

## ภาคผนวกที่ 4

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### 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. B21, B31, B37, B44, B45	Digital Balance
PM <sub>10</sub>	High Volume PM <sub>10</sub> Air Sampler No. B06, B15, B31, B34, R01	Digital Balance
NO <sub>2</sub>	NO Analyzer No. B05, B07, B10, B12, B22	NO Analyzer No. B05, B07, B10, B12, B22
SO <sub>2</sub>	SO <sub>2</sub> Analyzer No. B01, B02, B06, B07, B11	SO <sub>2</sub> Analyzer No. B01, B02, B06, B07, B11
คุณภาพอากาศจากปล่องระบาย		
Particulate	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	Digital Balance
NO <sub>x</sub>	Vacuum Gauge	Spectrophotometer
SO <sub>2</sub>	Personal Pump SKC No. B06, B27, B72 Rotameter No. H-B07, B09	Digital Balance
CO	Personal Pump SKC No. B06, B17, B18, B27, B39, B88 Rotameter No. H-B07, B09	CO Analyzer No. B01
HF	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	Ion Chromatography
HCl	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	Ion Chromatography
Total Hydrocarbon	Personal Pump SKC No. B17, B18, B29 Rotameter No. H-B07, B09	THC Analyzer No. B01
Lead	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Cadmium	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Mercury	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	AAS
Arsenic	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	AAS
Nickel	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Chromium	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Beryllium	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Antimony	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Copper	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศจากปล่องระบาย (ต่อ)		
Manganese	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Tin	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Cobalt	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
Total Sb, As, Cr, Co, Cu, Mn, Ni และ Sn	Console No. B03, B05, R02 Pitot Tube No. B04, B35, B36	ICP
VOCs	Personal Pump SKC No. B18, B29 Rotameter No. L-B07, B09	GC/MS
Dioxin	Console No. B03 Pitot Tube No. B18	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-B02, B03, B04, B10, B11, B15, B16, B19, B24, B28, B30, B32, B33, B36, B38, B39, B43, R55, R56	

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ Total Dust	Personal Pump SKC No. B47, B52, B81, B88, B92 Rotameter No. H-B07, B08, B09	Digital Balance
Respirable Dust	Personal Pump SKC No. B53, B51, B55, B59, B72 Rotameter No. H-B07, B08, B09	Digital Balance
VOCs	Personal Pump SKC No. B03, B67, B73, B75, B85 Rotameter No. L-B07, B08, B09	GC/MS
ระดับเสียงในสถานประกอบการ Leq 8 hr Lmax	Acoustic Calibrator Sound Level Meter No. ACO- B02, B04, B21, B26, B42, B44, B45, R54	-

## เอกสารแนบ 4-1

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในบรรยากาศ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10900  
Tel : (662) 939-4370-72 Fax : (662) 513-4321 E-mail : sale@spsc.com www.spsc.com

### High Volume Air Sampler Calibration Report

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

#### Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	01/08/2024	$y = 1.171x - 2.911$	0.998
B02	B02	02/08/2024	$y = 1.163x + 0.020$	0.999
B03	B03	05/08/2024	$y = 1.195x - 3.992$	0.998
B04	B04	02/08/2024	$y = 1.212x - 3.522$	0.999
B05	B05	02/08/2024	$y = 1.222x - 5.699$	0.997
B06	B06	05/08/2024	$y = 1.192x - 3.521$	0.999
B07	B07	08/08/2024	$y = 1.173x - 2.945$	0.998
B08	B08	02/08/2024	$y = 1.181x - 2.549$	0.999
B09	B09	02/08/2024	$y = 1.202x - 4.007$	0.999
B10	B10	05/08/2024	$y = 1.187x - 0.531$	0.998
B11	B11	05/08/2024	$y = 1.092x + 1.351$	1.000
B12	B12	07/08/2024	$y = 1.186x - 4.168$	0.998
B13	B13	05/08/2024	$y = 1.182x - 3.641$	0.996
B14	B14	05/08/2024	$y = 1.226x - 5.106$	0.999
B15	B15	05/08/2024	$y = 1.218x - 3.602$	1.000
B16	B16	02/08/2024	$y = 1.174x - 1.318$	0.997
B17	B17	05/08/2024	$y = 1.188x - 1.593$	1.000
B18	B18	02/08/2024	$y = 1.218x - 5.796$	0.999
B19	B19	02/08/2024	$y = 1.225x - 6.976$	0.998
B20	B20	02/08/2024	$y = 1.197x - 2.746$	0.999
B21	B21	05/08/2024	$y = 1.214x - 5.212$	0.997
B22	B22	05/08/2024	$y = 1.205x - 5.711$	0.999
B23	B23	02/08/2024	$y = 1.221x - 4.197$	0.998
B24	B24	02/08/2024	$y = 1.164x - 1.349$	0.999
B25	B25	07/08/2024	$y = 1.125x - 0.794$	1.000
B26	B26	07/08/2024	$y = 1.181x - 2.418$	0.998
B27	B27	07/08/2024	$y = 1.109x - 1.204$	0.998
B28	B28	07/08/2024	$y = 1.183x - 5.519$	1.000
B29	B29	02/08/2024	$y = 1.227x - 3.979$	0.996
B30	B30	05/08/2024	$y = 1.174x - 2.401$	0.999
B31	B31	05/08/2024	$y = 1.190x - 4.450$	1.000
B32	B32	05/08/2024	$y = 1.203x - 1.091$	0.999
B33	B33	05/08/2024	$y = 1.218x - 3.935$	1.000
B34	B34	05/08/2024	$y = 1.224x - 5.708$	0.996

Calibrated by :

[Signature]

Approved by :

[Signature]



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### High Volume Air Sampler Calibration Report

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

#### Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B35	B35	05/08/2024	$y = 1.186x - 3.084$	0.999
B36	B36	05/08/2024	$y = 1.210x - 3.778$	0.997
B37	B37	06/08/2024	$y = 1.196x - 3.291$	0.998
B38	B38	06/08/2024	$y = 1.176x - 3.769$	1.000
B39	B39	05/08/2024	$y = 1.200x - 1.884$	0.999
B40	B40	05/08/2024	$y = 1.192x - 3.238$	0.999
B41	B41	05/08/2024	$y = 1.170x - 2.205$	0.996
B42	B42	05/08/2024	$y = 1.141x - 0.385$	1.000
B43	B43	02/08/2024	$y = 1.175x - 1.695$	0.996
B44	B44	02/08/2024	$y = 1.167x - 1.577$	0.998
R01	R01	02/08/2024	$y = 1.177x - 4.285$	0.999
R02	R02	02/08/2024	$y = 1.216x - 5.757$	0.997
R03	R03	02/08/2024	$y = 1.198x - 6.621$	0.999
R04	R04	08/08/2024	$y = 1.170x - 2.838$	0.997
R05	R05	08/08/2024	$y = 1.184x - 4.669$	1.000
R06	R06	01/08/2024	$y = 1.205x - 5.684$	0.998
R07	R07	01/08/2024	$y = 1.114x + 0.237$	1.000
R08	R08	01/08/2024	$y = 1.073x + 1.881$	0.997
R09	R09	01/08/2024	$y = 1.186x - 1.865$	0.999
R10	R10	02/08/2024	$y = 1.171x - 3.610$	0.996
R11	R11	02/08/2024	$y = 1.201x - 4.470$	1.000
R12	R12	02/08/2024	$y = 1.167x - 3.984$	0.998
R13	R13	06/08/2024	$y = 1.171x - 3.661$	0.997
R14	R14	06/08/2024	$y = 1.194x - 2.635$	0.998
R15	R15	02/08/2024	$y = 1.207x - 6.878$	0.999
R16	R16	02/08/2024	$y = 1.212x - 6.360$	1.000
R17	R17	05/08/2024	$y = 1.194x - 4.223$	0.999
R18	R18	05/08/2024	$y = 1.151x - 2.849$	0.999
R19	R19	05/08/2024	$y = 1.172x - 3.442$	0.998
R20	R20	05/08/2024	$y = 1.184x - 3.473$	0.999

Calibrated by :

[Signature]

Approved by :

[Signature]



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

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

#### Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft <sup>3</sup> /min)	R <sup>2</sup>
B01	B01	02/08/2024	y = 1.192x-3.010	0.997
B02	B02	05/08/2024	y = 1.166x-1.422	0.998
B03	B03	07/08/2024	y = 1.198x-2.675	0.997
B04	B04	02/08/2024	y = 1.195x-4.855	0.999
B05	B05	05/08/2024	y = 1.215x-6.792	0.999
B06	B06	02/08/2024	y = 1.184x-3.554	0.997
B07	B07	01/05/2024	y = 1.132x-0.786	1.000
B08	B08	02/08/2024	y = 1.203x-1.746	0.997
B09	B09	05/08/2024	y = 1.198x-3.274	0.999
B10	B10	02/08/2024	y = 1.175x-1.634	0.996
B11	B11	02/08/2024	y = 1.188x-1.290	0.999
B12	B12	07/08/2024	y = 1.200x-4.619	0.997
B13	B13	05/08/2024	y = 1.140x-2.044	0.997
B14	B14	06/08/2024	y = 1.137x+0.196	0.996
B15	B15	05/08/2024	y = 1.156x-0.963	1.000
B16	B16	06/08/2024	y = 1.178x+0.511	0.999
B17	B17	02/08/2024	y = 1.167x-2.529	0.998
B18	B18	01/08/2024	y = 1.193x-2.801	0.997
B19	B19	05/08/2024	y = 1.174x-2.984	0.998
B20	B20	01/08/2024	y = 1.197x-4.582	0.999
B21	B21	05/08/2024	y = 1.195x-3.263	0.998
B22	B22	02/08/2024	y = 1.137x-0.996	0.998
B23	B23	05/08/2024	y = 1.191x-2.392	0.998
B24	B24	01/08/2024	y = 1.185x-3.393	0.997
B25	B25	02/08/2024	y = 1.202x-3.881	0.997
B26	B26	02/08/2024	y = 1.193x-3.733	0.997
B27	B27	02/08/2024	y = 1.165x-4.778	0.999
B28	B28	02/08/2024	y = 1.182x-4.730	0.999
B29	B29	05/08/2024	y = 1.177x-4.217	0.999
B30	B30	05/08/2024	y = 1.188x-3.046	0.998
B31	B31	01/08/2024	y = 1.173x-1.247	1.000
B32	B32	01/08/2024	y = 1.157x-3.072	1.000
B33	B33	05/08/2024	y = 1.153x-0.882	0.997
B34	B34	05/08/2024	y = 1.193x-1.943	0.996

Calibrated by :

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 (ft <sup>3</sup> /min)	R <sup>2</sup>
R01	R01	05/08/2024	y = 1.192x-5.434	0.998
R02	R02	07/08/2024	y = 1.182x-2.772	0.998
R03	R03	07/08/2024	y = 1.199x-4.793	1.000
R04	R04	07/08/2024	y = 1.189x-6.456	0.996
R05	R05	07/08/2024	y = 1.162x-3.444	1.000
R06	R06	07/08/2024	y = 1.194x-3.230	0.999
R07	R07	01/08/2024	y = 1.127x-0.967	0.998
R08	R08	01/08/2024	y = 1.181x-3.206	0.998
R09	R09	01/08/2024	y = 1.197x-3.914	0.999
R10	R10	01/08/2024	y = 1.133x-1.368	0.999
R11	R11	01/08/2024	y = 1.129x+0.473	0.999
R12	R12	06/08/2024	y = 1.194x-5.439	0.998
R13	R13	06/08/2024	y = 1.166x-1.899	1.000
R14	R14	06/08/2024	y = 1.181x-3.793	0.999
R15	R15	02/08/2024	y = 1.186x-3.195	0.997
R16	R16	02/08/2024	y = 1.174x-3.244	1.000
R17	R17	01/08/2024	y = 1.120x+0.523	0.999
R18	R18	07/08/2024	y = 1.146x-2.616	1.000
R19	R19	07/08/2024	y = 1.180x-1.421	1.000
R20	R20	07/08/2024	y = 1.123x-3.226	0.996

Calibrated by :

Approved by :



**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160  
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[www.qcalibration.com](http://www.qcalibration.com)



CERTIFICATE No : 24M2227  
REFERENCE No : 72448-1

PAGE : 1 OF 2

**Certificate of Calibration**

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

**CALIBRATED BY** : ATSAWIN Y.

**CALIBRATION DATE** : 08-Mar-24

**APPROVED BY** : PONGSAK J.

**ISSUED DATE** : 14-Mar-24

**RECEIVED DATE** : 08-Mar-24

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

F-G010 REV 03

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, Bangkok 10160  
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[www.qcalibration.com](http://www.qcalibration.com)

CERTIFICATE No : 24M2227

PAGE : 2 OF 2

**Calibration Report**

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

**CONDITION OF THIS RESULTS OF CALIBRATION**

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

**RESULT OF CALIBRATION** :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

F-G010 REV 03





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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	200E
NO.	NOX-B05	SERIAL NO.	2284		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A007265V	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.009
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.012
API Model 200E NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	511	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.3	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	674	V	420 - 900 constant		
RCCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.1	°C	8 - 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.009	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.7	mV	-20 to +150		
NO <sub>x</sub> Offset	1.0	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	200E
NO.	NOX-B07	SERIAL NO.	4338		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A007265V	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.9	-0.025	400.0	1.008
NO <sub>x</sub> Span	400	400.2	0.050	400.0	1.011
API Model 200E NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	509	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.1	mV	-20 - 150		
AZERO	93.8	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.3	°C	315 ± 5		
RCCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.5	mV	-20 to +150		
NO <sub>x</sub> Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Approved by :





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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	200E
NO.	NOX-B10	SERIAL NO.	4465		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.006
NO <sub>x</sub> Span	400	400.1	0.025	400.0	1.010
API Model 200E NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	505	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HVPS	671	V	420 - 900 constant		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	314.8	°C	315 ± 5		
RCCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.006	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.010	-	1.0 ± 0.3		
NO Offset	1.3	mV	-20 to +150		
NO <sub>x</sub> Offset	0.9	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	200A
NO.	NOX-B12	SERIAL NO.	2675		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.005
NO <sub>x</sub> Span	400	399.9	-0.025	400.0	1.008
API Model 200A NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.2	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO <sub>x</sub> Offset	0.8	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	TML-41M
NO.	NOX-B22	SERIAL NO.	NO1618		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
			Cylinder Conc.	: 48.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.1	0.025	400.0	1.010
NO <sub>x</sub> Span	400	400.3	0.075	400.0	1.014
API Model TML-41M NO <sub>x</sub> Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	507	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.9	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	675	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.0	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO <sub>x</sub> Span Conc	400	PPB	20 - 20,000		
NO Slope	1.010	-	1.0 ± 0.3		
NO <sub>x</sub> Slope	1.014	-	1.0 ± 0.3		
NO Offset	1.8	mV	-20 to +150		
NO <sub>x</sub> Offset	1.1	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 :

Approved by



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	100A
NO.	SO <sub>2</sub> -801	SERIAL NO.	1749		
Calibrator (Dilution System)					
Brand : API		Model : 700			
Last Cal. Date : 05 August 2024		Serial No. : 911			
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO <sub>2</sub> )		Cylinder No. : A008145K			
Certified Date : 21 June 2021		Expired Date : 21 June 2029		Cylinder Conc. : 49.8 ppm	
CALIBRATING CONDITION					
Pressure	1011 mmbar	Temp.	24.5 °C	% RH	50
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO <sub>2</sub> Span	400.0	400.2	0.050	400.0	1.012
API Model 100A SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.7	in-Hg	25-35		
SAMPLE FLOW	659	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3026.8	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	2529	mV	2500 ± 200		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO <sub>2</sub> Span Conc	400	PPB	20-20,000		
SO <sub>2</sub> Slope	1.012	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	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 :

