

ภาคผนวกที่ 4

เอกสารการสอบเทียบความถูกต้องของเครื่องมือ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศในบรรยากาศ		
TSP	High Volume Air Sampler No. B04, B10, B16, B19, B25	Digital Balance
PM-10	High Volume PM-10 Sampler No. B01, B10, B17, B18, B21	Digital Balance
NO ₂	NO ₂ Analyzer No. B03, B06, B08, B12, B21	NO ₂ Analyzer No. B03, B06, B08, B12, B21
SO ₂	SO ₂ Analyzer No. B01, B04, B08, B11, B13	SO ₂ Analyzer No. B01, B04, B08, B11, B13
2. คุณภาพอากาศจากปล่องระบาย		
Particulate	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	Digital Balance
NO _x	Vacuum Gauge	Spectrophotometer
SO ₂	Personal Pump SKC No. B10, B16 Rotameter No. H-B09	Digital Balance
CO	Personal Pump SKC No. B10, B16, B18, B23 Rotameter No. H-B09	CO Analyzer No. B01, B02
HF	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	Ion Chromatography
HCl	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	Ion Chromatography
Total Hydrocarbon	Personal Pump SKC No. B17, B18, B23 Rotameter No. H-B09	THC Analyzer No. B01
Lead	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Cadmium	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Mercury	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	AAS
Arsenic	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	AAS
Nickel	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Chromium	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Beryllium	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
2. คุณภาพอากาศจากปล่องระบาย (ต่อ)		
Antimony	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Copper	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Manganese	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Tin	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Cobalt	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
Total Sb, As, Cr, Co, Cu, Mn, Ni และ Sn	Console No. B01, B02, B03, B04 Pitot Tube No. B04, B35	ICP
VOCs	Personal Pump SKC No. B17, B18, B37 Rotameter No. L-B09	GC/MS
Dioxin	Console No. B02 Pitot Tube No. B04	GC/MS
3. 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

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
4. ระดับเสียงในบรรยากาศ L_{eq} 24 hr และ L_{max}	Acoustic Calibrator Sound Level Meter No. ACO-B01, B06, B11, B12, B13, B17, B18, B21, B25, B27, B28, B30, B35, B37, B42, B43, R02, R04, R06, R13 Sound Level Meter No. CR-B03	-
5. คุณภาพอากาศในสถานประกอบการ Total Dust	Personal Pump SKC No. B02, B24, B33, B42 Rotameter No. H-B07, B09, B10	Digital Balance
Respirable Dust	Personal Pump SKC No. B06, B21, B25, B41, B45, B46 Rotameter No. H-B07, B09, B10	Digital Balance
VOCs	Personal Pump SKC No. B01, B07, B30, B35, B41, B52 Rotameter No. L-B07, B09, B10	GC/MS
6. ระดับเสียงในสถานประกอบการ L_{eq} 8 hr และ L_{max}	Acoustic Calibrator Sound Level Meter No. ACO-R01, R03, R11, R12, B011, B23, B26, B28	-



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

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3095

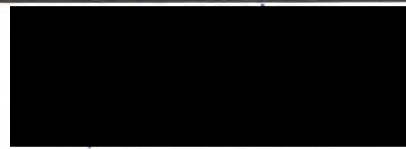
Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	04/05/2022	$y = 1.313x - 9.642$	0.999
B02	B02	02/05/2022	$y = 1.062x + 2.593$	1.000
B03	B03	04/05/2022	$y = 1.045x + 0.757$	0.998
B04	B04	04/05/2022	$y = 1.161x - 3.677$	0.996
B05	B05	02/05/2022	$y = 1.218x - 6.416$	1.000
B06	B06	04/05/2022	$y = 1.235x - 6.768$	0.998
B07	B07	06/05/2022	$y = 1.178x - 5.564$	0.999
B08	B08	02/05/2022	$y = 1.222x - 6.991$	1.000
B09	B09	04/05/2022	$y = 1.240x - 6.649$	0.996
B10	B10	04/05/2022	$y = 1.091x + 0.142$	0.995
B11	B11	04/05/2022	$y = 1.120x - 2.107$	1.000
B12	B12	02/05/2022	$y = 1.102x - 1.916$	0.996
B13	B13	03/05/2022	$y = 1.187x - 5.240$	0.999
B14	B14	06/05/2022	$y = 1.290x - 9.276$	0.998
B15	B15	03/05/2022	$y = 1.093x - 0.919$	0.999
B16	B16	04/05/2022	$y = 1.223x - 6.745$	0.999
B17	B17	03/05/2022	$y = 1.172x - 3.414$	0.998
B18	B18	04/05/2022	$y = 1.259x - 8.700$	1.000
B19	B19	03/05/2022	$y = 1.307x - 10.268$	0.999
B20	B20	02/05/2022	$y = 1.232x - 7.260$	0.999
B21	B21	04/05/2022	$y = 1.209x - 7.461$	0.996
B22	B22	02/05/2022	$y = 1.239x - 7.827$	0.999
B23	B23	03/05/2022	$y = 1.227x - 6.159$	0.999
B24	B24	03/05/2022	$y = 1.075x - 0.925$	0.997
B25	B25	04/05/2022	$y = 0.997x + 2.795$	0.998
B26	B26	04/05/2022	$y = 1.185x - 5.015$	0.998
B27	B27	06/05/2022	$y = 1.148x - 5.099$	0.996
B28	B28	04/05/2022	$y = 1.221x - 6.454$	1.000
B29	B29	02/05/2022	$y = 1.181x - 5.705$	0.995
B30	B30	04/05/2022	$y = 1.136x - 3.406$	0.999
B31	B31	04/05/2022	$y = 1.114x - 1.568$	0.999
B32	B32	04/05/2022	$y = 1.249x - 6.749$	1.000
B33	B33	06/05/2022	$y = 1.195x - 4.397$	0.996
B34	B34	04/05/2022	$y = 1.222x - 7.759$	0.999

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 : 3095

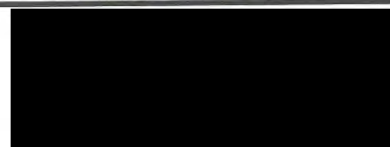
Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	02/05/2022	$y = 1.171x - 0.211$	0.997
B02	B02	02/05/2022	$y = 0.960x + 5.104$	0.998
B03	B03	04/05/2022	$y = 1.214x - 5.211$	0.996
B04	B04	02/05/2022	$y = 1.310x - 9.479$	0.999
B05	B05	03/05/2022	$y = 1.202x - 5.734$	0.999
B06	B06	04/05/2022	$y = 1.241x - 7.631$	0.998
B07	B07	04/05/2022	$y = 1.186x - 4.480$	0.999
B08	B08	03/05/2022	$y = 1.322x - 8.634$	0.999
B09	B09	04/05/2022	$y = 1.219x - 5.756$	0.998
B10	B10	03/05/2022	$y = 1.234x - 7.417$	1.000
B11	B11	02/05/2022	$y = 1.260x - 7.479$	0.999
B12	B12	02/05/2022	$y = 1.225x - 5.900$	0.998
B13	B13	04/05/2022	$y = 1.326x - 10.711$	0.999
B14	B14	07/05/2022	$y = 1.197x - 3.534$	0.999
B15	B15	04/05/2022	$y = 1.096x - 0.244$	0.998
B16	B16	04/05/2022	$y = 1.209x - 1.612$	1.000
B17	B17	03/05/2022	$y = 1.198x - 3.075$	0.999
B18	B18	07/05/2022	$y = 1.159x - 2.421$	0.999
B19	B19	03/05/2022	$y = 1.053x + 1.562$	0.999
B20	B20	03/05/2022	$y = 1.206x - 6.147$	1.000
B21	B21	04/05/2022	$y = 1.156x - 0.999$	0.998
B22	B22	04/05/2022	$y = 1.293x - 8.368$	0.998
B23	B23	07/05/2022	$y = 1.149x - 2.644$	1.000
B24	B24	02/05/2022	$y = 1.250x - 7.392$	1.000
B25	B25	03/05/2022	$y = 1.131x - 2.476$	0.999
B26	B26	07/05/2022	$y = 1.154x + 1.978$	1.000
B27	B27	02/05/2022	$y = 1.278x - 8.984$	0.998
B28	B28	04/05/2022	$y = 1.093x - 0.217$	0.999
B29	B29	04/05/2022	$y = 1.280x - 9.168$	0.999
B30	B30	03/05/2022	$y = 1.290x - 8.822$	0.997
B31	B31	03/05/2022	$y = 1.116x - 0.814$	0.997
B32	B32	05/05/2022	$y = 1.156x - 3.473$	0.999
B33	B33	06/05/2022	$y = 1.254x - 8.880$	0.998
B34	B34	03/05/2022	$y = 1.157x - 1.629$	0.999

