B33	SKC	224-PCXR4	091756	05/04/2024	1,000	1,500	2,000	994	1,500	1,995	1.000x - 2.836	1.000
B34	SKC	224-PCXR4	612962	08/04/2024	1,000	1,500	2,000	1,004	1,503	2,001	1.006x - 11.243	0.999
B35	SKC	224-PCXR4	602682	08/04/2024	1,000	1,500	2,000	997	1,496	1,995	0.998x - 2.772	1.000
B36	SKC	224-PCXR4	626164	05/04/2024	1,000	1,500	2,000	997	1,506	2,000	1.006x - 14.159	0.999
B37	SKC	224-PCXR4	626256	04/04/2024	1,000	1,500	2,000	997	1,507	1,998	1.010x - 23.269	0.999
B38	SKC	224-PCXR4	626167	04/04/2024	1,000	1,500	2,000	996	1,496	1,997	1.004x - 7.259	1.000
B39	SKC	224-PCXR4	034637	04/04/2024	1,000	1,500	2,000	1,007	1,499	2,000	1.003x - 11.120	0.999
B40	SKC	224-PCXR4	798349	08/04/2024	1,000	1,500	2,000	995	1,506	2,001	1.013x - 26.810	0.999

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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7 Soi Phaholyothin 24, Phaholyothin Rd., Jomjol, 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
B41	SKC	224-PCXR4	612669	05/04/2024	1,000	1,500	2,000	1,001	1,498	1,990	0.994x + 6.342	1.000
B42	SKC	224-PCXR4	626041	04/04/2024	1,000	1,500	2,000	1,006	1,496	1,990	0.984x + 20.844	1.000
B43	SKC	224-PCXR4	034636	04/04/2024	1,000	1,500	2,000	998	1,498	1,989	0.989x + 12.360	1.000
B44	SKC	224-PCXR8	529341	09/04/2024	1,000	1,500	2,000	1,000	1,501	2,002	1.005x - 9.213	1.000
B45	SKC	224-PCXR8	529594	04/04/2024	1,000	1,500	2,000	1,002	1,502	1,989	0.988x + 16.584	1.000
B46	SKC	224-PCXR8	566743	04/04/2024	1,000	1,500	2,000	996	1,507	2,001	1.012x - 24.724	0.999
B47	SKC	224-PCXR8	566747	08/04/2024	1,000	1,500	2,000	1,005	1,500	2,002	1.007x - 16.424	0.999
B48	SKC	224-PCXR8	566753	09/04/2024	1,000	1,500	2,000	998	1,492	1,997	0.998x - 1.157	1.000
B49	SKC	224-PCXR8	566780	08/04/2024	1,000	1,500	2,000	1,004	1,503	2,005	1.009x - 18.040	0.999
B50	SKC	224-PCXR8	500400	04/04/2024	1,000	1,500	2,000	1,003	1,495	2,003	1.000x - 1.783	1.000
B51	SKC	224-PCXR8	500363	04/04/2024	1,000	1,500	2,000	995	1,500	2,002	1.013x - 28.701	0.999
B52	SKC	224-PCXR8	093186	04/04/2024	1,000	1,500	2,000	992	1,494	1,991	0.996x + 0.116	1.000
B53	SKC	224-PCXR8	707670	08/04/2024	1,000	1,500	2,000	1,000	1,502	2,001	1.009x - 16.999	0.999
B54	SKC	224-PCXR3	509821	08/04/2024	1,000	1,500	2,000	996	1,503	2,002	1.015x - 30.009	0.999
B55	SKC	224-PCXR3	510710	05/04/2024	1,000	1,500	2,000	1,000	1,494	1,993	0.995x + 0.965	1.000
B56	SKC	224-PCXR3	511450	09/04/2024	1,000	1,500	2,000	1,004	1,499	2,000	1.002x - 4.651	1.000
B57	SKC	224-PCXR3	510798	08/04/2024	1,000	1,500	2,000	996	1,494	1,998	1.000x - 2.680	1.000
B58	SKC	224-PCXR3	509852	08/04/2024	1,000	1,500	2,000	1,002	1,501	2,000	1.006x - 16.480	0.999
B59	SKC	224-PCXR3	509862	08/04/2024	1,000	1,500	2,000	997	1,501	1,998	0.999x + 1.041	1.000
B60	SKC	224-PCXR3	512655	05/04/2024	1,000	1,500	2,000	1,005	1,507	2,003	1.003x - 4.627	1.000
B61	SKC	224-PCXR3	503915	05/04/2024	1,000	1,500	2,000	993	1,490	2,000	1.004x - 12.823	1.000
B62	SKC	224-PCXR3	505975	05/04/2024	1,000	1,500	2,000	1,001	1,495	1,997	0.995x + 2.616	1.000
B63	SKC	224-PCXR3	511432	05/04/2024	1,000	1,500	2,000	993	1,503	1,999	1.014x - 30.715	0.999
B64	SKC	224-PCXR3	508302	08/04/2024	1,000	1,500	2,000	1,000	1,493	1,987	0.988x + 13.991	1.000