Approved by :



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	100A
NO.	SO <sub>2</sub> -802	SERIAL NO.	1847		
Calibrator (Dilution System)					
Brand : API		Model : 700			
Last Cal. Date : 05 August 2024		Serial No. : 911			
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO <sub>2</sub> )		Cylinder No. : A008145K			
Certified Date : 21 June 2021		Expired Date : 21 June 2029		Cylinder Conc. : 49.8 ppm	
CALIBRATING CONDITION					
Pressure	1011 mmbar	Temp.	24.5 °C	% RH	50
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.7	-0.075	400.0	1.005
API Model 100A SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	657	cc/min	650 ± 10%		
PMT	103.0	mV	-20-150 with Zero Air		
UV LAMP	3016.4	mV	1000-4900		
STR. LGT	61.7	PPB	<100		
DRK PMT	63.2	mV	-50 - 200		
DRK LMP	58.0	mV	-50 - 200		
HVPS	672	V	550-900 constant		
DCPS	2517	mV	2500 ± 200		
RCCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.1	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO <sub>2</sub> Span Conc	400	PPB	20-20,000		
SO <sub>2</sub> Slope	1.005	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	21.9	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

Approved by :





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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	100E
NO.	SO <sub>2</sub> -B06	SERIAL NO.	3430		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 05 August 2024			Serial No. : 911		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO <sub>2</sub> )			Cylinder No. : A008145K		
Certified Date : 21 June 2021			Expired Date : 21 June 2029		
Cylinder Conc. : 49.8 ppm					
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.9	-0.025	400.0	1.010
API Model 100E SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.6	in-Hg	25-35		
SAMPLE FLOW	655	cc/min	650 ± 10%		
PMT	103.4	mV	-20-150 with Zero Air		
UV LAMP	3038.1	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.6	mV	-50 - 200		
HVPS	670	V	550-900 constant		
DCPS	2524	mV	2500 ± 200		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.0	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO <sub>2</sub> Span Conc	400	PPB	20-20,000		
SO <sub>2</sub> Slope	1.010	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	21.7	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

Approved by :



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	01 September 2024	BRAND :	API	MODEL :	100E
NO.	SO <sub>2</sub> -B07	SERIAL NO.	1706		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 05 August 2024			Serial No. : 911		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO <sub>2</sub> )			Cylinder No. : A008145K		
Certified Date : 21 June 2021			Expired Date : 21 June 2029		
Cylinder Conc. : 49.8 ppm					
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
% RH	50				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO <sub>2</sub> Span	400.0	400.3	0.075	400.0	1.014
API Model 100E SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.7	in-Hg	25-35		
SAMPLE FLOW	653	cc/min	650 ± 10%		
PMT	103.1	mV	-20-150 with Zero Air		
UV LAMP	3022.5	mV	1000-4900		
STR. LGT	61.8	PPB	<100		
DRK PMT	63.3	mV	-50 - 200		
DRK LMP	58.1	mV	-50 - 200		
HVPS	674	V	550-900 constant		
DCPS	2520	mV	2500 ± 200		
RCCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.4	°C	7 ± 2.0		
SO <sub>2</sub> Span Conc	400	PPB	20-20,000		
SO <sub>2</sub> Slope	1.014	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	22.2	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

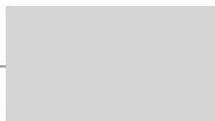
Approved by :



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CALIBRATION REPORT					
SO <sub>2</sub> FLUORESCENT ANALYZER					
DATE :	01 September 2024	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO <sub>2</sub> -811	SERIAL NO.	SO2187		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 05 August 2024		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Sulphur Dioxide (SO <sub>2</sub> )		Cylinder No.	: A008145K	
Certified Date	: 21 June 2021		Expired Date	: 21 June 2029	
			Cylinder Conc.	: 49.8 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.5	°C
			% RH	50	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO <sub>2</sub> Span	400.0	399.8	-0.050	400.0	1.006
API Model TML-50 SO <sub>2</sub> Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.4	in-Hg	25-35		
SAMPLE FLOW	660	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	3031.2	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	673	V	550 900 constant		
DCPS	2518	mV	2500 ± 200		
RCCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.2	°C	5-40		
PMT TEMP	7.3	°C	7 ± 2.0		
SO <sub>2</sub> Span Conc	400	PPB	20-20,000		
SO <sub>2</sub> Slope	1.006	-	1.0 ± 0.3		
SO <sub>2</sub> Offset	22.0	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :



Approved by :



## เอกสารแนบ 4-2

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศจากปล่อง





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### Console Calibration Report

Calibration Method

Critical Orifices

#### Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_g$ (mmH <sub>2</sub> 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  $\Delta H_g$  (test) is  $46.7 \pm 6.4$  (mmH<sub>2</sub>O)

Calibrated by :

Approved by :



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### Console Calibration Report

Calibration Method

Critical Orifices

#### Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_g$ (mmH <sub>2</sub> O)
B01	1563	02/09/2024	0.998	50.16
B02	8002514	04/09/2024	1.002	50.08
B03	1503016	02/09/2024	1.005	50.02
B04	00006659	03/09/2024	0.997	49.84
B05	00007428	02/09/2024	1.003	49.95
R01	1561	03/09/2024	0.998	50.11
R02	8002513	04/09/2024	0.997	49.97
R03	1570	03/09/2024	1.004	49.82
R04	8002519	02/09/2024	0.996	49.74
R05	1503015	04/09/2024	0.999	49.88

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

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

Calibrated by :

Approved by :



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## Console Calibration Report

Calibration Method

Critical Orifices

### Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_g$ (mmH <sub>2</sub> O)
B01	1563	03/12/2024	0.999	49.77
B02	8002514	02/12/2024	0.997	49.92
B03	1503016	04/12/2024	0.996	49.68
B04	00006659	02/12/2024	0.998	49.59
B05	00007428	04/12/2024	0.996	49.73
R01	1561	05/12/2024	0.999	49.88
R02	8002513	03/12/2024	0.996	49.65
R03	1570	02/12/2024	1.002	50.04
R04	8002519	03/12/2024	0.997	49.45
R05	1503015	04/12/2024	1.003	49.98

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

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

Calibrated by :		Approved by :	
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### Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

#### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
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  $0.84 \pm 0.01$

Calibrated by :

Approved by :



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### Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

#### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	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  $0.84 \pm 0.01$

Calibrated by :

Approved by :





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

Calibration Method

Standard Pitot Tube

### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	02/08/2024	0.84	0.83
B04	S	0.99	02/08/2024	0.85	0.84
B05	S	0.99	05/08/2024	0.84	0.84
B07	S	0.99	05/08/2024	0.84	0.83
B08	S	0.99	02/08/2024	0.84	0.84
B09	S	0.99	02/08/2024	0.84	0.85
B11	S	0.99	02/08/2024	0.84	0.84
B16	S	0.99	01/08/2024	0.83	0.84
B18	S	0.99	01/08/2024	0.84	0.84
B19	S	0.99	05/08/2024	0.84	0.84
B21	S	0.99	07/08/2024	0.84	0.85
B24	S	0.99	05/08/2024	0.83	0.84
B27	S	0.99	05/08/2024	0.84	0.83
B30	S	0.99	07/08/2024	0.85	0.84
B31	S	0.99	02/08/2024	0.84	0.85
B33	S	0.99	01/08/2024	0.84	0.84
B35	S	0.99	02/08/2024	0.84	0.85

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

Calibrated by :

Approved by :



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

Calibration Method

Standard Pitot Tube

### Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	02/08/2024	0.83	0.84
B37	S	0.99	02/08/2024	0.84	0.84
B38	S	0.99	01/08/2024	0.84	0.83
B39	S	0.99	05/08/2024	0.84	0.85
B40	S	0.99	08/08/2024	0.84	0.84
B41	S	0.99	05/08/2024	0.84	0.85
B44	S	0.99	05/08/2024	0.84	0.85
B45	S	0.99	05/08/2024	0.85	0.84
B46	S	0.99	02/08/2024	0.84	0.85
B47	S	0.99	05/08/2024	0.84	0.85
B48	S	0.99	07/08/2024	0.83	0.84
B49	S	0.99	07/08/2024	0.84	0.85
B54	S	0.99	07/08/2024	0.83	0.84
B56	S	0.99	02/08/2024	0.84	0.84
B57	S	0.99	06/08/2024	0.85	0.84
B58	S	0.99	02/08/2024	0.84	0.84

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

Calibrated by :

Approved by :



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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@spicon.com, www.spicon.com

### 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	05/11/2024	0.84	0.85
B04	S	0.99	05/11/2024	0.84	0.83
B05	S	0.99	01/11/2024	0.84	0.85
B07	S	0.99	04/11/2024	0.84	0.84
B08	S	0.99	04/11/2024	0.84	0.85
B09	S	0.99	04/11/2024	0.84	0.84
B11	S	0.99	01/11/2024	0.84	0.83
B16	S	0.99	05/11/2024	0.84	0.84
B18	S	0.99	04/11/2024	0.84	0.84
B19	S	0.99	04/11/2024	0.84	0.83
B21	S	0.99	04/11/2024	0.84	0.84
B24	S	0.99	01/11/2024	0.85	0.84
B27	S	0.99	05/11/2024	0.84	0.84
B30	S	0.99	04/11/2024	0.84	0.83
B31	S	0.99	05/11/2024	0.84	0.84
B33	S	0.99	05/11/2024	0.85	0.84
B35	S	0.99	01/11/2024	0.84	0.84

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

Calibrated by		Approved by :	
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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@spicon.com, www.spicon.com

### 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	04/11/2024	0.84	0.84
B37	S	0.99	04/11/2024	0.84	0.84
B38	S	0.99	04/11/2024	0.85	0.84
B39	S	0.99	05/11/2024	0.84	0.84
B40	S	0.99	05/11/2024	0.84	0.83
B41	S	0.99	01/11/2024	0.85	0.84
B44	S	0.99	01/11/2024	0.84	0.84
B45	S	0.99	04/11/2024	0.84	0.84
B46	S	0.99	05/11/2024	0.85	0.84
B47	S	0.99	05/11/2024	0.84	0.84
B48	S	0.99	05/11/2024	0.84	0.83
B49	S	0.99	05/11/2024	0.84	0.84
B54	S	0.99	05/11/2024	0.85	0.84
B56	S	0.99	05/11/2024	0.84	0.83
B57	S	0.99	01/11/2024	0.84	0.85
B58	S	0.99	01/11/2024	0.83	0.84

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

Calibrated by		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



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 :  
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



# CALIBRATION LABORATORY Co.,LTD.

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



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220066-3]  
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

## 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  $\pm 0.2$  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



# 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[64-220066-2]  
CLID. NO. : 212201113  
JOB CONTROL NO. : 240730078440  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 30 July 2024

DATE OF ISSUED : 02 August 2024

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

Calibrated By : Sittipong Pimdee  
Calibration Engineer

Approved By :

Authorized Signatory

02 August 2024



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

Certificate No. Q24078440

F3-011-05/12-23

page 1 of 3



@clccalibration



# CALIBRATION LABORATORY Co., LTD.

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



## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VACUUM GAUGE  
MANUFACTURER : HI-LIGHT  
MODEL / TYPE : N/A  
SERIAL NO. : N/A[64-220066-2]  
DATE OF CALIBRATION : 31 July 2024  
DUE DATE OF CALIBRATION : 31 July 2025

#### 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-0040-24, Due Date 08 February 2025.

#### 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. Q24078440

F3-011-05/12-23

page 2 of 3



@clccalibration





# CALIBRATION LABORATORY CO., LTD.

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



## CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

### 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	0.000	0.000	0.0	0.0	0.0	0.0
-5	-16.591	-16.930	-4.9	-5.0	+0.1	0.0
-10	-33.521	-33.521	-9.9	-9.9	+0.1	+0.1
-15	-50.113	-50.113	-14.8	-14.8	+0.2	+0.2
-20	-66.704	-67.043	-19.7	-19.8	+0.3	+0.2
-25	-83.634	-83.973	-24.7	-24.8	+0.3	+0.2
-30	-100.564	-100.564	-29.7	-29.7	+0.3	+0.3

Uncertainty of measurement  $\pm 0.2$  inHg

Transmitting fluid : Air.

Technical Note, Conversion factor 1 kPa ; 0.2953003 inHg

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 43 of 67

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

### End of Certificate ###

Certificate No. Q24078440

F3-011-05/12-23

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@sithiporn.com http://www.sithiporn.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 :

Approved by :

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

SITHIPORN  
associates

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

## Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

### Calibration Method :

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

### Condition of this result of calibration :

#### 1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

### Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC\* = Unit Under Calibration

Continuation of Calibration Certificate

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

**Result of calibration : Photometric Accuracy**

(Without adjustment)

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

UUC\* = Unit Under Calibration

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

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

**Parameter Setting**

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

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

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

**End of Calibration Certificate**



Cert. No. : SP24020  
Pages 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

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

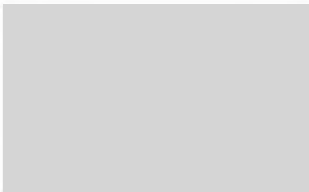
Location : WET CHEMISTRY LABORATORY IV

Ambient Temperature : ( 28.1 ± 5 ) °C  
Relative Humidity : ( 47.2 ± 25 ) %

Received Date : 27 AUGUST 2024  
Calibration Date : 27 AUGUST 2024  
Date of Issue : 27 AUGUST 2024

Calibrated by :

Approved by :



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

Calibration Method :

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

Condition of this result of calibration :

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

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC\* = Unit Under Calibration



**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand  
 Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : SP24020  
 Job No. : VC67SP0013  
 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	1.0550	0.0033	0.0029	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0029	2.00
		29381	0.5	0.5416	0.5431	0.0015	0.0030	2.00
	546.1	29360	1.0	0.9821	0.9820	-0.0001	0.0028	2.00
		29914	0.7	0.6961	0.6958	-0.0003	0.0028	2.00
		29381	0.5	0.5073	0.5080	0.0007	0.0029	2.00
	590.0	29360	1.0	1.0222	1.0210	-0.0012	0.0028	2.00
		29914	0.7	0.7237	0.7221	-0.0016	0.0029	2.00
		29381	0.5	0.5361	0.5361	0.0000	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9745	-0.0008	0.0028	2.00
		29914	0.7	0.6910	0.6900	-0.0010	0.0029	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
RM-0204060810	235.0	20	0.2422	0.2418	-0.0004	0.0101	2.00
		40	0.4866	0.4852	-0.0014	0.0115	2.00
		60	0.7414	0.7389	-0.0025	0.0067	2.00
		80	0.9858	0.9842	-0.0016	0.0093	2.00
		100	1.2442	1.2414	-0.0028	0.0086	2.00