Calibrated by :



Approved by :





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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 19 July 2022

BRAND : API

MODEL : 200A

NO. NOX-B03

SERIAL NO. 2617

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00681SK

Certified Date : 24 August 2020

Expired Date : 24 August 2022

Cylinder Conc. : 51.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.6 °C

% RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.1	0.025	400.0	1.006
NO _x Span	400	400.3	0.075	400.0	1.010

API Model 200A NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	507	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.4	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	671	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.0	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.006	-	1.0 ± 0.3
NO _x Slope	1.010	-	1.0 ± 0.3
NO Offset	1.3	mV	-20 to +150
NO _x Offset	0.9	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

Approved by :



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 19 July 2022

BRAND : API

MODEL : 200E

NO. NOX-B06

SERIAL NO. 2286

Calibrator (Dilution System)

Brand : API	Model : 700
Last Cal. Date : 05 August 2021	Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)	Cylinder No. : A00681SK
Certified Date : 24 August 2020	Expired Date : 24 August 2022
	Cylinder Conc. : 51.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.003
NO _x Span	400	399.9	-0.025	400.0	1.005

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	508	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	102.9	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	669	V	420 - 900 constant
RCELL TEMP	50.0	°C	50 ± 1
BOX TEMP	28.8	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	315.2	°C	315 ± 5
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.003	-	1.0 ± 0.3
NO _x Slope	1.005	-	1.0 ± 0.3
NO Offset	1.0	mV	-20 to +150
NO _x Offset	0.5	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

Approved by :



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 19 July 2022

BRAND : API

MODEL : 200E

NO. NOX-B08

SERIAL NO. 4336

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO)

Cylinder No. : A00681SK

Certified Date : 24 August 2020

Expired Date : 24 August 2022

Cylinder Conc. : 51.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.6 °C

% RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.005
NO _x Span	400	400.1	0.025	400.0	1.008

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	504	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.3	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	675	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.4	°C	7 ± 2
MOLY TEMP	315.1	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.005	-	1.0 ± 0.3
NO _x Slope	1.008	-	1.0 ± 0.3
NO Offset	1.2	mV	-20 to +150
NO _x Offset	0.8	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

Approved by :



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S.P.S. CONSULTING SERVICE CO., LTD.

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

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

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 19 July 2022

BRAND : API

MODEL : 200A

NO. NOX-B12

SERIAL NO. 2675

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 05 August 2021 Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : A00681SK
Certified Date : 24 August 2020 Expired Date : 24 August 2022 Cylinder Conc. : 51.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.2	0.050	400.0	1.008
NO _x Span	400	400.3	0.075	400.0	1.012

API Model 200A NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.0	mV	-20 - 150
AZERO	93.9	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.5	°C	7 ± 2
MOLY TEMP	314.7	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.008	-	1.0 ± 0.3
NO _x Slope	1.012	-	1.0 ± 0.3
NO Offset	1.6	mV	-20 to +150
NO _x Offset	1.0	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

Approved by :



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 19 July 2022

BRAND : API

MODEL : TML-41M

NO. NOX-B21

SERIAL NO. N02374

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 05 August 2021 Serial No. : 911

Reference Standard Gas

Standard Gas : Nitric Oxide (NO) Cylinder No. : A00681SK
Certified Date : 24 August 2020 Expired Date : 24 August 2022 Cylinder Conc. : 51.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.), PPB			Final Reading (After Adj.), PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	0.998
NO _x Span	400	399.8	-0.050	400.0	1.004

API Model TML-41M NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	510	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.1	mV	-20 - 150
AZERO	93.8	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.2	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	315.4	°C	315 ± 5
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	0.998	-	1.0 ± 0.3
NO _x Slope	1.004	-	1.0 ± 0.3
NO Offset	0.9	mV	-20 to +150
NO _x Offset	0.4	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

SO₂ FLUORESCENT ANALYZER

DATE : 19 July 2022

BRAND : API

MODEL : 100A

NO. SO₂-B01

SERIAL NO. 1749

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂)

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 50.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.6 °C

% RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	400.3	0.075	400.0	1.014

API Model 100A SO₂ Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.5	in-Hg	25-35
SAMPLE FLOW	654	cc/min	650 ± 10%
PMT	103.2	mV	-20-150 with Zero Air
UV LAMP	3009.7	mV	1000-4900
STR. LGT	61.3	PPB	<100
DRK PMT	62.9	mV	-50 - 200
DRK LMP	57.8	mV	-50 - 200
HVPS	671	V	550-900 constant
DCPS	2518	mV	2500 ± 200
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.2	°C	5-40
PMT TEMP	7.0	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.014	-	1.0 ± 0.3
SO ₂ Offset	21.9	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

Approved by :



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CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 19 July 2022

BRAND : API

MODEL : 100E

NO. SO₂-B04

SERIAL NO. 3159

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 05 August 2021 Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂) Cylinder No. : A00814SK
Certified Date : 21 June 2021 Expired Date : 21 June 2029 Cylinder Conc. : 50.0 ppm

Pressure 1011 mmbar Temp. 24.6 °C % RH 49

CALIBRATION SETTING

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

API Model 100E SO₂ 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	657	cc/min	650 ± 10%
PMT	103.6	mV	-20-150 with Zero Air
UV LAMP	3079.5	mV	1000-4900
STR. LGT	61.8	PPB	<100
DRK PMT	63.6	mV	-50 - 200
DRK LMP	58.1	mV	-50 - 200
HVPS	674	V	550-900 constant
DCPS	2523	mV	2500 ± 200
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.3	°C	5-40
PMT TEMP	7.0	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.006	-	1.0 ± 0.3
SO ₂ Offset	21.8	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

Approved by :



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CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 19 July 2022

BRAND : API

MODEL : 100A

NO. SO₂-B08

SERIAL NO. 1003

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 05 August 2021 Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂) Cylinder No. : A00814SK
Certified Date : 21 June 2021 Expired Date : 21 June 2029 Cylinder Conc. : 50.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 49

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	400.2	0.050	400.0	1.011

API Model 100A SO₂ Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.4	in-Hg	25-35
SAMPLE FLOW	658	cc/min	650 ± 10%
PMT	102.9	mV	-20-150 with Zero Air
UV LAMP	3006.2	mV	1000-4900
STR. LGT	61.5	PPB	<100
DRK PMT	63.2	mV	-50 - 200
DRK LMP	58.0	mV	-50 - 200
HVPS	673	V	550-900 constant
DCPS	2517	mV	2500 ± 200
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.1	°C	5-40
PMT TEMP	7.4	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.011	-	1.0 ± 0.3
SO ₂ Offset	22.1	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by :