B65	SKC	224-PCXR3	508310	09/04/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.006x - 12.021	1.000
B66	SKC	224-PCXR3	509861	08/04/2024	1,000	1,500	2,000	1,004	1,489	1,990	0.986x + 16.775	1.000
B67	SKC	224-PCXR3	506295	04/04/2024	1,000	1,500	2,000	997	1,506	2,003	1.004x - 9.094	1.000
B68	SKC	224-PCXR3	505872	04/04/2024	1,000	1,500	2,000	1,004	1,490	1,997	0.992x + 7.829	1.000
B69	SKC	224-PCXR3	508375	04/04/2024	1,000	1,500	2,000	1,005	1,500	1,998	1.006x - 13.832	0.999
B70	SKC	224-PCXR3	510623	08/04/2024	1,000	1,500	2,000	995	1,491	1,996	1.000x - 4.938	1.000
B71	SKC	224-PCXR3	508367	09/04/2024	1,000	1,500	2,000	996	1,504	2,000	1.012x - 27.572	0.999
B72	SKC	224-PCXR3	505977	09/04/2024	1,000	1,500	2,000	1,001	1,500	1,995	0.994x + 5.791	1.000
B73	SKC	224-PCXR3	512606	04/04/2024	1,000	1,500	2,000	1,002	1,499	2,002	1.007x - 12.671	1.000
B74	SKC	224-PCXR3	505993	04/04/2024	1,000	1,500	2,000	995	1,495	1,996	1.003x - 9.987	1.000
B75	SKC	224-PCXR3	509820	05/04/2024	1,000	1,500	2,000	998	1,497	1,993	0.997x + 1.432	1.000
B76	SKC	224-PCXR3	509811	05/04/2024	1,000	1,500	2,000	992	1,497	2,000	1.008x - 17.753	1.000
B77	SKC	224-PCXR3	508301	05/04/2024	1,000	1,500	2,000	1,004	1,499	2,001	1.010x - 19.743	0.999
B78	SKC	224-PCXR3	510677	08/04/2024	1,000	1,500	2,000	997	1,505	2,001	1.013x - 27.321	0.999
B79	SKC	224-PCXR3	510920	09/04/2024	1,000	1,500	2,000	995	1,495	1,993	1.000x - 4.702	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	09/04/2024	1,000	1,500	2,000	1,003	1,501	2,004	1.013x - 23.428	0.999
B81	SKC	224-PCXR3	503480	04/04/2024	1,000	1,500	2,000	998	1,499	2,003	1.015x - 30.384	0.999
B82	SKC	224-PCXR3	505673	04/04/2024	1,000	1,500	2,000	995	1,496	1,998	1.001x - 5.105	1.000
B83	SKC	224-PCXR3	510785	08/04/2024	1,000	1,500	2,000	1,012	1,499	2,000	1.002x - 7.155	0.999
B84	SKC	224-PCXR3	508333	08/04/2024	1,000	1,500	2,000	998	1,500	1,990	0.991x + 8.599	1.000
B85	SKC	224-PCXR3	505757	09/04/2024	1,000	1,500	2,000	993	1,503	2,000	1.008x - 16.396	1.000
B86	SKC	224-PCXR3	512625	04/04/2024	1,000	1,500	2,000	1,011	1,501	2,002	1.000x + 0.072	0.999
B87	SKC	224-PCXR3	504324	04/04/2024	1,000	1,500	2,000	998	1,495	2,001	1.003x - 4.738	1.000
B88	SKC	224-PCXR3	508307	08/04/2024	1,000	1,500	2,000	997	1,500	1,994	0.996x + 3.047	1.000
B89	SKC	224-PCXR3	509860	04/04/2024	1,000	1,500	2,000	1,001	1,501	2,006	1.011x - 17.174	1.000
B90	SKC	224-PCXR3	508366	08/04/2024	1,000	1,500	2,000	997	1,510	2,001	1.004x - 8.814	1.000
B91	SKC	224-PCXR3	510919	04/04/2024	1,000	1,500	2,000	1,001	1,502	1,998	0.993x + 7.522	1.000
B92	SKC	224-PCXR3	510987	04/04/2024	1,000	1,500	2,000	1,000	1,504	2,000	1.001x - 0.658	1.000
B93	SKC	224-PCXR3	509845	08/04/2024	1,000	1,500	2,000	998	1,495	2,003	1.007x - 13.389	1.000
B94	SKC	224-PCXR8	A127871	08/04/2024	1,000	1,500	2,000	1,001	1,501	2,004	1.008x - 19.942	0.999
B95	SKC	224-PCXR8	A127921	08/04/2024	1,000	1,500	2,000	996	1,504	2,005	1.016x - 31.417	0.999
B96	SKC	224-PCXR8	A127942	08/04/2024	1,000	1,500	2,000	999	1,500	2,000	1.003x - 5.715	1.000
B97	SKC	224-PCXR8	A127955	08/04/2024	1,000	1,500	2,000	1,004	1,502	2,005	1.011x - 20.122	0.999
B98	SKC	224-PCXR8	A127956	08/04/2024	1,000	1,500	2,000	995	1,496	2,000	1.004x - 9.122	1.000