UUC\* = Unit Under Calibration

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

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

Parameter Setting  
 Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

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

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

End of Calibration Certificate





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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.)			y		R <sup>2</sup>	
					1	2	3	1	2	3				
B01	SKC	224-PCXR4	262701	05/07/2024	1,000	1,500	2,000	999	1,499	2,006	1.009x - 12.249	1.000		
B02	SKC	224-PCXR4	626166	05/07/2024	1,000	1,500	2,000	1,000	1,494	1,997	0.995x + 3.958	1.000		
B03	SKC	224-PCXR4	612968	05/07/2024	1,000	1,500	2,000	1,006	1,510	2,005	1.010x - 16.611	0.999		
B04	SKC	224-PCXR4	602804	01/07/2024	1,000	1,500	2,000	1,006	1,506	2,008	1.009x - 11.881	1.000		
B05	SKC	224-PCXR4	612693	05/07/2024	1,000	1,500	2,000	998	1,502	2,001	1.003x - 6.328	1.000		
B06	SKC	224-PCXR4	262188	03/07/2024	1,000	1,500	2,000	1,007	1,513	2,006	1.012x - 16.439	0.999		
B07	SKC	224-PCXR4	626262	05/07/2024	1,000	1,500	2,000	1,002	1,498	2,002	0.999x + 1.531	1.000		
B08	SKC	224-PCXR4	612693	04/07/2024	1,000	1,500	2,000	1,005	1,506	2,005	1.008x - 13.624	0.999		
B09	SKC	224-PCXR4	626479	05/07/2024	1,000	1,500	2,000	1,003	1,503	2,002	1.005x - 11.861	0.999		
B10	SKC	224-PCXR4	091950	04/07/2024	1,000	1,500	2,000	994	1,495	2,003	1.007x - 13.804	1.000		
B11	SKC	224-PCXR8	564315	05/07/2024	1,000	1,500	2,000	1,000	1,498	2,000	1.001x - 3.486	1.000		
B12	SKC	224-PCXR4	034656	02/07/2024	1,000	1,500	2,000	1,005	1,513	2,009	1.007x - 8.707	0.999		
B13	SKC	224-PCXR4	602073	05/07/2024	1,000	1,500	2,000	1,006	1,512	2,007	1.009x - 11.410	0.999		
B14	SKC	224-PCXR4	626313	03/07/2024	1,000	1,500	2,000	1,006	1,494	1,995	0.992x + 9.519	1.000		
B15	SKC	224-PCXR4	626474	03/07/2024	1,000	1,500	2,000	997	1,511	2,006	1.010x - 15.823	1.000		
B16	SKC	224-PCXR4	626477	03/07/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.997x + 4.517	1.000		
B17	SKC	224-PCXR4	626860	03/07/2024	1,000	1,500	2,000	996	1,495	2,000	1.001x - 4.046	1.000		
B18	SKC	224-PCXR4	691484	05/07/2024	1,000	1,500	2,000	997	1,499	1,999	1.004x - 8.051	1.000		
B19	SKC	224-PCXR4	691599	05/07/2024	1,000	1,500	2,000	1,007	1,514	2,007	1.008x - 12.253	0.999		
B20	SKC	224-PCXR4	691587	05/07/2024	1,000	1,500	2,000	995	1,512	2,003	1.009x - 12.393	1.000		
B21	SKC	224-PCXR4	691531	03/07/2024	1,000	1,500	2,000	1,007	1,509	2,008	1.012x - 16.990	0.999		
B22	SKC	224-PCXR4	691654	04/07/2024	1,000	1,500	2,000	1,004	1,502	2,002	1.009x - 15.731	0.999		
B23	SKC	224-PCXR4	798393	04/07/2024	1,000	1,500	2,000	999	1,503	2,005	1.007x - 11.817	1.000		
B24	SKC	224-PCXR4	626363	04/07/2024	1,000	1,500	2,000	996	1,502	1,998	1.000x - 0.991	1.000		
B25	SKC	224-PCXR4	798489	04/07/2024	1,000	1,500	2,000	1,012	1,504	2,004	1.006x - 8.339	0.999		
B26	SKC	224-PCXR4	798479	03/07/2024	1,000	1,500	2,000	999	1,500	1,996	0.995x + 5.313	1.000		
B27	SKC	224-PCXR4	691673	03/07/2024	1,000	1,500	2,000	1,000	1,498	2,004	1.003x - 2.207	1.000		
B28	SKC	224-PCXR4	691570	01/07/2024	1,000	1,500	2,000	1,003	1,504	2,009	1.013x - 17.234	1.000		
B29	SKC	224-PCXR4	626472	01/07/2024	1,000	1,500	2,000	1,007	1,509	2,006	1.009x - 12.657	0.999		
B30	SKC	224-PCXR4	691489	01/07/2024	1,000	1,500	2,000	998	1,500	2,009	1.012x - 16.759	1.000		
B31	SKC	224-PCXR4	691509	04/07/2024	1,000	1,500	2,000	1,003	1,503	2,007	1.005x - 11.138	0.999		
B32	SKC	224-PCXR4	091567	04/07/2024	1,000	1,500	2,000	996	1,505	2,007	1.016x - 26.973	0.999		
B33	SKC	224-PCXR4	091756	04/07/2024	1,000	1,500	2,000	1,000	1,500	2,000	1.004x - 7.636	1.000		
B34	SKC	224-PCXR4	612962	04/07/2024	1,000	1,500	2,000	1,005	1,504	2,008	1.012x - 18.993	0.999		
B35	SKC	224-PCXR4	602682	05/07/2024	1,000	1,500	2,000	998	1,500	2,005	1.006x - 8.339	1.000		
B36	SKC	224-PCXR4	626164	04/07/2024	1,000	1,500	2,000	999	1,501	2,002	1.001x - 4.266	1.000		
B37	SKC	224-PCXR4	626256	05/07/2024	1,000	1,500	2,000	1,007	1,502	2,005	1.008x - 12.029	0.999		
B38	SKC	224-PCXR4	626167	04/07/2024	1,000	1,500	2,000	1,001	1,498	2,003	1.003x - 2.605	1.000		
B39	SKC	224-PCXR4	034637	04/07/2024	1,000	1,500	2,000	1,006	1,506	2,006	1.008x - 11.270	0.999		
B40	SKC	224-PCXR4	798349	03/07/2024	1,000	1,500	2,000	998	1,502	2,000	1.001x - 3.486	1.000		

Calibrated by :

Approved by :



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### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)						
					1	2	3	1	2	3	y	R <sup>2</sup>		
B41	SKC	224-PCXR4	612669	02/07/2024	1,000	1,500	2,000	1,009	1,502	2,005	1.006x - 11.146	0.999		
B42	SKC	224-PCXR4	626041	02/07/2024	1,000	1,500	2,000	1,005	1,499	2,005	0.997x + 6.432	1.000		
B43	SKC	224-PCXR4	034636	02/07/2024	1,000	1,500	2,000	1,004	1,505	2,013	1.010x - 15.091	0.999		
B44	SKC	224-PCXR8	529341	02/07/2024	1,000	1,500	2,000	1,004	1,506	2,005	1.005x - 9.731	0.999		
B45	SKC	224-PCXR8	529594	03/07/2024	1,000	1,500	2,000	996	1,491	2,002	1.009x - 16.399	1.000		
B46	SKC	224-PCXR8	566743	03/07/2024	1,000	1,500	2,000	996	1,495	2,001	1.001x - 5.621	1.000		
B47	SKC	224-PCXR8	566747	03/07/2024	1,000	1,500	2,000	1,003	1,496	1,996	0.995x + 7.632	1.000		
B48	SKC	224-PCXR8	566753	03/07/2024	1,000	1,500	2,000	1,007	1,503	2,005	1.007x - 9.047	0.999		
B49	SKC	224-PCXR8	566780	05/07/2024	1,000	1,500	2,000	1,005	1,492	2,001	0.998x + 2.047	1.000		
B50	SKC	224-PCXR8	500400	05/07/2024	1,000	1,500	2,000	997	1,513	2,006	1.008x - 10.870	1.000		
B51	SKC	224-PCXR8	500363	05/07/2024	1,000	1,500	2,000	1,007	1,496	2,010	1.003x - 3.758	1.000		
B52	SKC	224-PCXR8	093186	05/07/2024	1,000	1,500	2,000	1,003	1,496	2,002	0.999x + 1.439	1.000		
B53	SKC	224-PCXR8	707670	05/07/2024	1,000	1,500	2,000	999	1,501	1,998	1.002x - 4.254	0.999		
B54	SKC	224-PCXR3	509821	05/07/2024	1,000	1,500	2,000	1,000	1,503	1,998	1.003x - 5.249	1.000		
B55	SKC	224-PCXR3	510710	03/07/2024	1,000	1,500	2,000	998	1,519	2,003	1.006x - 5.785	0.999		
B56	SKC	224-PCXR3	511450	03/07/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.004x - 7.748	1.000		
B57	SKC	224-PCXR3	510798	01/07/2024	1,000	1,500	2,000	1,008	1,505	2,008	1.010x - 16.191	0.999		
B58	SKC	224-PCXR3	509852	01/07/2024	1,000	1,500	2,000	1,002	1,505	2,007	1.012x - 20.201	0.999		
B59	SKC	224-PCXR3	509862	01/07/2024	1,000	1,500	2,000	997	1,501	1,999	1.003x + 0.760	1.000		
B60	SKC	224-PCXR3	512655	05/07/2024	1,000	1,500	2,000	1,014	1,507	2,003	1.002x - 1.563	0.999		
B61	SKC	224-PCXR3	503915	05/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.998x + 5.213	0.999		
B62	SKC	224-PCXR3	505975	05/07/2024	1,000	1,500	2,000	1,000	1,501	2,010	1.008x - 7.876	1.000		
B63	SKC	224-PCXR3	511432	05/07/2024	1,000	1,500	2,000	1,005	1,506	2,009	1.010x - 11.514	1.000		
B64	SKC	224-PCXR3	508302	05/07/2024	1,000	1,500	2,000	999	1,512	2,009	1.009x - 11.825	1.000		
B65	SKC	224-PCXR3	508310	05/07/2024	1,000	1,500	2,000	998	1,499	2,004	1.008x - 11.573	1.000		
B66	SKC	224-PCXR3	509861	05/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.999x + 4.094	0.999		
B67	SKC	224-PCXR3	506295	03/07/2024	1,000	1,500	2,000	997	1,505	2,006	1.011x - 17.514	1.000		
B68	SKC	224-PCXR3	505872	01/07/2024	1,000	1,500	2,000	999	1,517	1,999	0.999x + 3.174	0.999		
B69	SKC	224-PCXR3	508375	01/07/2024	1,000	1,500	2,000	1,008	1,505	2,009	1.013x - 17.610	0.999		
B70	SKC	224-PCXR3	510623	01/07/2024	1,000	1,500	2,000	996	1,504	2,002	1.006x - 9.583	1.000		
B71	SKC	224-PCXR3	508367	01/07/2024	1,000	1,500	2,000	997	1,499	1,996	1.001x - 8.495	1.000		
B72	SKC	224-PCXR3	505977	01/07/2024	1,000	1,500	2,000	997	1,496	1,999	1.005x - 12.009	1.000		
B73	SKC	224-PCXR3	512606	03/07/2024	1,000	1,500	2,000	1,007	1,504	2,007	1.006x - 15.183	0.999		
B74	SKC	224-PCXR3	505993	03/07/2024	1,000	1,500	2,000	1,004	1,504	2,002	1.007x - 14.720	0.999		
B75	SKC	224-PCXR3	509820	03/07/2024	1,000	1,500	2,000	1,005	1,493	2,002	1.000x - 3.606	1.000		
B76	SKC	224-PCXR3	509811	03/07/2024	1,000	1,500	2,000	1,000	1,495	2,002	0.999x - 0.580	1.000		
B77	SKC	224-PCXR3	508301	04/07/2024	1,000	1,500	2,000	1,005	1,505	2,010	1.008 - 12.453	0.999		
B78	SKC	224-PCXR3	510677	04/07/2024	1,000	1,500	2,000	998	1,505	2,005	1.009x - 17.250	1.000		
B79	SKC	224-PCXR3	510920	04/07/2024	1,000	1,500	2,000	998	1,509	2,006	1.009x - 17.250	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.)			y	R <sup>2</sup>
					1	2	3	1	2	3		
880	SKC	224-PCXR3	504569	04/07/2024	1,000	1,500	2,000	1,006	1,505	2,003	1.009x - 14.904	0.999
881	SKC	224-PCXR3	503480	02/07/2024	1,000	1,500	2,000	1,006	1,503	2,006	1.011x - 19.229	0.999
882	SKC	224-PCXR3	505673	02/07/2024	1,000	1,500	2,000	1,004	1,504	2,007	1.010x - 14.060	1.000
883	SKC	224-PCXR3	510785	02/07/2024	1,000	1,500	2,000	998	1,504	2,002	1.000x - 0.396	1.000
884	SKC	224-PCXR3	508333	04/07/2024	1,000	1,500	2,000	998	1,508	2,005	1.009x - 17.242	0.999
885	SKC	224-PCXR3	505757	04/07/2024	1,000	1,500	2,000	1,009	1,493	2,004	0.999x + 1.151	1.000
886	SKC	224-PCXR3	512625	05/07/2024	1,000	1,500	2,000	1,000	1,495	2,005	1.002x - 3.458	1.000
887	SKC	224-PCXR3	504324	03/07/2024	1,000	1,500	2,000	1,003	1,505	2,006	1.005x - 5.057	1.000
888	SKC	224-PCXR3	508307	03/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.999x + 2.575	0.999
889	SKC	224-PCXR3	509860	03/07/2024	1,000	1,500	2,000	998	1,518	2,006	1.010x - 14.096	0.999
890	SKC	224-PCXR3	508366	03/07/2024	1,000	1,500	2,000	1,000	1,501	2,000	1.005x - 8.991	1.000
891	SKC	224-PCXR3	510919	03/07/2024	1,000	1,500	2,000	1,006	1,503	2,008	1.014x - 22.160	0.999
892	SKC	224-PCXR3	510987	02/07/2024	1,000	1,500	2,000	1,006	1,503	2,006	1.012x - 20.401	0.999
893	SKC	224-PCXR3	509845	02/07/2024	1,000	1,500	2,000	1,003	1,504	2,008	1.006x - 6.113	1.000
894	SKC	224-PCXR8	A127871	02/07/2024	1,000	1,500	2,000	1,012	1,496	1,998	0.997x - 0.876	0.999
895	SKC	224-PCXR8	A127921	01/07/2024	1,000	1,500	2,000	999	1,502	2,000	1.001x - 0.460	1.000
896	SKC	224-PCXR8	A127942	01/07/2024	1,000	1,500	2,000	997	1,501	2,001	1.005x - 7.496	1.000
897	SKC	224-PCXR8	A127955	02/07/2024	1,000	1,500	2,000	1,011	1,496	1,998	0.998x - 1.595	0.999
898	SKC	224-PCXR8	A127956	02/07/2024	1,000	1,500	2,000	1,011	1,496	1,998	0.997x - 0.476	0.999

Calibrated by :