Approved :



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CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 19 July 2022

BRAND : TELEDYNE

MODEL : TML-50

NO. SO₂-B11

SERIAL NO. SO2187

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 05 August 2021 Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂) Cylinder No. : A00814SK
Certified Date : 21 June 2021 Expired Date : 21 June 2029 Cylinder Conc. : 50.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	400.1	0.025	400.0	1.012

API Model TML-50 SO₂ Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.6	in-Hg	25-35
SAMPLE FLOW	653	cc/min	650 ± 10%
PMT	103.5	mV	-20-150 with Zero Air
UV LAMP	3020.4	mV	1000-4900
STR. LGT	61.6	PPB	<100
DRK PMT	63.4	mV	-50 - 200
DRK LMP	57.9	mV	-50 - 200
HVPS	669	V	550-900 constant
DCPS	2528	mV	2500 ± 200
RCELL TEMP	50.3	°C	50 ± 1
BOX TEMP	29.5	°C	5-40
PMT TEMP	7.2	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.012	-	1.0 ± 0.3
SO ₂ Offset	22.2	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

SO₂ FLUORESCENT ANALYZER

DATE : 19 July 2022

BRAND : TELEDYNE

MODEL : TML-50

NO. SO₂-B13

SERIAL NO. 1891

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2021

Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂)

Cylinder No. : A00814SK

Certified Date : 21 June 2021

Expired Date : 21 June 2029

Cylinder Conc. : 50.0 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar

Temp. 24.6 °C

% RH 49

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.6	-0.100	400.0	1.004

API Model TML-50 SO₂ 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	103.1	mV	-20-150 with Zero Air
UV LAMP	3018.4	mV	1000-4900
STR. LGT	61.4	PPB	<100
DRK PMT	63.1	mV	-50 - 200
DRK LMP	58.2	mV	-50 - 200
HVPS	670	V	550-900 constant
DCPS	2515	mV	2500 ± 200
RCELL TEMP	50.5	°C	50 ± 1
BOX TEMP	29.4	°C	5-40
PMT TEMP	7.3	°C	7 ± 2.0
SO ₂ Span Conc	400	PPB	20-20,000
SO ₂ Slope	1.004	-	1.0 ± 0.3
SO ₂ Offset	21.7	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by

Approved by



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Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{@}$ (mmH ₂ O)
B01	1563	01/06/2022	0.999	50.02
B02	8002514	03/06/2022	1.002	49.37
B03	1503016	06/06/2022	1.003	50.46
B04	00006659	02/06/2022	1.002	49.71
B05	00007428	02/06/2022	0.997	49.55
R01	1561	02/06/2022	0.999	49.94
R02	8002513	03/06/2022	0.994	50.51
R03	1570	06/06/2022	1.002	49.68
R04	8002519	02/06/2022	1.004	49.55
R05	1503015	01/06/2022	0.997	50.14

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

Accept Value of $\Delta H_{@}$ (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by

Approved by :



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Console Calibration Report

Calibration Method

Critical Orifices

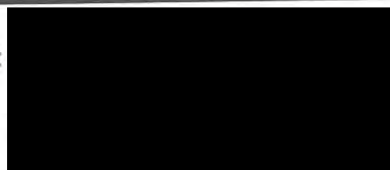
Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	$\Delta H_{@}$ (mmH ₂ O)
B01	1563	01/09/2022	1.004	50.11
B02	8002514	02/09/2022	1.006	49.25
B03	1503016	05/09/2022	1.008	50.30
B04	00006659	05/09/2022	1.005	47.45
B05	00007428	01/09/2022	1.002	49.96
R01	1561	02/09/2022	1.003	49.86
R02	8002513	05/09/2022	1.006	50.09
R03	1570	05/09/2022	1.004	49.23
R04	8002519	01/09/2022	1.005	49.17
R05	1503015	01/09/2022	0.996	49.68

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

Accept Value of $\Delta H_{@}$ (test) is 46.7 ± 6.4 (mmH₂O)

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	$\Delta H_{@}$ (mmH ₂ O)
B01	1563	01/12/2022	1.007	49.94
B02	8002514	02/12/2022	1.002	49.41
B03	1503016	05/12/2022	1.004	50.46
B04	00006659	01/12/2022	1.007	49.43
B05	00007428	01/12/2022	0.998	49.80
R01	1561	01/12/2022	1.004	49.52
R02	8002513	01/12/2022	1.003	49.77
R03	1570	05/12/2022	1.008	49.68
R04	8002519	05/12/2022	0.997	50.12
R05	1503015	01/12/2022	1.003	50.08

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

Accept Value of $\Delta H_{@}$ (test) is 46.7 ± 6.4 (mmH₂O)

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

Pitot Tube Calibration Report

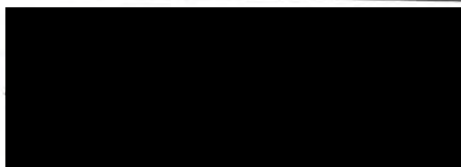
Calibration Method

Standard Pitot Tube

Calibration Data					
Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	03/05/2022	0.84	0.85
B04	S	0.99	03/05/2022	0.84	0.84
B05	S	0.99	05/05/2022	0.84	0.83
B07	S	0.99	06/05/2022	0.85	0.84
B08	S	0.99	03/05/2022	0.84	0.84
B09	S	0.99	05/05/2022	0.83	0.84
B11	S	0.99	03/05/2022	0.83	0.84
B16	S	0.99	05/05/2022	0.85	0.84
B18	S	0.99	06/05/2022	0.84	0.85
B19	S	0.99	05/05/2022	0.84	0.83
B21	S	0.99	03/05/2022	0.84	0.85
B24	S	0.99	03/05/2022	0.83	0.84
B27	S	0.99	06/05/2022	0.84	0.85
B30	S	0.99	03/05/2022	0.84	0.84
B31	S	0.99	03/05/2022	0.83	0.84
B33	S	0.99	06/05/2022	0.83	0.84
B35	S	0.99	03/05/2022	0.84	0.84

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

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	01/08/2022	0.84	0.83
B04	S	0.99	01/08/2022	0.85	0.84
B05	S	0.99	01/08/2022	0.84	0.84
B07	S	0.99	01/08/2022	0.83	0.84
B08	S	0.99	02/08/2022	0.85	0.84
B09	S	0.99	02/08/2022	0.84	0.84
B11	S	0.99	02/08/2022	0.84	0.83
B16	S	0.99	02/08/2022	0.85	0.84
B18	S	0.99	02/08/2022	0.84	0.83
B19	S	0.99	02/08/2022	0.84	0.84
B21	S	0.99	02/08/2022	0.84	0.85
B24	S	0.99	03/08/2022	0.84	0.84
B27	S	0.99	03/08/2022	0.84	0.85
B30	S	0.99	03/08/2022	0.84	0.84
B31	S	0.99	03/08/2022	0.84	0.83
B33	S	0.99	01/08/2022	0.83	0.84
B35	S	0.99	01/08/2022	0.85	0.84

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

Calibrated by :



Approved by :





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Pitot Tube Calibration Report