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

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	04/01/2024	500	1,000	2,000	506.5	991.1	1974.3	0.989x + 9.286	1.000
H-B02	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	496.7	997.6	1996.1	0.994x + 4.509	1.000
H-B03	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	497.6	988.8	2009.6	1.004x - 14.177	0.999
H-B04	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.6	998.7	2006.5	0.997x - 0.777	1.000
H-B05	Dwyer	VFB-65	05/01/2024	500	1,000	2,000	500.4	997.3	1974.3	0.980x + 21.602	0.999
H-B06	Dwyer	VFB-65	05/01/2024	500	1,000	2,000	504.9	994.8	1984.0	1.003x - 5.213	1.000
H-B07	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	502.6	990.6	2016.7	1.001x - 0.998	1.000
H-B08	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	499.7	998.7	1979.8	0.996x + 3.580	0.999
H-B09	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	504.1	1004.3	2010.7	0.993x + 13.998	1.000
H-B10	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	496.2	999.3	2009.2	0.996x + 3.860	1.000

Calibrated by :

(Mr.Adul Dangklorn)

Approved by :

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	04/01/2024	50	100	200	50.7	98.5	198.9	0.986x + 0.884	1.000
L-B02	Dwyer	VFA-21	04/01/2024	50	100	200	50.6	99.2	198.7	0.997x + 0.603	0.999
L-B03	Dwyer	VFA-21	04/01/2024	50	100	200	50.1	99.2	198.3	1.010x - 1.750	1.000
L-B04	Dwyer	VFA-21	03/01/2024	50	100	200	49.2	102.0	200.5	1.011x - 0.502	1.000
L-B05	Dwyer	VFA-21	05/01/2024	50	100	200	50.5	99.4	200.8	0.999x + 0.948	0.999
L-B06	Dwyer	VFA-21	05/01/2024	50	100	200	50.5	99.0	202.3	1.010x - 0.360	1.000
L-B07	Dwyer	VFA-21	03/01/2024	50	100	200	49.5	100.3	200.1	1.013x - 1.486	1.000
L-B08	Dwyer	VFA-21	04/01/2024	50	100	200	50.7	101.2	199.3	1.000x + 0.298	1.000
L-B09	Dwyer	VFA-21	04/01/2024	50	100	200	50.5	99.0	200.2	0.992x + 1.365	1.000
L-B10	Dwyer	VFA-21	03/01/2024	50	100	200	50.7	98.5	203.2	0.998x + 1.334	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-801	Dwyer	VFB-65	08/04/2024	500	1,000	2,000	504.3	992.1	1976.8	0.991x + 6.353	1.000
H-802	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	496.5	998.8	1996.7	0.995x + 4.247	1.000
H-803	Dwyer	VFB-65	05/04/2024	500	1,000	2,000	498.6	991.4	2011.0	1.003x - 12.161	0.999
H-804	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	501.4	1000.9	2008.3	0.998x - 1.566	1.000
H-805	Dwyer	VFB-65	08/04/2024	500	1,000	2,000	502.9	999.5	1974.5	0.979x + 24.520	0.999
H-806	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	504.7	996.0	1984.4	1.005x - 6.145	1.000
H-807	Dwyer	VFB-65	05/04/2024	500	1,000	2,000	502.2	992.8	2017.1	1.000x - 0.160	1.000
H-808	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	500.3	1000.7	1980.2	0.995x + 5.203	0.999
H-809	Dwyer	VFB-65	09/04/2024	500	1,000	2,000	503.3	1005.0	2011.1	0.994x + 13.348	1.000
H-810	Dwyer	VFB-65	08/04/2024	500	1,000	2,000	498.2	1001.7	2008.8	0.995x + 5.854	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