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)			y		R <sup>2</sup>	
					1	2	3	1	2	3				
B01	SKC	224-PCXR4	262101	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,012	1.013x - 17.267	0.999		
B02	SKC	224-PCXR4	626166	03/10/2024	1,000	1,500	2,000	998	1,500	1,995	1.000x - 2.067	1.000		
B03	SKC	224-PCXR4	612968	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,006	0.998x + 4.721	0.999		
B04	SKC	224-PCXR4	602804	03/10/2024	1,000	1,500	2,000	996	1,511	2,007	1.012x - 19.485	0.999		
B05	SKC	224-PCXR4	612693	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,006	1.004x - 4.306	1.000		
B06	SKC	224-PCXR4	626188	02/10/2024	1,000	1,500	2,000	1,013	1,505	2,006	0.996x + 6.748	0.999		
B07	SKC	224-PCXR4	626262	02/10/2024	1,000	1,500	2,000	1,005	1,506	2,010	1.011x - 12.753	1.000		
B08	SKC	224-PCXR4	626100	03/10/2024	1,000	1,500	2,000	1,000	1,498	1,993	0.995x + 5.105	1.000		
B09	SKC	224-PCXR4	626479	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.996x + 5.969	1.000		
B10	SKC	224-PCXR4	091950	02/10/2024	1,000	1,500	2,000	1,004	1,506	2,008	1.011x - 15.436	1.000		
B11	SKC	224-PCXR8	564315	03/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.993x + 10.007	1.000		
B12	SKC	224-PCXR4	034656	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.013x - 22.552	0.999		
B13	SKC	224-PCXR4	602073	03/10/2024	1,000	1,500	2,000	1,001	1,494	2,000	0.998x + 1.307	1.000		
B14	SKC	224-PCXR4	626313	03/10/2024	1,000	1,500	2,000	1,014	1,504	2,013	0.999x + 8.699	1.000		
B15	SKC	224-PCXR4	626474	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999		
B16	SKC	224-PCXR4	626477	03/10/2024	1,000	1,500	2,000	1,001	1,514	2,009	1.009x - 11.678	1.000		
B17	SKC	224-PCXR4	626860	02/10/2024	1,000	1,500	2,000	1,018	1,513	2,013	0.997x + 11.094	0.999		
B18	SKC	224-PCXR4	691484	02/10/2024	1,000	1,500	2,000	999	1,498	1,999	1.000x + 0.668	1.000		
B19	SKC	224-PCXR4	691599	03/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000		
B20	SKC	224-PCXR4	691587	03/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.010x - 12.129	1.000		
B21	SKC	224-PCXR4	691531	04/10/2024	1,000	1,500	2,000	996	1,499	2,000	1.001x - 1.875	1.000		
B22	SKC	224-PCXR4	691654	03/10/2024	1,000	1,500	2,000	999	1,508	2,006	1.008x - 13.641	1.000		
B23	SKC	224-PCXR4	798393	03/10/2024	1,000	1,500	2,000	1,001	1,494	1,995	0.996x + 3.954	1.000		
B24	SKC	224-PCXR4	626363	02/10/2024	1,000	1,500	2,000	999	1,492	2,003	1.001x - 3.994	1.000		
B25	SKC	224-PCXR4	798489	03/10/2024	1,000	1,500	2,000	1,001	1,501	1,995	0.993x + 10.845	1.000		
B26	SKC	224-PCXR4	798479	03/10/2024	1,000	1,500	2,000	996	1,507	2,004	1.007x - 13.888	1.000		
B27	SKC	224-PCXR4	691673	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,009	1.010x - 14.064	0.999		
B28	SKC	224-PCXR4	691570	03/10/2024	1,000	1,500	2,000	996	1,510	2,008	1.012x - 19.941	0.999		
B29	SKC	224-PCXR4	626472	03/10/2024	1,000	1,500	2,000	1,005	1,502	2,005	1.006x - 9.763	1.000		
B30	SKC	224-PCXR4	691489	03/10/2024	1,000	1,500	2,000	1,004	1,501	2,008	1.009x - 13.737	1.000		
B31	SKC	224-PCXR4	691509	03/10/2024	1,000	1,500	2,000	1,012	1,497	1,997	0.990x + 14.932	1.000		
B32	SKC	224-PCXR4	091567	03/10/2024	1,000	1,500	2,000	1,010	1,510	2,008	1.003x - 3.978	0.999		
B33	SKC	224-PCXR4	091756	02/10/2024	1,000	1,500	2,000	998	1,512	2,005	1.007x - 10.478	1.000		
B34	SKC	224-PCXR4	612962	02/10/2024	1,000	1,500	2,000	999	1,504	2,000	1.001x - 0.963	1.000		
B35	SKC	224-PCXR4	602682	02/10/2024	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000		
B36	SKC	224-PCXR4	626164	02/10/2024	1,000	1,500	2,000	1,008	1,507	2,004	1.000x + 2.331	1.000		
B37	SKC	224-PCXR4	626256	04/10/2024	1,000	1,500	2,000	1,008	1,505	2,006	1.002x - 2.423	1.000		
B38	SKC	224-PCXR4	626167	04/10/2024	1,000	1,500	2,000	997	1,499	1,998	1.001x - 2.994	1.000		
B39	SKC	224-PCXR4	034637	04/10/2024	1,000	1,500	2,000	998	1,504	1,999	1.004x - 8.599	1.000		
B40	SKC	224-PCXR4	798349	04/10/2024	1,000	1,500	2,000	1,001	1,500	1,994	0.999x - 2.619	1.000		

Calibrated by :

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)			y		R <sup>2</sup>	
					1	2	3	1	2	3				
B41	SKC	224-PCXR4	612669	02/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.994x + 9.527	1.000		
B42	SKC	224-PCXR4	626041	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.009x - 14.416	0.999		
B43	SKC	224-PCXR4	034636	03/10/2024	1,000	1,500	2,000	1,005	1,494	2,001	0.995x + 6.369	1.000		
B44	SKC	224-PCXR8	529341	03/10/2024	1,000	1,500	2,000	1,010	1,494	2,000	0.990x + 14.704	1.000		
B45	SKC	224-PCXR8	529594	02/10/2024	1,000	1,500	2,000	1,014	1,504	2,010	0.997x + 11.890	1.000		
B46	SKC	224-PCXR8	566743	04/10/2024	1,000	1,500	2,000	1,006	1,514	2,009	1.002x - 1.391	0.999		
B47	SKC	224-PCXR8	566747	02/10/2024	1,000	1,500	2,000	1,000	1,513	2,009	1.009x - 11.714	1.000		
B48	SKC	224-PCXR8	566753	04/10/2024	1,000	1,500	2,000	1,020	1,513	2,012	0.995x + 15.140	0.999		
B49	SKC	224-PCXR8	566780	04/10/2024	1,000	1,500	2,000	999	1,498	2,000	1.000x + 0.144	1.000		
B50	SKC	224-PCXR8	500400	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,006	1.004x - 5.541	1.000		
B51	SKC	224-PCXR8	500363	04/10/2024	1,000	1,500	2,000	996	1,506	2,005	1.007x - 10.582	1.000		
B52	SKC	224-PCXR8	093106	03/10/2024	1,000	1,500	2,000	998	1,509	2,003	1.006x - 10.386	1.000		
B53	SKC	224-PCXR8	707670	03/10/2024	1,000	1,500	2,000	1,000	1,493	1,996	0.994x + 4.977	0.999		
B54	SKC	224-PCXR3	509821	02/10/2024	1,000	1,500	2,000	1,001	1,493	2,008	1.006x - 9.295	1.000		
B55	SKC	224-PCXR3	510710	04/10/2024	1,000	1,500	2,000	999	1,508	2,004	1.005x - 8.519	1.000		
B56	SKC	224-PCXR3	511450	03/10/2024	1,000	1,500	2,000	1,003	1,502	2,012	1.008x - 10.418	1.000		
B57	SKC	224-PCXR3	510798	02/10/2024	1,000	1,500	2,000	997	1,503	2,005	1.009x - 15.639	1.000		
B58	SKC	224-PCXR3	509852	02/10/2024	1,000	1,500	2,000	1,016	1,517	2,008	0.994x + 13.453	0.999		
B59	SKC	224-PCXR3	509862	04/10/2024	1,000	1,500	2,000	999	1,511	2,010	1.010x - 14.912	0.999		
B60	SKC	224-PCXR3	512655	02/10/2024	1,000	1,500	2,000	1,009	1,514	1,996	0.992x + 12.737	0.999		
B61	SKC	224-PCXR3	503915	04/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.011x - 15.735	0.999		
B62	SKC	224-PCXR3	505975	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999		
B63	SKC	224-PCXR3	511432	02/10/2024	1,000	1,500	2,000	1,020	1,513	2,013	0.995x + 14.152	0.999		
B64	SKC	224-PCXR3	508302	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000		
B65	SKC	224-PCXR3	508310	02/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.006x - 7.652	1.000		
B66	SKC	224-PCXR3	509861	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.009x - 13.421	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 <sup>2</sup>
880	SKC	224-PCXR3	504569	03/10/2024	1,000	1,500	2,000	998	1,507	2,003	1.007x - 12.517	1.000
881	SKC	224-PCXR3	503480	03/10/2024	1,000	1,500	2,000	997	1,496	1,997	1.001x - 3.994	1.000
882	SKC	224-PCXR3	505673	03/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.001x - 1.851	0.999
883	SKC	224-PCXR3	510785	02/10/2024	1,000	1,500	2,000	1,001	1,505	2,000	0.999x + 0.108	1.000
884	SKC	224-PCXR3	508333	02/10/2024	1,000	1,500	2,000	1,003	1,504	1,999	1.001x - 1.315	1.000
885	SKC	224-PCXR3	505757	02/10/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.003x - 1.855	1.000
886	SKC	224-PCXR3	512625	04/10/2024	1,000	1,500	2,000	1,000	1,501	1,998	1.000x - 1.111	1.000
887	SKC	224-PCXR3	504324	04/10/2024	1,000	1,500	2,000	999	1,509	2,007	1.009x - 15.683	0.999
888	SKC	224-PCXR3	508307	04/10/2024	1,000	1,500	2,000	999	1,500	1,996	0.996x + 4.825	1.000
889	SKC	224-PCXR3	509860	04/10/2024	1,000	1,500	2,000	1,002	1,503	2,006	1.008x - 10.170	1.000
890	SKC	224-PCXR3	508366	02/10/2024	1,000	1,500	2,000	999	1,506	2,003	1.000x - 0.612	1.000
891	SKC	224-PCXR3	510919	02/10/2024	1,000	1,500	2,000	1,011	1,504	2,001	0.991x + 17.894	1.000
892	SKC	224-PCXR3	510987	03/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.008x - 10.210	1.000
893	SKC	224-PCXR3	509845	03/10/2024	1,000	1,500	2,000	1,005	1,505	2,005	1.005x - 5.793	1.000
894	SKC	224-PCXR8	A127871	03/10/2024	1,000	1,500	2,000	1,003	1,503	2,001	1.003x - 3.458	1.000
895	SKC	224-PCXR8	A127921	01/10/2024	1,000	1,500	2,000	998	1,506	2,006	1.008x - 11.706	1.000
896	SKC	224-PCXR8	A127942	01/10/2024	1,000	1,500	2,000	1,003	1,502	2,000	0.999x + 2.679	1.000
897	SKC	224-PCXR8	A127955	01/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.010x - 12.557	1.000
898	SKC	224-PCXR8	A127956	01/10/2024	1,000	1,500	2,000	998	1,497	2,000		

Calibrated by :

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 <sup>2</sup>
H-801	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	504.1	997.1	1991.2	$0.995x + 6.628$	1.000
H-802	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	497.3	1003.5	2015.2	$0.998 + 5.168$	1.000
H-803	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	498.4	994.8	2013.0	$1.005x - 12.628$	0.999
H-804	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.1	997.9	1992.5	$0.996x + 6.085$	1.000
H-805	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	497.9	1004.0	2014.2	$0.998x + 4.472$	1.000
H-806	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	499.7	997.9	2015.7	$1.004x - 9.662$	0.999
H-807	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	501.4	1002.3	1990.2	$0.999x + 4.103$	1.000
H-808	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	501.5	999.6	1988.9	$0.991x + 12.846$	1.000
H-809	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	502.7	1003.8	1984.8	$0.997x + 6.523$	0.999
H-810	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	501.5	999.7	1988.7	$0.994x + 9.648$	1.000

Calibrated by :

Approved by :



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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-801	Dwyer	VFA-21	04/07/2024	50	100	200	50.4	99.3	200.4	$0.992x + 0.838$	1.000
L-802	Dwyer	VFA-21	04/07/2024	50	100	200	50.7	99.2	199.1	$1.001x + 0.439$	0.999
L-803	Dwyer	VFA-21	05/07/2024	50	100	200	50.2	101.1	199.3	$1.003x - 0.202$	1.000
L-804	Dwyer	VFA-21	02/07/2024	50	100	200	50.1	100.5	202.3	$0.996x + 1.455$	1.000
L-805	Dwyer	VFA-21	02/07/2024	50	100	200	50.3	101.2	199.4	$1.002x - 0.013$	1.000
L-806	Dwyer	VFA-21	01/07/2024	50	100	200	50.6	100.3	201.7	$0.998x + 1.163$	1.000
L-807	Dwyer	VFA-21	01/07/2024	50	100	200	50.8	100.1	201.3	$0.997x + 1.558$	0.999
L-808	Dwyer	VFA-21	04/07/2024	50	100	200	50.9	101.6	199.8	$0.999x + 0.563$	1.000
L-809	Dwyer	VFA-21	05/07/2024	50	100	200	50.5	99.3	201.7	$1.000x + 0.963$	0.999
L-810	Dwyer	VFA-21	05/07/2024	50	100	200	50.6	99.8	201.3	$1.004x + 0.228$	1.000

Calibrated by :

Approved by :



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
H-801	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	502.4	998.3	1992.4	0.996x + 5.889	1.000
H-802	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	498.5	1001.9	2009.0	0.997x + 5.707	1.000
H-803	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	499.2	996.1	2011.4	1.004x - 11.451	0.999
H-804	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	504.0	999.2	1995.1	0.995x + 7.219	1.000
H-805	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	498.7	1001.8	2007.6	0.997x + 4.568	1.000
H-806	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	497.3	999.1	2012.1	1.005x - 11.101	0.999
H-807	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	503.0	1004.1	1992.6	0.998x + 6.074	1.000
H-808	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	503.7	1000.4	1994.6	0.992x + 12.996	1.000
H-809	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	501.3	1001.6	1990.3	0.999x + 4.046	0.999
H-810	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	500.3	1002.0	1992.6	0.995x + 8.990	1.000

Calibrated by :

Approved by :



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data				Calibration Data							
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-801	Dwyer	VFA-21	02/10/2024	50	100	200	50.8	99.7	201.2	0.990x + 1.455	1.000
L-802	Dwyer	VFA-21	04/10/2024	50	100	200	50.3	98.8	199.5	1.003x - 0.022	0.999
L-803	Dwyer	VFA-21	04/10/2024	50	100	200	50.6	100.7	200.1	1.002x + 0.030	1.000
L-804	Dwyer	VFA-21	04/10/2024	50	100	200	50.9	101.3	201.6	0.993x + 2.147	1.000
L-805	Dwyer	VFA-21	03/10/2024	50	100	200	49.9	102.0	200.2	1.001x + 0.423	1.000
L-806	Dwyer	VFA-21	03/10/2024	50	100	200	50.2	100.7	200.9	0.999x + 0.931	1.000
L-807	Dwyer	VFA-21	01/10/2024	50	100	200	50.1	100.5	200.9	0.999x + 1.192	0.999
L-808	Dwyer	VFA-21	02/10/2024	50	100	200	50.1	101.2	199.0	1.001x - 0.298	1.000
L-809	Dwyer	VFA-21	01/10/2024	50	100	200	50.2	99.0	202.1	1.001x + 0.711	0.999
L-810	Dwyer	VFA-21	01/10/2024	50	100	200	50.3	100.2	201.7	1.003x + 0.455	1.000

Calibrated by :

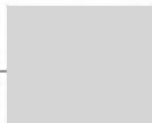
Approved by :



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

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	04 July 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	49	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.08	0.200	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4013.9	mV	2500-4800 mV		
CO Reference	3947.7	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.7	in-Hg-A	~2" ± Ambient Absolute Pressure		
Sample Flow	805	CC/Min	800 ± 10%		
Sample Temperature	48.2	°C	48 ± 4		
Bench Temperature	48.0	°C	48 ± 2		
Wheel Temperature	68.2	°C	68 ± 2		
Box Temperature	30.7	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3038.9	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		

Calibrated by :



Approved by :