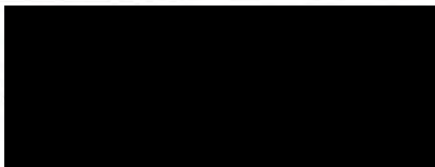
Calibration Method

Standard Pitot Tube

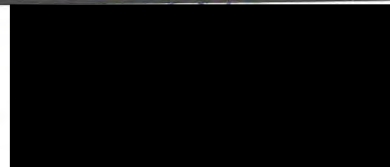
Calibration Data					
Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	01/08/2022	0.83	0.84
B37	S	0.99	01/08/2022	0.84	0.84
B38	S	0.99	02/08/2022	0.85	0.84
B39	S	0.99	02/08/2022	0.85	0.84
B40	S	0.99	02/08/2022	0.84	0.84
B41	S	0.99	02/08/2022	0.84	0.84
B44	S	0.99	02/08/2022	0.83	0.84
B45	S	0.99	01/08/2022	0.84	0.85
B46	S	0.99	01/08/2022	0.84	0.84
B47	S	0.99	03/08/2022	0.84	0.84
B48	S	0.99	03/08/2022	0.83	0.84
B49	S	0.99	01/08/2022	0.84	0.84
B54	S	0.99	01/08/2022	0.84	0.83
B56	S	0.99	01/08/2022	0.84	0.84
B57	S	0.99	04/08/2022	0.83	0.84
B58	S	0.99	04/08/2022	0.84	0.83

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

Calibrated by :



Approved by :





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Pitot Tube Calibration Report

Calibration Method

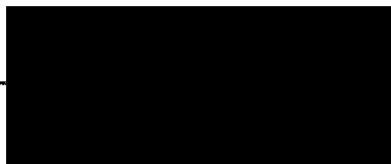
Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	02/11/2022	0.84	0.85
B04	S	0.99	04/11/2022	0.84	0.85
B05	S	0.99	04/11/2022	0.84	0.84
B07	S	0.99	02/11/2022	0.84	0.83
B08	S	0.99	03/11/2022	0.84	0.84
B09	S	0.99	02/11/2022	0.83	0.84
B11	S	0.99	04/11/2022	0.84	0.84
B16	S	0.99	02/11/2022	0.83	0.84
B18	S	0.99	02/11/2022	0.84	0.84
B19	S	0.99	04/11/2022	0.83	0.84
B21	S	0.99	02/11/2022	0.84	0.85
B24	S	0.99	04/11/2022	0.84	0.84
B27	S	0.99	03/11/2022	0.84	0.85
B30	S	0.99	03/11/2022	0.84	0.85
B31	S	0.99	03/11/2022	0.83	0.84
B33	S	0.99	01/11/2022	0.84	0.84
B35	S	0.99	01/11/2022	0.84	0.83

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

Calibrated by :



Approved by :



CERTIFICATE OF CALIBRATION

FOR

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

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

DATE OF RECEIVED : 20 July 2022

DATE OF ISSUED : 22 July 2022

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

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
22 July 2022



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

Certificate No. Q22073201

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

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

UNCERTAINTY :

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

Certificate No. **Q22073201**

F3-011-04/01-12

page 2 of 3



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

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

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. k factor 1 kPa = 0.2952998 inHg