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-801	Dwyer	VFA-21	08/04/2024	50	100	200	50.7	98.8	199.3	0.987x + 1.039	1.000
L-802	Dwyer	VFA-21	04/04/2024	50	100	200	50.2	98.8	198.3	0.998x + 0.180	0.999
L-803	Dwyer	VFA-21	05/04/2024	50	100	200	50.5	98.8	197.9	1.012x - 1.915	1.000
L-804	Dwyer	VFA-21	04/04/2024	50	100	200	49.8	101.6	201.9	1.010x - 0.036	1.000
L-805	Dwyer	VFA-21	08/04/2024	50	100	200	50.9	99.0	201.2	0.998x + 0.999	1.000
L-806	Dwyer	VFA-21	04/04/2024	50	100	200	50.1	99.4	202.7	1.011x - 0.423	1.000
L-807	Dwyer	VFA-21	05/04/2024	50	100	200	50.3	99.9	200.5	1.009x - 0.861	1.000
L-808	Dwyer	VFA-21	04/04/2024	50	100	200	50.6	100.8	198.9	1.002x - 0.189	1.000
L-809	Dwyer	VFA-21	09/04/2024	50	100	200	50.1	99.4	200.6	0.997x + 0.731	1.000
L-810	Dwyer	VFA-21	08/04/2024	50	100	200	51.0	98.9	202.8	0.996x + 1.709	0.999

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.

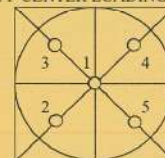
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

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

END OF CALIBRATION REPORT

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.comCERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

ID No : BA05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.CALIBRATION DATE : 08-Mar-24APPROVED BY : ISSUED DATE : 14-Mar-24RECEIVED DATE : 08-Mar-24THIS 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

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www.qcalibration.com

CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU

MANUFACTURER : METTLER TOLEDO S/N : 1126422905

ID No : BA05/50 RECEIVED DATE : 08-Mar-24

AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 08-Mar-24

AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 53 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000065
0.02	0.02001	-0.00001	0.000065
0.10	0.10002	-0.00002	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	9.99994	0.00006	0.000070
20.00	20.00008	-0.00008	0.000078
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	50.0000
2	50.0000
3	50.0000
4	50.0000
5	50.0000
OFF-CENTER LOADING	0.0000

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

END OF CALIBRATION REPORT

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

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-01852714
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2023	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2023

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the Turbomass/Clarus MS SQ8 MS by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3	
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

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

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



Procedure Checklist

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

General:

- ☒ Column type Elite 5ms
- ☒ Carrier gas flow rate 1 ml/min.
- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Check incoming AC line voltage for proper levels and grounding.

Mechanical:

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

Electrical:

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

Operational Tests:

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



PC Maintenance:

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

Review:

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

Additional Comments


Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.</i>		
<i>This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.</i>		
Review of Preventive Maintenance:		
Authorized PerkinElmer Representative Monchai Kitcharoenkeat		Date: 22-Feb-2023 (DD-MMM-YYYY)
Authorized Customer Representative:		Date: 22-Feb-2023 (DD-MMM-YYYY)

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

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	1 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-02760693
Date PM Performed: (DD-MMM-YYY)	22-Feb-2024	Next PM Due Date: (DD-MMM-YYY)	22-Aug-2024

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

The purpose of this PM is to ensure the continued functionality of the Turbomass/Clarus MS SQ8 MS by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3.1	PSS,PSS,FID
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX 1.0	

Parts lists

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

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
N/A				

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

Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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


Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

เอกสารแนบ 4-6

เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

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

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

FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	93.85	-0.15	± 0.10	±0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	±2.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.65	± 0.50	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev.4

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



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

Noise B_095/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B13	ACO	6236	00152084	02 April 2024	93.9	93.9
ACO-B16	ACO	6236	00172039	02 April 2024	94.0	93.9
ACO-B18	ACO	6236	00172048	02 April 2024	94.0	93.9
ACO-B26	ACO	6236	00182007	02 April 2024	94.0	93.9
ACO-B27	ACO	6236	00182008	02 April 2024	93.9	93.9
ACO-B33	ACO	6236	00182015	02 April 2024	93.9	93.9
ACO-B37	ACO	6236	00192028	02 April 2024	94.0	93.9
ACO-B40	ACO	6236	00192031	02 April 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

Approved by :