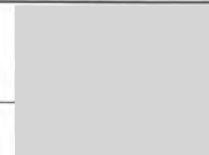
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Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	02 August 2024	Brand :	API	Model :	300E
No.	CO-801	Serial No.	782		
Calibrator (Dilution System)					
Brand :	Teledyne	Model :	700		
Last Cal. Date :	30 October 2023	Serial No. :	421		
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	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	-0.10	-	0	
CO Span	40.00	40.04	0.100	40.00	
API Model 300E CO Analyzer Check List					
Parameter	Observed Value	Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4015.1	mV	2500-4800 mV		
CO Reference	3946.9	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.5	in-Hg-A	~2" ± Ambient Absolute Pressure		
Sample Flow	808	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.0	°C	48 ± 2		
Wheel Temperature	68.4	°C	68 ± 2		
Box Temperature	30.9	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3036.7	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		

Calibrated by :



Approved by :







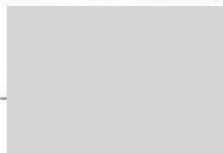
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jomjol, Chulachok, Bangkok 10900  
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Calibration Report			
Non-Dispersive Infrared CO Analyzer			
Date :	02 September 2024	Brand :	API
No.	CO-801	Model :	300E
		Serial No.	782
Calibrator (Dilution System)			
Brand :	Teledyne	Model :	700
Last Cal. Date :	30 October 2023	Serial No. :	421
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	D711839
Certified Date :	14 March 2024	Expired Date :	14 March 2032
		Cylinder Conc. :	4,580 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.5 °C
		% RH	50
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Diff
Zero	0	0.10	-
CO Span	40.00	39.94	-0.150
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	< 1 ppm With Zero Air
CO Measure	4014.1	mV	2500-4800 mV
CO Reference	3947.3	mV	2500-4800 mV
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air
Sample Pressure	28.4	In-Hg-A	~2" ± Ambient Absolute Pressure
Sample Flow	809	CC/Min	800 ± 10%
Sample Temperature	48.5	°C	48 ± 4
Bench Temperature	48.2	°C	48 ± 2
Wheel Temperature	68.5	°C	68 ± 2
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10
Photo-Drive	3035.1	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :



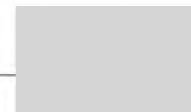
Approved by :



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

Calibration Report			
Non-Dispersive Infrared CO Analyzer			
Date :	02 October 2024	Brand :	API
No.	CO-801	Model :	300E
		Serial No.	782
Calibrator (Dilution System)			
Brand :	Teledyne	Model :	700
Last Cal. Date :	30 October 2023	Serial No. :	421
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	49
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Diff
Zero	0	-0.10	-
CO Span	40.00	40.04	0.100
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	< 1 ppm With Zero Air
CO Measure	4015.1	mV	2500-4800 mV
CO Reference	3947.8	mV	2500-4800 mV
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air
Sample Pressure	28.6	In-Hg-A	~2" ± Ambient Absolute Pressure
Sample Flow	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	30.8	°C	Ambient Temp + 7 ± 10
Photo-Drive	3033.4	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :



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			
Non-Dispersive Infrared CO Analyzer			
Date :	04 November 2024	Brand :	API
No.	CO-801	Model :	300E
		Serial No.	782
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	05 August 2024	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	D711839
Certified Date :	14 March 2024	Expired Date :	14 March 2032
		Cylinder Conc. :	4.580 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.5 °C
		% RH	50
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif
Zero	0	0.10	-
CO Span	40.00	39.96	-0.100
			40.00
API Model 300E CO Analyzer Check List			
Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	< 1 ppm With Zero Air
CO Measure	4016.1	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	28.5	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	68.5	°C	68 ± 2
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10
Photo-Drive	3034.7	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :

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			
Non-Dispersive Infrared CO Analyzer			
Date :	03 December 2024	Brand :	API
No.	CO-801	Model :	300E
		Serial No.	782
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	05 August 2024	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Carbon Monoxide (CO)	Cylinder No. :	D711839
Certified Date :	14 March 2024	Expired Date :	14 March 2032
		Cylinder Conc. :	4.580 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.6 °C
		% RH	49
Calibration Setting			
Span	Initial Reading (Before Adj.), PPM		Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif
Zero	0	-0.10	-
CO Span	40.00	39.93	-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	4017.1	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	806	CC/Min	800 ± 10%
Sample Temperature	48.2	°C	48 ± 4
Bench Temperature	48.0	°C	48 ± 2
Wheel Temperature	68.4	°C	68 ± 2
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10
Photo-Drive	3032.1	mV	250 mV to 4750 mV
Slope	1.017	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by :

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.

Operator Signature: \_\_\_\_\_

บริษัท อาร์เคมีคา แล็บ จำกัด  
ARCHEMICA LAB CO.,LTD.

Date: June 24, 2024

Test Engineer





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
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Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sales@spscs.com, www.spscs.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 01 July 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 <sub>4</sub> )		Cylinder No. : D612165	
Certified Date : 25 February 2023		Cylinder Conc. : 453 ppm	
Calibrating Condition			
Pressure : 1011 mmbar		Temp. : 24.6 °C	% RH : 49
Start Time : 3:00 AM			
Pre-Calibration Checks			
Change Particulate Filter : Yes		Station Temp : 25.0 °C	
Leak Test : Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.02	10
Calibration Setting (Final)			
Span Instrument Gain : 0.998		Finish Time : 4:00 AM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	911.4	mV	800-1,350
Signal (THC)	916.6	mV	800-1,350
Detector	78.0	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.1	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 :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10000  
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sales@spscs.com, www.spscs.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 02 August 2024		Brand : HORIBA	Model : APHA-360CE
No. 801		Serial No. 4211954001	
Calibrator (Dilution System)			
Brand : Teledyne		Model : 700E	
Last Cal. Date : 30 October 2023		Serial No. : 201-5	
Reference Standard Gas			
Standard Gas : Methane (CH <sub>4</sub> )		Cylinder No. : D612165	
Certified Date : 25 February 2023		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 Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.10	0
Span	10	10.04	10
Calibration Setting (Final)			
Span Instrument Gain : 0.996		Finish Time : 11:00 AM	
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	912.3	mV	800-1,350
Signal (THC)	917.5	mV	800-1,350
Detector	78.1	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 :

Approved by :



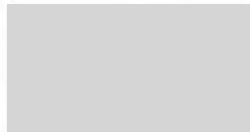
บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sales@spscs.com, www.spscs.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 02 September 2024	Brand : HORIBA	Model : APHA-360CE	
No. B01	Serial No. 4211954001		
Calibrator (Dilution System)			
Brand : Teledyne	Model : 700E		
Last Cal. Date : 30 October 2023	Serial No. : 201-5		
Reference Standard Gas			
Standard Gas : Methane (CH <sub>4</sub> )	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 : 2:00 PM
Pre-Calibration Checks			
Change Particulate Filter Yes	Station Temp : 25.0 °C		
Leak Test Yes			
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.03	10
Calibration Setting (Final)			
Span Instrument Gain: 0.998	Finish Time: 3:00 PM		
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	911.8	mV	800-1,350
Signal (THC)	917.1	mV	800-1,350
Detector	77.9	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.1	kPa	8 ± 25
NMC	259.5	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :



Approved by :



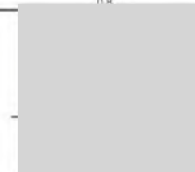
บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900  
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sales@spscs.com, www.spscs.com

Calibration Report Total Hydrocarbon Analyzer			
Date : 04 October 2024	Brand : HORIBA	Model : APHA-360CE	
No. B01	Serial No. 4211954001		
Calibrator (Dilution System)			
Brand : Teledyne	Model : 700E		
Last Cal. Date : 30 October 2023	Serial No. : 201-5		
Reference Standard Gas			
Standard Gas : Methane (CH <sub>4</sub> )	Cylinder No. : D612165		
Certified Date : 25 February 2023	Expired Date : 25 February 2031	Cylinder Conc. : 453 ppm	
Calibrating Condition			
Pressure 1011 mmbar	Temp. 24.6 °C	% RH 49	Start Time : 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	10.04	10
Calibration Setting (Final)			
Span Instrument Gain: 0.996	Finish Time: 10:00 AM		
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	911.2	mV	800-1,350
Signal (THC)	916.5	mV	800-1,350
Detector	78.1	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.3	kPa	8 ± 25
NMC	258.7	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
7 ซอยพหลโยธิน 24 แขวงพหลโยธิน เขตจตุจักร กรุงเทพฯ 10000  
7 Soi Phaholyothin 24, Phaholyothin Rd., Jomoth, Chatuchak, Bangkok 10000  
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sales@spscon.com, www.spscon.com

Calibration Report  
Total Hydrocarbon Analyzer

Date : 04 November 2024 Brand : HORIBA Model : APHA-360CE  
No. B01 Serial No. 4211954001

Calibrator (Dilution System)

Brand : API Model : 700  
Last Cal. Date : 05 August 2024 Serial No. : 911

Reference Standard Gas

Standard Gas : Methane (CH<sub>4</sub>) 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)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.10	0
Span	10	10.03	10

Calibration Setting (Final)

Span Instrument Gain : 0.998 Finish Time : 11:00 AM

APHA-360 Total Hydrocarbon Analyzer

Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	912.3	mV	800-1,350
Signal (THC)	917.1	mV	800-1,350
Detector	77.9	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.2	kPa	8 - 25
NMC	259.1	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
S.P.S. CONSULTING SERVICE CO., LTD.  
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jomoth, Chatuchak, Bangkok 10000  
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sales@spscon.com, www.spscon.com

Calibration Report  
Total Hydrocarbon Analyzer

Date : 02 December 2024 Brand : HORIBA Model : APHA-360CE  
No. B01 Serial No. 4211954001

Calibrator (Dilution System)

Brand : API Model : 700  
Last Cal. Date : 05 August 2024 Serial No. : 911

Reference Standard Gas

Standard Gas : Methane (CH<sub>4</sub>) 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 : 50  
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	0.11	0
Span	10	10.05	10

Calibration Setting (Final)

Span Instrument Gain : 0.996 Finish Time : 10:00 AM

APHA-360 Total Hydrocarbon Analyzer

Test Values	Observed Value	Units	Nominal Range
Signal (CH <sub>4</sub> )	911.7	mV	800-1,350
Signal (THC)	916.5	mV	800-1,350
Detector	78.1	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	kPa	8 - 25
NMC	258.7	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :

Approved by :





WO-02612424/2024

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

<b>Customer :</b> <u>S.P.S.Consulting Service Co.,Ltd</u>	<b>Date Tested:</b> <u>July 4, 2024</u>
<b>Address :</b> <u>7 Soi Phaholyothin 24</u>	<b>Recommendation Recertification</b>
<u>Paholyothin Road</u>	<b>Period</b> <u>6</u> <b>Months</b>
<b>Jompoi Chatuchak, Bangkok 1090</b>	<b>Recertification Due:</b> <u>January 4, 2025</u>
<b>User Name:</b> <u>K.Phenpha Vipasthawatt</u>	<b>Date Last Certified:</b> <u>January 4, 2024</u>
<b>Phone:</b> <u>083-9269252</u>	<b>Visit Number:</b> <u>1 of 2</u>
<b>Fax:</b> <u>02-513-4221</u>	<b>PerkinElmer Phone:</b> <u>02-719-6420 ext 206</u>
	<b>PerkinElmer Fax:</b> <u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
<b>MODEL</b>	<b>SERIAL NUMBER</b>	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Methods</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>September 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>January 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-02612424/2024

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

<b>SERIAL NUMBER</b> <u>077C7042401</u>	<b>DATE TESTED</b> <u>July 4, 2024</u>
<b>1. MECHANICAL CHECKS</b>	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
<b>2. OPTICAL CHECKS</b>	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every year.	<input type="checkbox"/> N/A
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK

Page 2 of 4



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

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



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

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

Commissioning follow as commissioning performance sheets.

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

☒ meets  
☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Ser

Authorized Representative:

(  )

Service Engineer

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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



## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103		DATE TESTED	July 4, 2024
PARAMETER	SPECIFICATION	ACTUAL VAULE		
<b>B. THGA Tests</b>				
1. Furnace Gas Flows				
Internal Flow	250 ± 25 mL/min	250	mL/min	
External Flow	100 ± 10 mL/min	100	mL/min	
2. Chromium Baseline Noise (357.87 nm) (mesure 5 furnace dry firings without any sample)				
	Baseline ≤ 0.005 Int.Abs	0.0021		
	SD ≤ 0.005 Int.Abs	0.0004	Int.Abs.	
3. Chromium Characteristic Mass(m <sub>0</sub> ) and Precition (357.87 nm) (measure 5 furnace firing using 20 ul sample injections of 10 ug/L Cr standard)				
	m0 Results ≤ 7.0 pg/0.0044A-s	7	pg/0.0044A-s	
	Precision ≤ 2.0%	1.32	%	
4. Copper Characteristic Mass(m <sub>0</sub> ) and Zeeman Ratio (324.75 nm) (measure 5 furnace firing using 20 ul sample injections of 25 ug/L Cu standard)				
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s	
	Zeeman Ratio 0.52 ± 0.04	0.559		


## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103		DATE TESTED	July 4, 2024
Remarks :				
- Neutral Density Filter refer to data sheet				
- Zeeman Ratio = $\frac{\text{Atomic Signal(peak area)}}{\text{Atomic Signal(peak area)+Background Signal(peak area)}}$				
= 0.1491/0.1491+0.1176				
0.559				
This is to certify that the above tests have been performed and the configuration tested				
<input checked="" type="checkbox"/> meets <input type="checkbox"/> does not meet				
the PerkinElmer Specifications listed on this certificate.				
This certificate does not modify PerkinElmer's standrd terms and condition of sale, including warranty terms.				
<div> <div>Service D</div> <div></div> </div>				
Customer Service Engineer: _____				
( _____ )				
Service Engineer				

<b>Turbomass/Clarus Mass/ SQ8 MS Preventive Maintenance (PM)</b>			
<b>Company Name:</b>	<b>S.P.S. Consulting Service Co.,Ltd</b>		
<b>Address (Instrument Location):</b>	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
<b>Serial Number:</b>	648N4050804	<b>PM Number:</b>	1 of 2
<b>Customer Name (if applicable):</b>	Ms. Naruecha	<b>Telephone Number:</b>	NA
<b>Service Engineer Name:</b>		<b>Service Order Number:</b>	WO-02760693
<b>Date PM Performed: (DD-MMM-YYYY)</b>	22-Feb-2024	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	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	

#### 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</i>	<i>Pass the preventive maintenance.</i>
<b>Review of Preventive Maintenance:</b>	
	Date: 22-Feb-2024 (DD-MMM-YYYY)
	Date: 22-Feb-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:	2 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:		Service Order Number:	WO-02927336
Date PM Performed: (DD-MMM-YYYY)	22-Aug-2024	Next PM Due Date: (DD-MMM-YYYY)	22-Feb-2025

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

#### Scope

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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	

#### 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).

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- ☒ 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</i>	<i>Pass the preventive maintenance.</i>
<b>Review of Preventive Maintenance:</b>	
	Date: 22-Aug-2024 (DD-MMM-YYYY)
	Date: 22-Aug-2024 (DD-MMM-YYYY)



### เอกสารแนบ 4-3

เอกสารสอบเทียบเครื่องมือตรวจวิเคราะห์คุณภาพน้ำใต้ดิน



CERTIFICATE No : 24E6416  
REFERENCE No : 73694-I

PAGE : 1 OF 3

### Certificate of Calibration

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

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

APPROVED BY : PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24



CERTIFICATE No : 24E6416

PAGE : 2 OF 3

### Calibration Report

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

#### CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

#### RESULT OF CALIBRATION : ADJUSTMENT

##### 1. DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3





CERTIFICATE No : 24E6416

PAGE : 3 OF 3

## Calibration Report

### RESULT OF CALIBRATION (CONTINUE) :

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

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

#### 3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING ( $^{\circ}$ C)	UUC READING ( $^{\circ}$ C)	CORRECTION ( $^{\circ}$ C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT ( $\pm$ $^{\circ}$ C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

#### 4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



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 : PONGSAK J.