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

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

End of Certificate

Certificate No. Q22073201

F3-011-04/01-12

page 3 of 3



@clccalibration



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B01	SKC	224-PCXR4	262101	04/07/2022	1,000	1,500	2,000	994	1,497	1,998	1.002x - 4.028	1.000
B02	SKC	224-PCXR4	626166	01/07/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.009x - 20.106	0.999
B03	SKC	224-PCXR4	612968	04/07/2022	1,000	1,500	2,000	996	1,494	2,001	1.006x - 12.907	1.000
B04	SKC	224-PCXR4	602804	04/07/2022	1,000	1,500	2,000	1,000	1,502	1,996	1.001x - 2.688	1.000
B05	SKC	224-PCXR4	612693	04/07/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.383	0.999
B06	SKC	224-PCXR4	262188	04/07/2022	1,000	1,500	2,000	996	1,508	2,009	1.020x - 35.110	0.999
B07	SKC	224-PCXR4	626262	01/07/2022	1,000	1,500	2,000	998	1,492	1,995	0.992x + 6.884	1.000
B08	SKC	224-PCXR4	626100	01/07/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 23.269	0.999
B09	SKC	224-PCXR4	626479	01/07/2022	1,000	1,500	2,000	997	1,490	1,994	0.993x + 3.909	1.000
B10	SKC	224-PCXR4	091950	01/07/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 33.950	0.999
B11	SKC	224-PCXR8	564315	04/07/2022	1,000	1,500	2,000	995	1,490	1,999	1.004x - 10.290	1.000
B12	SKC	224-PCXR4	034656	04/07/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.404	0.999
B13	SKC	224-PCXR4	602073	04/07/2022	1,000	1,500	2,000	995	1,500	1,999	1.001x - 3.554	1.000
B14	SKC	224-PCXR4	626313	04/07/2022	1,000	1,500	2,000	999	1,491	1,988	0.992x + 7.243	1.000
B15	SKC	224-PCXR4	626474	04/07/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.013x - 23.723	0.999
B16	SKC	224-PCXR4	626477	01/07/2022	1,000	1,500	2,000	994	1,504	2,001	1.015x - 31.425	0.999
B17	SKC	224-PCXR4	626860	04/07/2022	1,000	1,500	2,000	997	1,495	1,991	0.997x - 0.558	1.000
B18	SKC	224-PCXR4	691484	01/07/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.009x - 18.825	0.999
B19	SKC	224-PCXR4	691599	01/07/2022	1,000	1,500	2,000	995	1,503	1,999	1.005x - 7.985	1.000
B20	SKC	224-PCXR4	691587	01/07/2022	1,000	1,500	2,000	993	1,504	1,999	1.014x - 30.719	0.999
B21	SKC	224-PCXR4	691531	04/07/2022	1,000	1,500	2,000	993	1,499	1,994	1.001x - 7.187	1.000
B22	SKC	224-PCXR4	691654	01/07/2022	1,000	1,500	2,000	1,004	1,501	2,003	1.011x - 19.990	0.999
B23	SKC	224-PCXR4	798393	04/07/2022	1,000	1,500	2,000	993	1,505	2,002	1.017x - 34.763	0.999
B24	SKC	224-PCXR4	626363	01/07/2022	1,000	1,500	2,000	1,000	1,502	2,000	1.011x - 22.826	0.999
B25	SKC	224-PCXR4	798489	04/07/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 4.850	1.000
B26	SKC	224-PCXR4	798479	05/07/2022	1,000	1,500	2,000	999	1,499	1,993	0.996x + 2.692	1.000
B27	SKC	224-PCXR4	691673	05/07/2022	1,000	1,500	2,000	993	1,503	2,002	1.017x - 32.988	0.999
B28	SKC	224-PCXR4	691570	05/07/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.012x - 23.632	0.999
B29	SKC	224-PCXR4	626472	05/07/2022	1,000	1,500	2,000	999	1,494	1,998	1.002x - 6.856	1.000
B30	SKC	224-PCXR4	691489	05/07/2022	1,000	1,500	2,000	1,004	1,500	2,004	1.013x - 22.910	0.999
B31	SKC	224-PCXR4	691509	04/07/2022	1,000	1,500	2,000	993	1,495	1,998	1.004x - 9.879	1.000
B32	SKC	224-PCXR4	091567	05/07/2022	1,000	1,500	2,000	992	1,504	2,001	1.016x - 32.243	0.999
B33	SKC	224-PCXR4	091756	05/07/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.634	1.000
B34	SKC	224-PCXR4	612962	05/07/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.693	0.999
B35	SKC	224-PCXR4	602682	04/07/2022	1,000	1,500	2,000	993	1,498	1,996	1.001x - 7.411	1.000
B36	SKC	224-PCXR4	626164	04/07/2022	1,000	1,500	2,000	999	1,495	1,999	1.000x - 4.946	1.000
B37	SKC	224-PCXR4	626256	01/07/2022	1,000	1,500	2,000	994	1,506	2,000	1.014x - 28.892	0.999
B38	SKC	224-PCXR4	626167	04/07/2022	1,000	1,500	2,000	997	1,497	1,996	1.002x - 5.504	1.000
B39	SKC	224-PCXR4	034637	04/07/2022	1,000	1,500	2,000	1,003	1,500	2,002	1.011x - 22.048	0.999
B40	SKC	224-PCXR4	798349	05/07/2022	1,000	1,500	2,000	992	1,505	1,998	1.015x - 32.514	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 \pm 3 $^{\circ}$ C
Pressure : 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B41	SKC	224-PCXR4	612669	06/07/2022	1,000	1,500	2,000	998	1,496	1,990	0.994x + 3.749	1.000
B42	SKC	224-PCXR4	626041	06/07/2022	1,000	1,500	2,000	1,003	1,498	1,995	0.990x + 12.946	1.000
B43	SKC	224-PCXR4	034636	06/07/2022	1,000	1,500	2,000	999	1,501	1,992	0.991x + 10.805	1.000
B44	SKC	224-PCXR8	529341	06/07/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.012x - 21.857	0.999
B45	SKC	224-PCXR8	529594	04/07/2022	1,000	1,500	2,000	997	1,498	1,989	0.994x + 4.563	1.000
B46	SKC	224-PCXR8	566743	01/07/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 33.363	0.999
B47	SKC	224-PCXR8	566747	04/07/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 25.000	0.999
B48	SKC	224-PCXR8	566753	04/07/2022	1,000	1,500	2,000	999	1,494	1,998	0.999x - 2.194	1.000
B49	SKC	224-PCXR8	566780	04/07/2022	1,000	1,500	2,000	1,003	1,502	2,003	1.012x - 22.626	0.999
B50	SKC	224-PCXR8	500400	04/07/2022	1,000	1,500	2,000	1,002	1,495	2,002	1.001x - 3.458	1.000
B51	SKC	224-PCXR8	500363	04/07/2022	1,000	1,500	2,000	995	1,504	2,000	1.012x - 26.388	0.999
B52	SKC	224-PCXR8	093186	04/07/2022	1,000	1,500	2,000	995	1,497	1,994	0.997x - 1.360	1.000
B53	SKC	224-PCXR8	707670	04/07/2022	1,000	1,500	2,000	1,002	1,499	2,002	1.010x - 20.947	0.999
B54	SKC	224-PCXR3	509821	01/07/2022	1,000	1,500	2,000	993	1,501	2,001	1.016x - 33.878	0.999
B55	SKC	224-PCXR3	510710	01/07/2022	1,000	1,500	2,000	1,000	1,494	1,993	0.993x + 5.432	1.000
B56	SKC	224-PCXR3	511450	01/07/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x - 20.804	0.999
B57	SKC	224-PCXR3	510798	01/07/2022	1,000	1,500	2,000	997	1,493	1,998	1.001x - 3.199	1.000
B58	SKC	224-PCXR3	509852	05/07/2022	1,000	1,500	2,000	1,001	1,498	1,999	1.007x - 19.033	0.999
B59	SKC	224-PCXR3	509862	05/07/2022	1,000	1,500	2,000	996	1,503	1,994	0.997x + 3.115	1.000
B60	SKC	224-PCXR3	512655	04/07/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 23.691	0.999
B61	SKC	224-PCXR3	503915	04/07/2022	1,000	1,500	2,000	994	1,489	1,998	1.004x - 11.866	1.000
B62	SKC	224-PCXR3	505975	04/07/2022	1,000	1,500	2,000	999	1,494	1,996	0.997x - 0.104	1.000
B63	SKC	224-PCXR3	511432	01/07/2022	1,000	1,500	2,000	991	1,501	1,999	1.017x - 35.541	0.999
B64	SKC	224-PCXR3	508302	01/07/2022	1,000	1,500	2,000	997	1,493	1,989	0.992x + 5.947	1.000
B65	SKC	224-PCXR3	508310	04/07/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 22.949	0.999
B66	SKC	224-PCXR3	509861	05/07/2022	1,000	1,500	2,000	1,002	1,491	1,991	0.988x + 13.425	1.000
B67	SKC	224-PCXR3	506295	01/07/2022	1,000	1,500	2,000	993	1,507	2,004	1.017x - 32.945	0.999
B68	SKC	224-PCXR3	505872	01/07/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.755	1.000
B69	SKC	224-PCXR3	508375	01/07/2022	1,000	1,500	2,000	1,001	1,500	2,000	1.010x - 21.569	0.999
B70	SKC	224-PCXR3	510623	04/07/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x - 6.533	1.000
B71	SKC	224-PCXR3	508367	05/07/2022	1,000	1,500	2,000	990	1,506	2,002	1.018x - 37.184	0.999
B72	SKC	224-PCXR3	505977	05/07/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.993x + 5.652	1.000
B73	SKC	224-PCXR3	512606	04/07/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.013x - 24.278	0.999
B74	SKC	224-PCXR3	505993	01/07/2022	1,000	1,500	2,000	996	1,495	1,994	1.000x - 4.682	1.000
B75	SKC	224-PCXR3	509820	01/07/2022	1,000	1,500	2,000	996	1,499	1,990	0.994x + 3.625	1.000
B76	SKC	224-PCXR3	509811	04/07/2022	1,000	1,500	2,000	993	1,498	1,998	1.007x - 14.602	1.000
B77	SKC	224-PCXR3	508301	04/07/2022	1,000	1,500	2,000	1,000	1,501	2,004	1.014x - 26.842	0.999
B78	SKC	224-PCXR3	510677	04/07/2022	1,000	1,500	2,000	996	1,503	1,998	1.012x - 27.121	0.999
B79	SKC	224-PCXR3	510920	04/07/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 3.506	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 \pm 3 $^{\circ}$ C
Pressure : 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B01	SKC	224-PCXR4	262101	06/10/2022	1,000	1,500	2,000	994	1,497	1,998	1.001x - 3.789	1.000
B02	SKC	224-PCXR4	626166	03/10/2022	1,000	1,500	2,000	1,002	1,505	2,001	1.009x - 19.707	0.999
B03	SKC	224-PCXR4	612968	03/10/2022	1,000	1,500	2,000	996	1,494	2,001	1.006x - 12.308	1.000
B04	SKC	224-PCXR4	602804	03/10/2022	1,000	1,500	2,000	1,000	1,502	2,000	1.004x - 5.919	1.000
B05	SKC	224-PCXR4	612693	06/10/2022	1,000	1,500	2,000	1,003	1,499	2,003	1.012x - 22.622	0.999
B06	SKC	224-PCXR4	262188	06/10/2022	1,000	1,500	2,000	995	1,507	1,999	1.005x - 11.738	1.000
B07	SKC	224-PCXR4	626262	04/10/2022	1,000	1,500	2,000	998	1,492	1,995	0.993x + 6.405	1.000
B08	SKC	224-PCXR4	626100	04/10/2022	1,000	1,500	2,000	1,002	1,499	2,003	1.013x - 24.18	0.999
B09	SKC	224-PCXR4	626479	06/10/2022	1,000	1,500	2,000	996	1,490	1,994	0.994x + 1.675	1.000
B10	SKC	224-PCXR4	091950	03/10/2022	1,000	1,500	2,000	993	1,503	2,001	1.017x - 34.588	0.999
B11	SKC	224-PCXR8	564315	06/10/2022	1,000	1,500	2,000	994	1,490	2,003	1.007x - 14.438	1.000
B12	SKC	224-PCXR4	034656	03/10/2022	1,000	1,500	2,000	1,003	1,503	2,003	1.010x - 19.005	0.999
B13	SKC	224-PCXR4	602073	03/10/2022	1,000	1,500	2,000	995	1,500	1,993	0.997x + 2.708	1.000
B14	SKC	224-PCXR4	626313	03/10/2022	1,000	1,500	2,000	998	1,491	1,988	0.992x + 6.007	1.000
B15	SKC	224-PCXR4	626474	03/10/2022	1,000	1,500	2,000	1,003	1,502	2,005	1.003x - 10.123	0.999
B16	SKC	224-PCXR4	626477	03/10/2022	1,000	1,500	2,000	993	1,504	2,001	1.015x - 31.624	0.999
B17	SKC	224-PCXR4	626860	03/10/2022	1,000	1,500	2,000	997	1,494	1,991	0.997x - 0.239	1.000
B18	SKC	224-PCXR4	691484	03/10/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.008x - 16.073	0.999
B19	SKC	224-PCXR4	691599	03/10/2022	1,000	1,500	2,000	993	1,503	2,000	1.005x - 8.623	1.000
B20	SKC	224-PCXR4	691587	03/10/2022	1,000	1,500	2,000	991	1,504	1,999	1.016x - 33.631	0.999
B21	SKC	224-PCXR4	691531	06/10/2022	1,000	1,500	2,000	993	1,500	1,994	1.001x - 6.669	1.000
B22	SKC	224-PCXR4	691654	04/10/2022	1,000	1,500	2,000	1,003	1,501	2,003	1.011x - 20.429	0.999
B23	SKC	224-PCXR4	798393	04/10/2022	1,000	1,500	2,000	993	1,505	2,002	1.018x - 34.843	0.999
B24	SKC	224-PCXR4	626363	06/10/2022	1,000	1,500	2,000	999	1,502	2,000	1.012x - 23.225	0.999
B25	SKC	224-PCXR4	798489	06/10/2022	1,000	1,500	2,000	1,001	1,512	2,001	0.998x + 5.049	1.000
B26	SKC	224-PCXR4	798479	06/10/2022	1,000	1,500	2,000	999	1,499	1,993	0.996x + 2.892	1.000
B27	SKC	224-PCXR4	691673	06/10/2022	1,000	1,500	2,000	994	1,503	1,999	1.011x - 22.778	0.999
B28	SKC	224-PCXR4	691570	04/10/2022	1,000	1,500	2,000	1,001	1,500	2,002	1.007x - 13.301	1.000
B29	SKC	224-PCXR4	626472	06/10/2022	1,000	1,500	2,000	1,000	1,496	1,998	1.002x - 5.261	1.000
B30	SKC	224-PCXR4	691489	03/10/2022	1,000	1,500	2,000	1,007	1,500	2,004	1.010x - 18.482	0.999
B31	SKC	224-PCXR4	691509	03/10/2022	1,000	1,500	2,000	993	1,497	1,998	1.004x - 8.882	1.000
B32	SKC	224-PCXR4	091567	03/10/2022	1,000	1,500	2,000	992	1,504	2,001	1.007x - 15.930	1.000
B33	SKC	224-PCXR4	091756	06/10/2022	1,000	1,500	2,000	994	1,496	1,991	0.996x + 0.714	1.000
B34	SKC	224-PCXR4	612962	03/10/2022	1,000	1,500	2,000	1,002	1,501	2,001	1.009x - 17.944	0.999
B35	SKC	224-PCXR4	602682	03/10/2022	1,000	1,500	2,000	993	1,498	1,995	1.001x - 7.331	1.000
B36	SKC	224-PCXR4	626164	06/10/2022	1,000	1,500	2,000	999	1,495	1,999	1.000x - 4.866	1.000
B37	SKC	224-PCXR4	626256	06/10/2022	1,000	1,500	2,000	994	1,506	1,999	1.013x - 28.214	0.999
B38	SKC	224-PCXR4	626167	06/10/2022	1,000	1,500	2,000	997	1,496	1,996	1.002x - 6.342	1.000
B39	SKC	224-PCXR4	034637	06/10/2022	1,000	1,500	2,000	1,006	1,500	2,001	1.008x - 16.624	0.999
B40	SKC	224-PCXR4	798349	05/10/2022	1,000	1,500	2,000	994	1,505	1,998	1.014x - 29.642	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 \pm 3 $^{\circ}$ C
Pressure : 1010 \pm 15 mmbar

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R²
B41	SKC	224-PCXR4	612669	05/10/2022	1,000	1,500	2,000	998	1,496	1,990	0.994x + 3.271	1.000
B42	SKC	224-PCXR4	626041	06/10/2022	1,000	1,500	2,000	1,005	1,498	1,994	0.988x + 15.619	1.000
B43	SKC	224-PCXR4	034636	06/10/2022	1,000	1,500	2,000	999	1,501	1,992	0.991x + 10.565	1.000
B44	SKC	224-PCXR8	529341	06/10/2022	1,000	1,500	2,000	1,002	1,502	2,002	1.011x - 21.418	0.999
B45	SKC	224-PCXR8	529594	06/10/2022	1,000	1,500	2,000	998	1,498	1,989	0.993x + 5.959	1.000
B46	SKC	224-PCXR8	566743	06/10/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 32.885	0.999
B47	SKC	224-PCXR8	566747	06/10/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.960	0.999
B48	SKC	224-PCXR8	566753	03/10/2022	1,000	1,500	2,000	999	1,494	1,998	0.999x - 2.114	1.000
B49	SKC	224-PCXR8	566780	05/10/2022	1,000	1,500	2,000	1,003	1,502	2,003	1.012x - 22.706	0.999
B50	SKC	224-PCXR8	500400	06/10/2022	1,000	1,500	2,000	1,001	1,495	2,002	1.001x - 3.737	1.000
B51	SKC	224-PCXR8	500363	06/10/2022	1,000	1,500	2,000	995	1,504	1,999	1.011x - 25.590	0.999
B52	SKC	224-PCXR8	093186	03/10/2022	1,000	1,500	2,000	995	1,496	1,994	0.997x - 1.161	1.000
B53	SKC	224-PCXR8	707670	03/10/2022	1,000	1,500	2,000	1,002	1,500	2,002	1.010x - 20.668	0.999
B54	SKC	224-PCXR3	509821	03/10/2022	1,000	1,500	2,000	993	1,500	2,001	1.017x - 34.516	0.999
B55	SKC	224-PCXR3	510710	03/10/2022	1,000	1,500	2,000	999	1,494	1,994	0.995x + 2.521	1.000
B56	SKC	224-PCXR3	511450	03/10/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.004x - 7.562	1.000
B57	SKC	224-PCXR3	510798	06/10/2022	1,000	1,500	2,000	997	1,492	1,998	0.996x +1.109	1.000
B58	SKC	224-PCXR3	509852	06/10/2022	1,000	1,500	2,000	1,000	1,498	1,999	1.007x - 19.113	0.999
B59	SKC	224-PCXR3	509862	03/10/2022	1,000	1,500	2,000	996	1,503	1,994	0.997x + 2.955	1.000
B60	SKC	224-PCXR3	512655	03/10/2022	1,000	1,500	2,000	1,005	1,500	2,003	1.010x - 19.862	0.999
B61	SKC	224-PCXR3	503915	04/10/2022	1,000	1,500	2,000	994	1,489	1,998	1.004x - 11.786	1.000
B62	SKC	224-PCXR3	505975	03/10/2022	1,000	1,500	2,000	999	1,494	1,996	0.997x - 0.064	1.000
B63	SKC	224-PCXR3	511432	03/10/2022	1,000	1,500	2,000	991	1,501	1,999	1.017x - 35.461	0.999
B64	SKC	224-PCXR3	508302	03/10/2022	1,000	1,500	2,000	997	1,492	1,989	0.992x + 6.266	1.000
B65	SKC	224-PCXR3	508310	06/10/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.011x - 21.992	0.999
B66	SKC	224-PCXR3	509861	06/10/2022	1,000	1,500	2,000	1,002	1,491	1,991	0.988x + 13.904	1.000
B67	SKC	224-PCXR3	506295	06/10/2022	1,000	1,500	2,000	993	1,508	2,004	1.017x - 32.785	0.999
B68	SKC	224-PCXR3	505872	05/10/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.237	1.000
B69	SKC	224-PCXR3	508375	05/10/2022	1,000	1,500	2,000	1,001	1,499	2,000	1.010x - 21.330	0.999
B70	SKC	224-PCXR3	510623	05/10/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x - 6.054	1.000
B71	SKC	224-PCXR3	508367	05/10/2022	1,000	1,500	2,000	990	1,506	2,002	1.018x - 37.025	0.999
B72	SKC	224-PCXR3	505977	05/10/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.993x + 5.731	1.000
B73	SKC	224-PCXR3	512606	05/10/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.014x - 24.397	0.999
B74	SKC	224-PCXR3	505993	05/10/2022	1,000	1,500	2,000	996	1,495	1,994	0.999x - 4.284	1.000
B75	SKC	224-PCXR3	509820	05/10/2022	1,000	1,500	2,000	996	1,498	1,990	0.995x + 2.987	1.000
B76	SKC	224-PCXR3	509811	03/10/2022	1,000	1,500	2,000	993	1,498	1,998	1.006x - 14.003	1.000
B77	SKC	224-PCXR3	508301	06/10/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 25.845	0.999
B78	SKC	224-PCXR3	510677	06/10/2022	1,000	1,500	2,000	996	1,503	1,999	1.012x - 27.321	0.999
B79	SKC	224-PCXR3	510920	06/10/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 3.905	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 ²
H-B01	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	505.3	989.5	1973.5	0.990x + 8.629	1.000
H-B02	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	495.3	997.8	1995.3	0.999x - 1.842	1.000
H-B03	Dwyer	VFB-65	05/07/2022	500	1,000	2,000	497.9	987.5	2010.2	1.006x - 16.084	0.999
H-B04	Dwyer	VFB-65	05/07/2022	500	1,000	2,000	500.4	999.5	2008.7	0.998x - 1.698	1.000
H-B05	Dwyer	VFB-65	01/07/2022	500	1,000	2,000	498.6	997.4	1982.3	0.988x + 13.004	1.000
H-B06	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	503.9	994.2	1981.4	1.005x - 8.757	0.999
H-B07	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	504.1	993.3	2018.3	1.002x - 1.639	1.000
H-B08	Dwyer	VFB-65	01/07/2022	500	1,000	2,000	500.2	999.2	1975.8	0.996x + 3.649	0.999
H-B09	Dwyer	VFB-65	01/07/2022	500	1,000	2,000	503.7	1006.6	2014.3	0.994x + 14.328	1.000
H-B10	Dwyer	VFB-65	04/07/2022	500	1,000	2,000	496.9	998.6	2012.4	0.997x + 3.130	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 High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	505.3	990.7	1975.7	0.990x + 8.856	1.000
H-B02	Dwyer	VFB-65	04/10/2022	500	1,000	2,000	495.7	997.8	1995.3	0.994x + 4.025	1.000
H-B03	Dwyer	VFB-65	04/10/2022	500	1,000	2,000	498.3	987.5	2010.2	1.004x - 14.483	0.999
H-B04	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	501.2	999.9	2008.7	0.998x - 0.511	1.000
H-B05	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	499.0	997.4	1972.3	0.987x + 14.507	1.000
H-B06	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	503.9	993.4	1981.4	1.006x - 9.415	0.999
H-B07	Dwyer	VFB-65	05/10/2022	500	1,000	2,000	504.1	989.0	2018.3	1.002x - 2.255	1.000
H-B08	Dwyer	VFB-65	04/10/2022	500	1,000	2,000	499.8	999.2	1975.8	0.997x + 2.922	0.999
H-B09	Dwyer	VFB-65	06/10/2022	500	1,000	2,000	503.7	1006.6	2014.3	0.993x + 14.424	1.000
H-B10	Dwyer	VFB-65	06/10/2022	500	1,000	2,000	496.9	998.6	2012.4	0.998x + 1.450	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