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&amp;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 :

Approved by :

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

SITHIPORN  
associates

SITHIPORN ASSOCIATES CO.,LTD.  
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

### Calibration Method :

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

### Condition of this result of calibration :

#### 1. Certified reference materials

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

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

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

- 3.1 The UK National Physical Laboratory (NPL)
- 3.2 The National Institute of Standards and Technology, NIST.

### Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC\* = Unit Under Calibration

Continuation of Calibration Certificate

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

**Result of calibration : Photometric Accuracy**

(Without adjustment)

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

UUC\* = Unit Under Calibration

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

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

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

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

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

**End of Calibration Certificate**



Cert. No. : SP24020  
Pages 1 of 3

# Calibration Certificate

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

Condition As Found : GOOD

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

Location : WET CHEMISTRY LABORATORY IV

Ambient Temperature : ( 28.1 ± 5 ) °C  
Relative Humidity : ( 47.2 ± 25 ) %

Received Date : 27 AUGUST 2024  
Calibration Date : 27 AUGUST 2024  
Date of Issue : 27 AUGUST 2024

Calibrated by :

Approved by :



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

## Calibration Method :

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

## Condition of this result of calibration :

1. Certified reference materials

Material	Ref. type	Cell serial No.	Cert. No.	Due Date
Holmium liquid	RM-HL	29706	106864	01/11/2024
Didymium liquid	RM-DL	28912	106905	02/11/2024
Neutral density filter	RM-1N2N3N	13877	106918	03/11/2024
Potassium dichromate solutions	RM-0204060810	14204	106902	02/11/2024
Potassium Iodide solution	-	KI-0701-001	CI-0185-24	14/05/2026

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

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

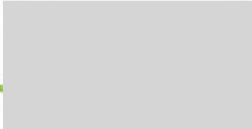
- 3.1 The UK National Physical Laboratory (NPL)
- 3.2 The National Institute of Standards and Technology, NIST.

## Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC\* = Unit Under Calibration



**SITHIPORN ASSOCIATES CO., LTD.**  
**CALIBRATION LABORATORY**

451-451/1 Sirinthorn Road, Bangbunru, Bangplud, Bangkok, 10700 Thailand  
 Tel. +66 2433 8331 Email : calibration@sithiporn.com



Cert. No. : SP24020  
 Job No. : VC67SP0013  
 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	1.0550	0.0033	0.0029	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0029	2.00
		29381	0.5	0.5416	0.5431	0.0015	0.0030	2.00
	546.1	29360	1.0	0.9821	0.9820	-0.0001	0.0028	2.00
		29914	0.7	0.6961	0.6958	-0.0003	0.0028	2.00
		29381	0.5	0.5073	0.5080	0.0007	0.0029	2.00
	590.0	29360	1.0	1.0222	1.0210	-0.0012	0.0028	2.00
		29914	0.7	0.7237	0.7221	-0.0016	0.0029	2.00
		29381	0.5	0.5361	0.5361	0.0000	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9745	-0.0008	0.0028	2.00
		29914	0.7	0.6910	0.6900	-0.0010	0.0029	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00
Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor	
RM-0204060810	235.0	20	0.2422	0.2418	-0.0004	0.0101	2.00	
		40	0.4866	0.4852	-0.0014	0.0115	2.00	
		60	0.7414	0.7389	-0.0025	0.0067	2.00	
		80	0.9858	0.9842	-0.0016	0.0093	2.00	
		100	1.2442	1.2414	-0.0028	0.0086	2.00	

UUC\* = Unit Under Calibration

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

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

Parameter Setting  
 Measurement Mode Wavelength, Absorbance

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

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

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

End of Calibration Certificate



WO-02612424/2024

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

<b>Customer :</b> <u>S.P.S.Consulting Service Co.,Ltd</u>	<b>Date Tested:</b> <u>July 4, 2024</u>
<b>Address :</b> <u>7 Soi Phaholyothin 24</u>	<b>Recommendation Recertification</b>
<u>Paholyothin Road</u>	<b>Period</b> <u>6</u> <b>Months</b>
<b>Jompoi Chatuchak, Bangkok 1090</b>	<b>Recertification Due:</b> <u>January 4, 2025</u>
<b>User Name:</b> <u>K.Phenpha Vipasthawatt</u>	<b>Date Last Certified:</b> <u>January 4, 2024</u>
<b>Phone:</b> <u>083-9269252</u>	<b>Visit Number:</b> <u>1 of 2</u>
<b>Fax:</b> <u>02-513-4221</u>	<b>PerkinElmer Phone:</b> <u>02-719-6420 ext 206</u>
	<b>PerkinElmer Fax:</b> <u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
<b>MODEL</b>	<b>SERIAL NUMBER</b>	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Methods</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>September 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>January 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-02612424/2024

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

<b>SERIAL NUMBER</b> <u>077C7042401</u>	<b>DATE TESTED</b> <u>July 4, 2024</u>
<b>1. MECHANICAL CHECKS</b>	
A. Inspect and clean all fans and filters.	<input type="checkbox"/> OK
B. Inspect and replace as necessary, all torch components including the RF coil.	<input type="checkbox"/> OK
C. Inspect all tubing for sign of clacking or leaking.	<input type="checkbox"/> OK
D. Adjust water and gas pressure regulator settings.	<input type="checkbox"/> OK
E. Inspect and leak check pneumatics drawers.	<input type="checkbox"/> OK
F. Clean the exterior of the instrument.	<input type="checkbox"/> OK
<b>2. OPTICAL CHECKS</b>	
A. Inspect and clean all optical components.	<input type="checkbox"/> OK
B. As required, check and replace all purgefilters.	<input type="checkbox"/> OK
C. Recheck optical alignment.	<input type="checkbox"/> OK
<b>3. COOLING SYSTEM CHECKS</b>	
A. Perform preventive maintenance on chiller.	<input type="checkbox"/> OK
B. Flush out the chiller every year.	<input type="checkbox"/> N/A
<b>4. PERFORMANCE CHECKS</b>	
A. Torch View Alignment.	<input type="checkbox"/> OK
B. Wavelength Calibration.	<input type="checkbox"/> OK

Page 2 of 4





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

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



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

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

Commissioning follow as commissioning performance sheets.

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

☒ meets  
☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Authorized Representative

Service Engineer

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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



## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103		DATE TESTED	July 4, 2024
PARAMETER	SPECIFICATION		ACTUAL VAULE	
<b>B. THGA Tests</b>				
1. Furnace Gas Flows				
Internal Flow	250 ± 25 mL/min	250	mL/min	
External Flow	100 ± 10 mL/min	100	mL/min	
2. Chromium Baseline Noise (357.87 nm) (mesure 5 furnace dry firings without any sample)				
	Baseline ≤ 0.005 Int.Abs	0.0021		
	SD ≤ 0.005 Int.Abs	0.0004	Int.Abs.	
3. Chromium Characteristic Mass(m <sub>0</sub> ) and Precition (357.87 nm) (measure 5 furnace firing using 20 ul sample injections of 10 ug/L Cr standard)				
	m0 Results ≤ 7.0 pg/0.0044A-s	7	pg/0.0044A-s	
	Precision ≤ 2.0%	1.32	%	
4. Copper Characteristic Mass(m <sub>0</sub> ) and Zeeman Ratio (324.75 nm) (measure 5 furnace firing using 20 ul sample injections of 25 ug/L Cu standard)				
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s	
	Zeeman Ratio 0.52 ± 0.04	0.559		

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER	PTCS14111103		DATE TESTED	July 4, 2024
Remarks :				
- Neutral Density Filter refer to data sheet				
- Zeeman Ratio = $\frac{\text{Atomic Signal(peak area)}}{\text{Atomic Signal(peak area)+Background Signal(peak area)}}$				
= 0.1491/0.1491+0.1176				
0.559				
This is to certify that the above tests have been performed and the configuration tested				
<input checked="" type="checkbox"/> meets <input type="checkbox"/> does not meet				
the PerkinElmer Specifications listed on this certificate.				
This certificate does not modify PerkinElmer's standrd terms and condition of sale, including warranty terms.				
<div style="display: flex; justify-content: space-between;"> <div> <p><b>Servi</b></p> <p>Customer Service Engineer:</p> </div> <div style="background-color: #cccccc; width: 200px; height: 80px; margin-left: 10px;"></div> </div>				
Service Engineer				

#### เอกสารแนบ 4-4

เอกสารสอบเทียบเครื่องมือตรวจวัดระดับเสียงในบรรยากาศ



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 / 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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

### 1. Sound Pressure Level

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

### 2. Frequency

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

### 3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

Approved by :

Director

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev.4

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

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

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

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

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

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



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	30 June 2024	94.0	93.9
ACO-B30	ACO	6236	00182012	30 June 2024	94.1	93.9
ACO-B38	ACO	6236	00192029	30 June 2024	93.9	93.9
ACO-B43	ACO	6236	00192034	30 June 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Approved by :

Noise B\_325/24

### 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-B04	ACO	6236	00222298	04 August 2024	94.1	93.9
ACO-B15	ACO	6236	00222300	04 August 2024	94.1	93.9
ACO-B28	ACO	6236	00182009	04 August 2024	93.9	93.9
ACO-B32	ACO	6236	00182014	04 August 2024	93.9	93.9
ACO-B42	ACO	6236	00192033	04 August 2024	94.0	93.9
ACO-B44	ACO	6236	00222302	04 August 2024	93.9	93.9
ACO-B45	ACO	6236	00222304	04 August 2024	94.0	93.9
ACO-R56	ACO	6236	00222310	04 August 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Approved by :



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Noise B\_346/24

### 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-B11	ACO	6236	00152079	01 September 2024	93.9	93.9
ACO-B24	ACO	6236	00182005	01 September 2024	94.0	93.9
ACO-B33	ACO	6236	00182015	01 September 2024	94.1	93.9
ACO-R55	ACO	6236	00222309	01 September 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :



Approved by :



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Noise B\_380/24

### 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-B02	ACO	6236	00090370	03 October 2024	94.1	93.9
ACO-B04	ACO	6236	00222298	03 October 2024	94.1	93.9
ACO-B36	ACO	6236	00192027	03 October 2024	94.0	93.9
ACO-B38	ACO	6236	00192029	03 October 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :



Approved by :



Noise B\_423/24

### 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-B04	ACO	6236	00222298	03 November 2024	94.1	93.9
ACO-B16	ACO	6236	00172039	03 November 2024	93.9	93.9
ACO-B19	ACO	6236	00172057	03 November 2024	93.9	93.9
ACO-B32	ACO	6236	00182014	03 November 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Approved by :

Noise B\_476/24

### 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-B02	ACO	6236	00222306	02 December 2024	93.9	93.9
ACO-B10	ACO	6236	00222299	02 December 2024	93.9	93.9
ACO-B21	ACO	6236	00172059	02 December 2024	93.9	93.9
ACO-B26	ACO	6236	00182007	02 December 2024	94.1	93.9
ACO-B28	ACO	6236	00182009	02 December 2024	94.1	93.9
ACO-B32	ACO	6236	00182014	02 December 2024	93.9	93.9
ACO-B39	ACO	6236	00222301	02 December 2024	94.0	93.9
ACO-R54	ACO	6236	00222307	02 December 2024	94.0	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Approved by :



## เอกสารแนบ 4-5

เอกสารสอบเทียบเครื่องมือตรวจวัดคุณภาพอากาศในสถานประกอบการ



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### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)			y		R <sup>2</sup>	
					1	2	3	1	2	3				
B01	SKC	224-PCXR4	262701	05/07/2024	1,000	1,500	2,000	999	1,499	2,006	1.009x - 12.249	1.000		
B02	SKC	224-PCXR4	626166	05/07/2024	1,000	1,500	2,000	1,000	1,494	1,997	0.995x + 3.958	1.000		
B03	SKC	224-PCXR4	612968	05/07/2024	1,000	1,500	2,000	1,006	1,510	2,005	1.010x - 16.611	0.999		
B04	SKC	224-PCXR4	602804	01/07/2024	1,000	1,500	2,000	1,006	1,506	2,008	1.009x - 11.881	1.000		
B05	SKC	224-PCXR4	612693	05/07/2024	1,000	1,500	2,000	998	1,502	2,001	1.003x - 6.328	1.000		
B06	SKC	224-PCXR4	262188	03/07/2024	1,000	1,500	2,000	1,007	1,513	2,006	1.012x - 16.439	0.999		
B07	SKC	224-PCXR4	626262	05/07/2024	1,000	1,500	2,000	1,002	1,498	2,002	0.999x + 1.531	1.000		
B08	SKC	224-PCXR4	612693	04/07/2024	1,000	1,500	2,000	1,005	1,506	2,005	1.008x - 13.624	0.999		
B09	SKC	224-PCXR4	626479	05/07/2024	1,000	1,500	2,000	1,003	1,503	2,002	1.005x - 11.861	0.999		
B10	SKC	224-PCXR4	091950	04/07/2024	1,000	1,500	2,000	994	1,495	2,003	1.007x - 13.804	1.000		
B11	SKC	224-PCXR8	564315	05/07/2024	1,000	1,500	2,000	1,000	1,498	2,000	1.001x - 3.486	1.000		
B12	SKC	224-PCXR4	034656	02/07/2024	1,000	1,500	2,000	1,005	1,513	2,009	1.007x - 8.707	0.999		
B13	SKC	224-PCXR4	602073	05/07/2024	1,000	1,500	2,000	1,006	1,512	2,007	1.009x - 11.410	0.999		
B14	SKC	224-PCXR4	626313	03/07/2024	1,000	1,500	2,000	1,006	1,494	1,995	0.992x + 9.519	1.000		
B15	SKC	224-PCXR4	626474	03/07/2024	1,000	1,500	2,000	997	1,511	2,006	1.010x - 15.823	1.000		
B16	SKC	224-PCXR4	626477	03/07/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.997x + 4.517	1.000		
B17	SKC	224-PCXR4	626860	03/07/2024	1,000	1,500	2,000	996	1,495	2,000	1.001x - 4.046	1.000		
B18	SKC	224-PCXR4	691484	05/07/2024	1,000	1,500	2,000	997	1,499	1,999	1.004x - 8.051	1.000		
B19	SKC	224-PCXR4	691599	05/07/2024	1,000	1,500	2,000	1,007	1,514	2,007	1.008x - 12.253	0.999		
B20	SKC	224-PCXR4	691587	05/07/2024	1,000	1,500	2,000	995	1,512	2,003	1.009x - 12.393	1.000		
B21	SKC	224-PCXR4	691531	03/07/2024	1,000	1,500	2,000	1,007	1,509	2,008	1.012x - 16.990	0.999		
B22	SKC	224-PCXR4	691654	04/07/2024	1,000	1,500	2,000	1,004	1,502	2,002	1.009x - 15.731	0.999		
B23	SKC	224-PCXR4	798393	04/07/2024	1,000	1,500	2,000	999	1,503	2,005	1.007x - 11.817	1.000		
B24	SKC	224-PCXR4	626363	04/07/2024	1,000	1,500	2,000	996	1,502	1,998	1.000x - 0.991	1.000		
B25	SKC	224-PCXR4	798489	04/07/2024	1,000	1,500	2,000	1,012	1,504	2,004	1.006x - 8.339	0.999		
B26	SKC	224-PCXR4	798479	03/07/2024	1,000	1,500	2,000	999	1,500	1,996	0.995x + 5.313	1.000		
B27	SKC	224-PCXR4	691673	03/07/2024	1,000	1,500	2,000	1,000	1,498	2,004	1.003x - 2.207	1.000		
B28	SKC	224-PCXR4	691570	01/07/2024	1,000	1,500	2,000	1,003	1,504	2,009	1.013x - 17.234	1.000		
B29	SKC	224-PCXR4	626472	01/07/2024	1,000	1,500	2,000	1,007	1,509	2,006	1.009x - 12.657	0.999		
B30	SKC	224-PCXR4	691489	01/07/2024	1,000	1,500	2,000	998	1,500	2,009	1.012x - 16.759	1.000		
B31	SKC	224-PCXR4	691509	04/07/2024	1,000	1,500	2,000	1,003	1,503	2,007	1.005x - 11.138	0.999		
B32	SKC	224-PCXR4	091567	04/07/2024	1,000	1,500	2,000	996	1,505	2,007	1.016x - 26.973	0.999		
B33	SKC	224-PCXR4	091756	04/07/2024	1,000	1,500	2,000	1,000	1,500	2,000	1.004x - 7.636	1.000		
B34	SKC	224-PCXR4	612962	04/07/2024	1,000	1,500	2,000	1,005	1,504	2,008	1.012x - 18.993	0.999		
B35	SKC	224-PCXR4	602682	05/07/2024	1,000	1,500	2,000	998	1,500	2,005	1.006x - 8.339	1.000		
B36	SKC	224-PCXR4	626164	04/07/2024	1,000	1,500	2,000	999	1,501	2,002	1.001x - 4.266	1.000		
B37	SKC	224-PCXR4	626256	05/07/2024	1,000	1,500	2,000	1,007	1,502	2,005	1.008x - 12.029	0.999		
B38	SKC	224-PCXR4	626167	04/07/2024	1,000	1,500	2,000	1,001	1,498	2,003	1.003x - 2.605	1.000		
B39	SKC	224-PCXR4	034637	04/07/2024	1,000	1,500	2,000	1,006	1,506	2,006	1.008x - 11.270	0.999		
B40	SKC	224-PCXR4	798349	03/07/2024	1,000	1,500	2,000	998	1,502					