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-B01	Dwyer	VFA-21	04/07/2022	50	100	200	50.7	99.1	198.9	0.986x + 1.078	1.000
L-B02	Dwyer	VFA-21	04/07/2022	50	100	200	50.2	99.4	198.3	1.004x - 1.615	0.999
L-B03	Dwyer	VFA-21	05/07/2022	50	100	200	50.8	98.8	198.3	1.016x - 2.213	1.000
L-B04	Dwyer	VFA-21	05/07/2022	50	100	200	49.9	102.0	201.1	0.994x + 1.640	1.000
L-B05	Dwyer	VFA-21	01/07/2022	50	100	200	50.5	98.1	200.8	0.991x + 0.476	1.000
L-B06	Dwyer	VFA-21	04/07/2022	50	100	200	50.3	100.5	203.0	0.999x + 0.476	0.999
L-B07	Dwyer	VFA-21	04/07/2022	50	100	200	49.4	100.8	199.7	1.016x - 1.898	1.000
L-B08	Dwyer	VFA-21	01/07/2022	50	100	200	49.8	101.3	198.1	0.999x - 0.218	1.000
L-B09	Dwyer	VFA-21	01/07/2022	50	100	200	49.6	99.6	200.7	1.010x - 1.907	0.999
L-B10	Dwyer	VFA-21	04/07/2022	50	100	200	51.0	100.2	202.8	0.992x + 2.266	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

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-B01	Dwyer	VFA-21	05/10/2022	50	100	200	50.7	99.1	198.9	0.985x + 1.192	1.000
L-B02	Dwyer	VFA-21	04/10/2022	50	100	200	49.8	99.4	198.3	1.012x - 2.104	1.000
L-B03	Dwyer	VFA-21	04/10/2022	50	100	200	50.8	99.2	198.3	1.009x - 1.844	0.999
L-B04	Dwyer	VFA-21	04/10/2022	50	100	200	49.9	101.6	201.1	0.996x + 1.334	1.000
L-B05	Dwyer	VFA-21	04/10/2022	50	100	200	50.1	98.5	200.8	0.992x + 0.311	1.000
L-B06	Dwyer	VFA-21	04/10/2022	50	100	200	50.3	100.5	203.4	1.009x + 0.376	1.000
L-B07	Dwyer	VFA-21	04/10/2022	50	100	200	49.4	100.8	199.7	1.005x - 1.24	0.999
L-B08	Dwyer	VFA-21	04/10/2022	50	100	200	49.8	101.3	198.1	0.998x - 0.116	1.000
L-B09	Dwyer	VFA-21	06/10/2022	50	100	200	49.6	99.2	200.7	1.013x - 1.491	1.000
L-B10	Dwyer	VFA-21	06/10/2022	50	100	200	50.6	100.2	202.8	0.993x + 2011	1.000

Calibrated by :

Approved by :

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

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

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

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

Date of Receipt : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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

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. 21-65/0455

MTC No. EEL. BP. 41/0465

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.93	-0.07	± 0.10	± 0.40 dB

2. Frequency

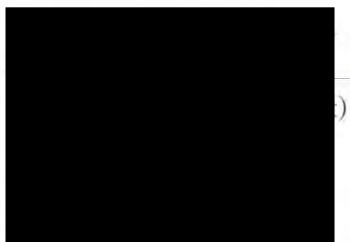
Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	$\pm 1.0\%$

3. Total Distortion

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

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

Calibrated by :



Approved by :



Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011265042601787001

2 / 2

End of Certificate

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

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FM.BL.MTC.002 Rev.4

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0374

MTC No. EEL. BP. 47/0365

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Cirrus

Model : CR:515

Serial No. : 92002

Ambient Environment

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

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

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

- Standards used :**
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer Keithley 2015-P S/N 4106495.
 7. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871.