Calibrated by :

Approved by :



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### Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

#### Environmental Conditions

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

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)					
					1	2	3	1	2	3	y	R <sup>2</sup>	
B41	SKC	224-PCXR4	612669	02/07/2024	1,000	1,500	2,000	1,009	1,502	2,005	1.006x - 11.146	0.999	
B42	SKC	224-PCXR4	626041	02/07/2024	1,000	1,500	2,000	1,005	1,499	2,005	0.997x + 6.432	1.000	
B43	SKC	224-PCXR4	034636	02/07/2024	1,000	1,500	2,000	1,004	1,505	2,013	1.010x - 15.091	0.999	
B44	SKC	224-PCXR8	529341	02/07/2024	1,000	1,500	2,000	1,004	1,506	2,005	1.005x - 9.731	0.999	
B45	SKC	224-PCXR8	529594	03/07/2024	1,000	1,500	2,000	996	1,491	2,002	1.009x - 16.399	1.000	
B46	SKC	224-PCXR8	566763	03/07/2024	1,000	1,500	2,000	996	1,495	2,001	1.001x - 5.621	1.000	
B47	SKC	224-PCXR8	566747	03/07/2024	1,000	1,500	2,000	1,003	1,496	1,996	0.995x + 7.632	1.000	
B48	SKC	224-PCXR8	566753	03/07/2024	1,000	1,500	2,000	1,007	1,503	2,005	1.007x - 9.047	0.999	
B49	SKC	224-PCXR8	566780	05/07/2024	1,000	1,500	2,000	1,005	1,492	2,001	0.998x + 2.047	1.000	
B50	SKC	224-PCXR8	500400	05/07/2024	1,000	1,500	2,000	997	1,513	2,006	1.008x - 10.870	1.000	
B51	SKC	224-PCXR8	500363	05/07/2024	1,000	1,500	2,000	1,007	1,496	2,010	1.003x - 3.758	1.000	
B52	SKC	224-PCXR8	093186	05/07/2024	1,000	1,500	2,000	1,003	1,496	2,002	0.999x + 1.439	1.000	
B53	SKC	224-PCXR8	707670	05/07/2024	1,000	1,500	2,000	999	1,501	1,998	1.002x - 4.254	0.999	
B54	SKC	224-PCXR3	509821	05/07/2024	1,000	1,500	2,000	1,000	1,503	1,998	1.003x - 5.249	1.000	
B55	SKC	224-PCXR3	510710	03/07/2024	1,000	1,500	2,000	998	1,519	2,003	1.006x - 5.785	0.999	
B56	SKC	224-PCXR3	511450	03/07/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.004x - 7.748	1.000	
B57	SKC	224-PCXR3	510798	01/07/2024	1,000	1,500	2,000	1,008	1,505	2,008	1.010x - 16.191	0.999	
B58	SKC	224-PCXR3	509852	01/07/2024	1,000	1,500	2,000	1,002	1,505	2,007	1.012x - 20.201	0.999	
B59	SKC	224-PCXR3	509862	01/07/2024	1,000	1,500	2,000	997	1,501	1,999	1.003x + 0.760	1.000	
B60	SKC	224-PCXR3	512655	05/07/2024	1,000	1,500	2,000	1,014	1,507	2,003	1.002x - 1.563	0.999	
B61	SKC	224-PCXR3	503915	05/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.998x + 5.213	0.999	
B62	SKC	224-PCXR3	505975	05/07/2024	1,000	1,500	2,000	1,000	1,501	2,010	1.008x - 7.876	1.000	
B63	SKC	224-PCXR3	511432	05/07/2024	1,000	1,500	2,000	1,005	1,506	2,009	1.010x - 11.514	1.000	
B64	SKC	224-PCXR3	508302	05/07/2024	1,000	1,500	2,000	999	1,512	2,009	1.009x - 11.825	1.000	
B65	SKC	224-PCXR3	508310	05/07/2024	1,000	1,500	2,000	998	1,499	2,004	1.008x - 11.573	1.000	
B66	SKC	224-PCXR3	509861	05/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.999x + 4.094	0.999	
B67	SKC	224-PCXR3	506295	03/07/2024	1,000	1,500	2,000	997	1,505	2,006	1.011x - 17.514	1.000	
B68	SKC	224-PCXR3	505872	01/07/2024	1,000	1,500	2,000	999	1,517	1,999	0.999x + 3.174	0.999	
B69	SKC	224-PCXR3	506375	01/07/2024	1,000	1,500	2,000	1,008	1,505	2,009	1.013x - 17.610	0.999	
B70	SKC	224-PCXR3	510623	01/07/2024	1,000	1,500	2,000	996	1,504	2,002	1.006x - 9.583	1.000	
B71	SKC	224-PCXR3	508367	01/07/2024	1,000	1,500	2,000	997	1,499	1,996	1.001x - 8.495	1.000	
B72	SKC	224-PCXR3	505977	01/07/2024	1,000	1,500	2,000	997	1,496	1,999	1.005x - 12.009	1.000	
B73	SKC	224-PCXR3	512606	03/07/2024	1,000	1,500	2,000	1,007	1,504	2,007	1.006x - 15.183	0.999	
B74	SKC	224-PCXR3	505993	03/07/2024	1,000	1,500	2,000	1,004	1,504	2,002	1.007x - 14.720	0.999	
B75	SKC	224-PCXR3	509820	03/07/2024	1,000	1,500	2,000	1,005	1,493	2,002	1.000x - 3.606	1.000	
B76	SKC	224-PCXR3	509811	03/07/2024	1,000	1,500	2,000	1,000	1,495	2,002	0.999x - 0.580	1.000	
B77	SKC	224-PCXR3	508301	04/07/2024	1,000	1,500	2,000	1,005	1,505	2,010	1.008 - 12.453	0.999	
B78	SKC	224-PCXR3	510677	04/07/2024	1,000	1,500	2,000	998	1,503	2,005	1.009x - 17.250	1.000	
B79	SKC	224-PCXR3	510920	04/07/2024	1,000	1,500	2,000	998	1,509	1,996	1.002x - 3.822	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.)			y	R <sup>2</sup>
					1	2	3	1	2	3		
880	SKC	224-PCXR3	504569	04/07/2024	1,000	1,500	2,000	1,006	1,505	2,003	1.009x - 14.904	0.999
881	SKC	224-PCXR3	503480	02/07/2024	1,000	1,500	2,000	1,006	1,503	2,006	1.011x - 19.229	0.999
882	SKC	224-PCXR3	505673	02/07/2024	1,000	1,500	2,000	1,004	1,504	2,007	1.010x - 14.060	1.000
883	SKC	224-PCXR3	510785	02/07/2024	1,000	1,500	2,000	998	1,504	2,002	1.000x - 0.396	1.000
884	SKC	224-PCXR3	508333	04/07/2024	1,000	1,500	2,000	998	1,508	2,005	1.009x - 17.242	0.999
885	SKC	224-PCXR3	505757	04/07/2024	1,000	1,500	2,000	1,009	1,493	2,004	0.999x + 1.151	1.000
886	SKC	224-PCXR3	512625	05/07/2024	1,000	1,500	2,000	1,000	1,495	2,003	1.002x - 3.458	1.000
887	SKC	224-PCXR3	504324	03/07/2024	1,000	1,500	2,000	1,003	1,505	2,006	1.005x - 5.057	1.000
888	SKC	224-PCXR3	508307	03/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.999x + 2.575	0.999
889	SKC	224-PCXR3	509860	03/07/2024	1,000	1,500	2,000	998	1,518	2,006	1.010x - 14.096	0.999
890	SKC	224-PCXR3	508366	03/07/2024	1,000	1,500	2,000	1,000	1,501	2,000	1.005x - 8.991	1.000
891	SKC	224-PCXR3	510919	03/07/2024	1,000	1,500	2,000	1,006	1,503	2,008	1.014x - 22.160	0.999
892	SKC	224-PCXR3	510987	02/07/2024	1,000	1,500	2,000	1,006	1,503	2,006	1.012x - 20.401	0.999
893	SKC	224-PCXR3	509845	02/07/2024	1,000	1,500	2,000	1,003	1,504	2,008	1.006x - 6.113	1.000
894	SKC	224-PCXR8	A127871	02/07/2024	1,000	1,500	2,000	1,012	1,496	1,998	0.997x - 0.876	0.999
895	SKC	224-PCXR8	A127921	01/07/2024	1,000	1,500	2,000	999	1,502	2,000	1.001x - 0.460	1.000
896	SKC	224-PCXR8	A127942	01/07/2024	1,000	1,500	2,000	997	1,501	2,001	1.005x - 7.496	1.000
897	SKC	224-PCXR8	A127955	02/07/2024	1,000	1,500	2,000	1,011	1,496	1,998	0.998x - 1.595	0.999
898	SKC	224-PCXR8	A127956	02/07/2024	1,000	1,500	2,000	1,011	1,496	1,998	0.997x - 0.476	0.999

Calibrated by :

Approved by :





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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)			y		R <sup>2</sup>	
					1	2	3	1	2	3				
B01	SKC	224-PCXR4	262101	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,012	1.013x - 17.267	0.999		
B02	SKC	224-PCXR4	626166	03/10/2024	1,000	1,500	2,000	998	1,500	1,995	1.000x - 2.067	1.000		
B03	SKC	224-PCXR4	612968	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,006	0.998x + 4.721	0.999		
B04	SKC	224-PCXR4	602804	03/10/2024	1,000	1,500	2,000	996	1,511	2,007	1.012x - 19.485	0.999		
B05	SKC	224-PCXR4	612693	02/10/2024	1,000	1,500	2,000	1,005	1,504	2,006	1.004x - 4.306	1.000		
B06	SKC	224-PCXR4	626188	02/10/2024	1,000	1,500	2,000	1,013	1,505	2,006	0.996x + 6.748	0.999		
B07	SKC	224-PCXR4	626262	02/10/2024	1,000	1,500	2,000	1,005	1,506	2,010	1.011x - 12.753	1.000		
B08	SKC	224-PCXR4	626100	03/10/2024	1,000	1,500	2,000	1,000	1,498	1,993	0.995x + 5.105	1.000		
B09	SKC	224-PCXR4	626479	02/10/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.996x + 5.969	1.000		
B10	SKC	224-PCXR4	091950	02/10/2024	1,000	1,500	2,000	1,004	1,506	2,008	1.011x - 15.436	1.000		
B11	SKC	224-PCXR8	564315	03/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.993x + 10.007	1.000		
B12	SKC	224-PCXR4	034656	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.013x - 22.552	0.999		
B13	SKC	224-PCXR4	602073	03/10/2024	1,000	1,500	2,000	1,001	1,494	2,000	0.998x + 1.307	1.000		
B14	SKC	224-PCXR4	626313	03/10/2024	1,000	1,500	2,000	1,014	1,504	2,013	0.999x + 8.699	1.000		
B15	SKC	224-PCXR4	626474	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999		
B16	SKC	224-PCXR4	626477	03/10/2024	1,000	1,500	2,000	1,001	1,514	2,009	1.009x - 11.678	1.000		
B17	SKC	224-PCXR4	626860	02/10/2024	1,000	1,500	2,000	1,018	1,513	2,013	0.997x + 11.094	0.999		
B18	SKC	224-PCXR4	691484	02/10/2024	1,000	1,500	2,000	999	1,498	1,999	1.000x + 0.668	1.000		
B19	SKC	224-PCXR4	691599	03/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000		
B20	SKC	224-PCXR4	691587	03/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.010x - 12.129	1.000		
B21	SKC	224-PCXR4	691531	04/10/2024	1,000	1,500	2,000	996	1,499	2,000	1.001x - 1.875	1.000		
B22	SKC	224-PCXR4	691654	03/10/2024	1,000	1,500	2,000	999	1,508	2,006	1.008x - 13.641	1.000		
B23	SKC	224-PCXR4	798393	03/10/2024	1,000	1,500	2,000	1,001	1,494	1,995	0.996x + 3.954	1.000		
B24	SKC	224-PCXR4	626363	02/10/2024	1,000	1,500	2,000	999	1,492	2,003	1.001x - 3.994	1.000		
B25	SKC	224-PCXR4	798489	03/10/2024	1,000	1,500	2,000	1,001	1,501	1,995	0.993x + 10.845	1.000		
B26	SKC	224-PCXR4	798479	03/10/2024	1,000	1,500	2,000	996	1,507	2,004	1.007x - 13.888	1.000		
B27	SKC	224-PCXR4	691673	03/10/2024	1,000	1,500	2,000	1,006	1,505	2,009	1.010x - 14.064	0.999		
B28	SKC	224-PCXR4	691570	03/10/2024	1,000	1,500	2,000	996	1,510	2,008	1.012x - 19.941	0.999		
B29	SKC	224-PCXR4	626472	03/10/2024	1,000	1,500	2,000	1,005	1,502	2,005	1.006x - 9.763	1.000		
B30	SKC	224-PCXR4	691489	03/10/2024	1,000	1,500	2,000	1,004	1,501	2,008	1.009x - 13.737	1.000		
B31	SKC	224-PCXR4	691509	03/10/2024	1,000	1,500	2,000	1,012	1,497	1,997	0.990x + 14.932	1.000		
B32	SKC	224-PCXR4	091567	03/10/2024	1,000	1,500	2,000	1,010	1,510	2,008	1.003x - 3.978	0.999		
B33	SKC	224-PCXR4	091756	02/10/2024	1,000	1,500	2,000	998	1,512	2,005	1.007x - 10.478	1.000		
B34	SKC	224-PCXR4	612962	02/10/2024	1,000	1,500	2,000	999	1,504	2,000	1.001x - 0.963	1.000		
B35	SKC	224-PCXR4	602682	02/10/2024	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000		
B36	SKC	224-PCXR4	626164	02/10/2024	1,000	1,500	2,000	1,008	1,507	2,004	1.000x + 2.331	1.000		
B37	SKC	224-PCXR4	626256	04/10/2024	1,000	1,500	2,000	1,008	1,505	2,006	1.002x - 2.423	1.000		
B38	SKC	224-PCXR4	626167	04/10/2024	1,000	1,500	2,000	997	1,499	1,998	1.001x - 2.994	1.000		
B39	SKC	224-PCXR4	034637	04/10/2024	1,000	1,500	2,000	998	1,504	1,999	1.004x - 8.599	1.000		
B40	SKC	224-PCXR4	798349	04/10/2024	1,000	1,500	2,000	1,001	1,500	1,994	0.999x - 2.619	1.000		

Calibrated by :

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)			y		R <sup>2</sup>	
					1	2	3	1	2	3				
B41	SKC	224-PCXR4	612669	02/10/2024	1,000	1,500	2,000	1,010	1,497	2,001	0.994x + 9.527	1.000		
B42	SKC	224-PCXR4	626041	04/10/2024	1,000	1,500	2,000	998	1,507	2,005	1.009x - 14.416	0.999		
B43	SKC	224-PCXR4	034636	03/10/2024	1,000	1,500	2,000	1,005	1,494	2,001	0.995x + 6.369	1.000		
B44	SKC	224-PCXR8	529341	03/10/2024	1,000	1,500	2,000	1,010	1,494	2,000	0.990x + 14.704	1.000		
B45	SKC	224-PCXR8	529594	02/10/2024	1,000	1,500	2,000	1,014	1,504	2,010	0.997x + 11.890	1.000		
B46	SKC	224-PCXR8	566743	04/10/2024	1,000	1,500	2,000	1,006	1,514	2,009	1.002x - 1.391	0.999		
B47	SKC	224-PCXR8	566747	02/10/2024	1,000	1,500	2,000	1,000	1,513	2,009	1.009x - 11.714	1.000		
B48	SKC	224-PCXR8	566753	04/10/2024	1,000	1,500	2,000	1,020	1,513	2,012	0.995x + 15.140	0.999		
B49	SKC	224-PCXR8	566780	04/10/2024	1,000	1,500	2,000	999	1,498	2,000	1.000x + 0.144	1.000		
B50	SKC	224-PCXR8	500400	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,006	1.004x - 5.541	1.000		
B51	SKC	224-PCXR8	500363	04/10/2024	1,000	1,500	2,000	996	1,506	2,005	1.007x - 10.582	1.000		
B52	SKC	224-PCXR8	093106	03/10/2024	1,000	1,500	2,000	998	1,509	2,003	1.006x - 10.386	1.000		
B53	SKC	224-PCXR8	707670	03/10/2024	1,000	1,500	2,000	1,000	1,493	1,996	0.994x + 4.977	0.999		
B54	SKC	224-PCXR3	509821	02/10/2024	1,000	1,500	2,000	1,001	1,493	2,008	1.005x - 9.295	1.000		
B55	SKC	224-PCXR3	510710	04/10/2024	1,000	1,500	2,000	999	1,508	2,004	1.005x - 8.519	1.000		
B56	SKC	224-PCXR3	511450	03/10/2024	1,000	1,500	2,000	1,003	1,502	2,012	1.008x - 10.418	1.000		
B57	SKC	224-PCXR3	510798	02/10/2024	1,000	1,500	2,000	997	1,503	2,005	1.009x - 15.639	1.000		
B58	SKC	224-PCXR3	509852	02/10/2024	1,000	1,500	2,000	1,016	1,517	2,008	0.994x + 13.453	0.999		
B59	SKC	224-PCXR3	509862	04/10/2024	1,000	1,500	2,000	999	1,511	2,010	1.010x - 14.912	0.999		
B60	SKC	224-PCXR3	512655	02/10/2024	1,000	1,500	2,000	1,009	1,514	1,996	0.992x + 12.737	0.999		
B61	SKC	224-PCXR3	503915	04/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.011x - 15.735	0.999		
B62	SKC	224-PCXR3	505975	03/10/2024	1,000	1,500	2,000	1,006	1,513	2,008	1.002x - 0.788	0.999		
B63	SKC	224-PCXR3	511432	02/10/2024	1,000	1,500	2,000	1,020	1,513	2,013	0.995x + 14.152	0.999		
B64	SKC	224-PCXR3	508302	04/10/2024	1,000	1,500	2,000	1,000	1,508	2,007	1.004x - 5.189	1.000		
B65	SKC	224-PCXR3	508310	02/10/2024	1,000	1,500	2,000	997	1,514	2,005	1.006x - 7.652	1.000		
B66	SKC	224-PCXR3	509861	04/10/2024	1,000	1,500	2,000	996	1,499	2,003	1.009x - 13.421	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 <sup>2</sup>
880	SKC	224-PCXR3	504569	03/10/2024	1,000	1,500	2,000	998	1,507	2,003	1.007x - 12.517	1.000
881	SKC	224-PCXR3	503480	03/10/2024	1,000	1,500	2,000	997	1,496	1,997	1.001x - 3.994	1.000
882	SKC	224-PCXR3	505673	03/10/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.001x - 1.851	0.999
883	SKC	224-PCXR3	510785	02/10/2024	1,000	1,500	2,000	1,001	1,505	2,000	0.999x + 0.108	1.000
884	SKC	224-PCXR3	508333	02/10/2024	1,000	1,500	2,000	1,003	1,504	1,999	1.001x - 1.315	1.000
885	SKC	224-PCXR3	505757	02/10/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.003x - 1.855	1.000
886	SKC	224-PCXR3	512625	04/10/2024	1,000	1,500	2,000	1,000	1,501	1,998	1.000x - 1.111	1.000
887	SKC	224-PCXR3	504324	04/10/2024	1,000	1,500	2,000	999	1,509	2,007	1.009x - 15.683	0.999
888	SKC	224-PCXR3	508307	04/10/2024	1,000	1,500	2,000	999	1,500	1,996	0.996x + 4.825	1.000
889	SKC	224-PCXR3	509860	04/10/2024	1,000	1,500	2,000	1,002	1,503	2,006	1.008x - 10.170	1.000
890	SKC	224-PCXR3	508366	02/10/2024	1,000	1,500	2,000	999	1,506	2,003	1.000x - 0.612	1.000
891	SKC	224-PCXR3	510919	02/10/2024	1,000	1,500	2,000	1,011	1,504	2,001	0.991x + 17.894	1.000
892	SKC	224-PCXR3	510987	03/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.008x - 10.210	1.000
893	SKC	224-PCXR3	509845	03/10/2024	1,000	1,500	2,000	1,005	1,505	2,005	1.005x - 5.793	1.000
894	SKC	224-PCXR8	A127871	03/10/2024	1,000	1,500	2,000	1,003	1,503	2,001	1.003x - 3.458	1.000
895	SKC	224-PCXR8	A127921	01/10/2024	1,000	1,500	2,000	998	1,506	2,006	1.008x - 11.706	1.000
896	SKC	224-PCXR8	A127942	01/10/2024	1,000	1,500	2,000	1,003	1,502	2,000	0.999x + 2.679	1.000
897	SKC	224-PCXR8	A127955	01/10/2024	1,000	1,500	2,000	1,004	1,505	2,008	1.010x - 12.557	1.000
898	SKC	224-PCXR8	A127956	01/10/2024	1,000	1,500	2,000	998	1,497	2,001	1.004x - 8.311	1.000

Calibrated by :

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 <sup>2</sup>
H-801	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	504.1	997.1	1991.2	$0.995x + 6.628$	1.000
H-802	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	497.3	1003.5	2015.2	$0.998 + 5.168$	1.000
H-803	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	498.4	994.8	2013.0	$1.005x - 12.628$	0.999
H-804	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.1	997.9	1992.5	$0.996x + 6.085$	1.000
H-805	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	497.9	1004.0	2014.2	$0.998x + 4.472$	1.000
H-806	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	499.7	997.9	2015.7	$1.004x - 9.662$	0.999
H-807	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	501.4	1002.3	1990.2	$0.999x + 4.103$	1.000
H-808	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	501.5	999.6	1988.9	$0.991x + 12.846$	1.000
H-809	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	502.7	1003.8	1984.8	$0.997x + 6.523$	0.999
H-810	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	501.5	999.7	1988.7	$0.994x + 9.648$	1.000

Calibrated by :

Approved by :



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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-801	Dwyer	VFA-21	04/07/2024	50	100	200	50.4	99.3	200.4	$0.992x + 0.838$	1.000
L-802	Dwyer	VFA-21	04/07/2024	50	100	200	50.7	99.2	199.1	$1.001x + 0.439$	0.999
L-803	Dwyer	VFA-21	05/07/2024	50	100	200	50.2	101.1	199.3	$1.003x - 0.202$	1.000
L-804	Dwyer	VFA-21	02/07/2024	50	100	200	50.1	100.5	202.3	$0.996x + 1.455$	1.000
L-805	Dwyer	VFA-21	02/07/2024	50	100	200	50.3	101.2	199.4	$1.002x - 0.013$	1.000
L-806	Dwyer	VFA-21	01/07/2024	50	100	200	50.6	100.3	201.7	$0.998x + 1.163$	1.000
L-807	Dwyer	VFA-21	01/07/2024	50	100	200	50.8	100.1	201.3	$0.997x + 1.558$	0.999
L-808	Dwyer	VFA-21	04/07/2024	50	100	200	50.9	101.6	199.8	$0.999x + 0.563$	1.000
L-809	Dwyer	VFA-21	05/07/2024	50	100	200	50.5	99.3	201.7	$1.000x + 0.963$	0.999
L-810	Dwyer	VFA-21	05/07/2024	50	100	200	50.6	99.8	201.3	$1.004x + 0.228$	1.000

Calibrated by :

Approved by :





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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
H-801	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	502.4	998.3	1992.4	0.996x + 5.889	1.000
H-802	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	498.5	1001.9	2009.0	0.997x + 5.707	1.000
H-803	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	499.2	996.1	2011.4	1.004x - 11.451	0.999
H-804	Dwyer	VFB-65	04/10/2024	500	1,000	2,000	504.0	999.2	1995.1	0.995x + 7.219	1.000
H-805	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	498.7	1001.8	2007.6	0.997x + 4.568	1.000
H-806	Dwyer	VFB-65	03/10/2024	500	1,000	2,000	497.3	999.1	2012.1	1.005x - 11.101	0.999
H-807	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	503.0	1004.1	1992.6	0.998x + 6.074	1.000
H-808	Dwyer	VFB-65	02/10/2024	500	1,000	2,000	503.7	1000.4	1994.6	0.992x + 12.996	1.000
H-809	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	501.3	1001.6	1990.3	0.999x + 4.046	0.999
H-810	Dwyer	VFB-65	01/10/2024	500	1,000	2,000	500.3	1002.0	1992.6	0.995x + 8.990	1.000

Calibrated by :

Approved by :



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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164


Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R <sup>2</sup>
L-801	Dwyer	VFA-21	02/10/2024	50	100	200	50.8	99.7	201.2	0.990x + 1.455	1.000
L-802	Dwyer	VFA-21	04/10/2024	50	100	200	50.3	98.8	199.5	1.003x - 0.022	0.999
L-803	Dwyer	VFA-21	04/10/2024	50	100	200	50.6	100.7	200.1	1.002x + 0.030	1.000
L-804	Dwyer	VFA-21	04/10/2024	50	100	200	50.9	101.3	201.6	0.993x + 2.147	1.000
L-805	Dwyer	VFA-21	03/10/2024	50	100	200	49.9	102.0	200.2	1.001x + 0.423	1.000
L-806	Dwyer	VFA-21	03/10/2024	50	100	200	50.2	100.7	200.9	0.999x + 0.931	1.000
L-807	Dwyer	VFA-21	01/10/2024	50	100	200	50.1	100.5	200.9	0.999x + 1.192	0.999
L-808	Dwyer	VFA-21	02/10/2024	50	100	200	50.1	101.2	199.0	1.001x - 0.298	1.000
L-809	Dwyer	VFA-21	01/10/2024	50	100	200	50.2	99.0	202.1	1.001x + 0.711	0.999
L-810	Dwyer	VFA-21	01/10/2024	50	100	200	50.3	100.2	201.7	1.003x + 0.455	1.000

Calibrated by :

Approved by :

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:		Service Order Number:	WO-02760693
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2024	Next PM Due Date: (DD-MMM-YYYY)	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	

#### 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</i>	<i>Pass the preventive maintenance.</i>
<b>Review of Preventive Maintenance:</b>	
	Date: 22-Feb-2024 (DD-MMM-YYYY)
	Date: 22-Feb-2024 (DD-MMM-YYYY)



<b>Turbomass/Clarus Mass/ SQ8 MS Preventive Maintenance (PM)</b>			
<b>Company Name:</b>	<b>S.P.S. Consulting Service Co.,Ltd</b>		
<b>Address (Instrument Location):</b>	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
<b>Serial Number:</b>	648N4050804	<b>PM Number:</b>	2 of 2
<b>Customer Name (if applicable):</b>	Ms. Naruecha	<b>Telephone Number:</b>	NA
<b>Service Engineer Name:</b>		<b>Service Order Number:</b>	WO-02927336
<b>Date PM Performed: (DD-MMM-YYYY)</b>	22-Aug-2024	<b>Next PM Due Date: (DD-MMM-YYYY)</b>	22-Feb-2025

<b>Part Number</b>	<b>Release</b>	<b>Publication Date</b>	
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

<b>Component / Specific Model</b>	<b>Serial #</b>	<b>Software Version</b>	<b>Configuration Notes</b>
Clarus680	680S14042502	Totalchrom6.3.1	PSS,PSS,FID
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX.1	

#### Parts lists

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

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

<b>Additional Reagents and Standards Required for PM</b>				
<b>Part Number (if applicable)</b>	<b>Description</b>	<b>Quantity</b>	<b>Batch/Lot #</b>	<b>Expiration Date (MM/YY)</b>
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</i>	<i>Pass the preventive maintenance.</i>
<b>Review of Preventive Maintenance:</b>	
	Date: 22-Aug-2024 (DD-MMM-YYYY)
	Date: 22-Aug-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

1 / 2

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

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

FM.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 :

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  
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Tel. (66) 0 2323 1672-80 ext. 115, 116  
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196 Phahonyothin Road, Chatuchak, Bangkok 10900,  
Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumalee@tistr.or.th

Noise B\_325/24

### 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-B04	ACO	6236	00222298	04 August 2024	94.1	93.9
ACO-B15	ACO	6236	00222300	04 August 2024	94.1	93.9
ACO-B28	ACO	6236	00182009	04 August 2024	93.9	93.9
ACO-B32	ACO	6236	00182014	04 August 2024	93.9	93.9
ACO-B42	ACO	6236	00192033	04 August 2024	94.0	93.9
ACO-B44	ACO	6236	00222302	04 August 2024	93.9	93.9
ACO-B45	ACO	6236	00222304	04 August 2024	94.0	93.9
ACO-R56	ACO	6236	00222310	04 August 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Approved by :

Noise B\_476/24

### 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-B02	ACO	6236	00222306	02 December 2024	93.9	93.9
ACO-B10	ACO	6236	00222299	02 December 2024	93.9	93.9
ACO-B21	ACO	6236	00172059	02 December 2024	93.9	93.9
ACO-B26	ACO	6236	00182007	02 December 2024	94.1	93.9
ACO-B28	ACO	6236	00182009	02 December 2024	94.1	93.9
ACO-B32	ACO	6236	00182014	02 December 2024	93.9	93.9
ACO-B39	ACO	6236	00222301	02 December 2024	94.0	93.9
ACO-R54	ACO	6236	00222307	02 December 2024	94.0	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Approved by :