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level 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 : 14 Mar. 2022

Date of Calibration : 19 Mar. 2022

1 / 2

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0374

MTC No. EEL. BP. 47/0365

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.00	± 0.50	$\pm 3.0\%$

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

Calibrated by :



Approved by :



Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 19 Mar. 2022

Date of Issue : 22 Mar. 2022

Ref : 2011265031401103001

End of Certificate

2 / 2

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FM.BL.MTC.002 Rev.4

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Noise B_427/22

Sound Level Meter Calibration Report

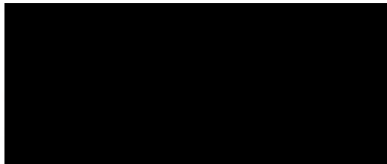
Acoustic Calibrator Data

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

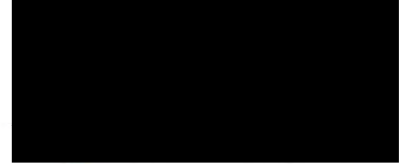
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B11	ACO	6236	00152079	19 July 2022	94.1	94.0
ACO-B17	ACO	6236	00172042	19 July 2022	94.0	94.0
ACO-B25	ACO	6236	00182006	19 July 2022	93.9	94.0
ACO-B30	ACO	6236	00182012	19 July 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Noise B_465/22

Sound Level Meter Calibration Report

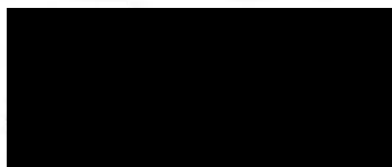
Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R01	ACO	6236	00122005	14 August 2022	93.9	94.0
ACO-R02	ACO	6236	00132029	14 August 2022	94.0	94.0
ACO-R03	ACO	6236	00132031	14 August 2022	94.0	94.0
ACO-R04	ACO	6236	00142005	14 August 2022	94.0	94.0
ACO-R06	ACO	6236	00152005	14 August 2022	94.0	94.0
ACO-R11	ACO	6236	00172038	14 August 2022	93.9	94.0
ACO-R12	ACO	6236	00172040	14 August 2022	94.0	94.0
ACO-R13	ACO	6236	00172041	14 August 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :



Approved by :





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
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Noise B_525/22

Sound Level Meter Calibration Report

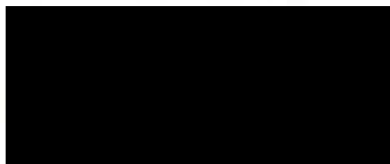
Acoustic Calibrator Data

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

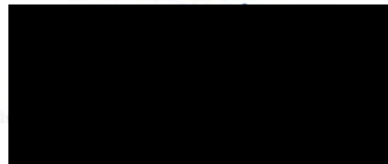
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B13	ACO	6236	00152084	13 September 2022	94.1	94.0
ACO-B18	ACO	6236	00172048	13 September 2022	94.0	94.0
ACO-B27	ACO	6236	00182008	13 September 2022	93.9	94.0
ACO-B37	ACO	6236	00192028	13 September 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

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 : sale@spscon.com., www.spscon.com

Noise B_577/22

Sound Level Meter Calibration Report

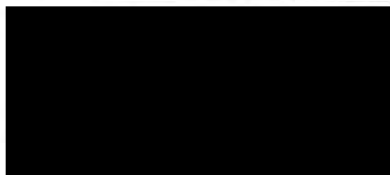
Acoustic Calibrator Data

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

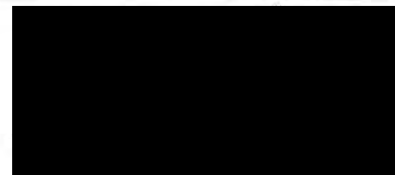
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B21	ACO	6236	00172059	18 October 2022	94.1	94.0
ACO-B25	ACO	6236	00182006	18 October 2022	93.9	94.0
ACO-B35	ACO	6236	00192026	18 October 2022	94.0	94.0
ACO-B43	ACO	6236	00192034	18 October 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

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

Noise B_616/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B12	ACO	6236	00152081	13 November 2022	94.1	94.0
ACO-B21	ACO	6236	00172059	13 November 2022	94.1	94.0
ACO-B28	ACO	6236	00182009	13 November 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

Approved by :



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Noise B_616_1/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand CIRRUS

Number AC-CR01/63

Model CR515

Serial No. 92002

Calibration Range 94 dB, 1000 Hz

Last Calibration 19 March 2022

Due Date 19 March 2023

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B03	Cirrus	CR161B	G301155	13 November 2022	94.0	94.0

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

93.99 ± 0.10 dB

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Noise B_677/22

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B01	ACO	6236	00132025	18 December 2022	94.0	94.0
ACO-B06	ACO	6236	00142003	18 December 2022	94.1	94.0
ACO-B11	ACO	6236	00152079	18 December 2022	94.0	94.0
ACO-B21	ACO	6236	00172059	18 December 2022	94.0	94.0
ACO-B23	ACO	6236	00182002	18 December 2022	93.9	94.0
ACO-B26	ACO	6236	00182007	18 December 2022	94.0	94.0
ACO-B28	ACO	6236	00182009	18 December 2022	94.0	94.0
ACO-B42	ACO	6236	00192033	18 December 2022	93.9	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.93 ± 0.10 dB	

Calibrated by :

Approved by :



CERTIFICATE No : 22M2567

REFERENCE No : 64386-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS 105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY :

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22



CERTIFICATE No : 22M2567

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

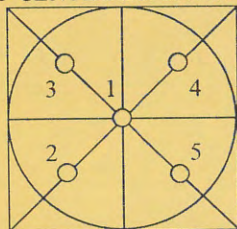
3. THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

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

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

6. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP22018

Pages 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

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

Location : ORGANIC LABORATORY IV

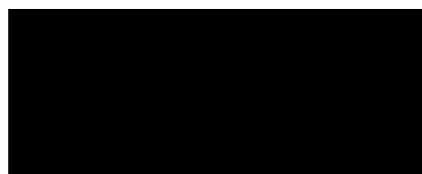
Ambient Temperature : (24.4 ± 5) °C
Relative Humidity : (60.1 ± 25) %

Received Date : 30 AUGUST 2022
Calibration Date : 30 AUGUST 2022
Date of Issue : 31 AUGUST 2022

Calibrated by :

Nathakorn Pisutpaisan

Approved by :



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

Continuation of Calibration Certificate

Cert. No. : SP22018

Job No. : VC65SP0008

Pages : 2 of 3

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

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

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

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate



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7 Soi Phaholyothin 24, Phaholyothin Rd., Jomjol, 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 : 01 July 2022 Brand : API Model : 300E
No. CO-B01 Serial No. 782

Calibrator (Dilution System)

Brand : API Model : 700
Last Cal. Date : 20 September 2021 Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO) Cylinder No. : D196045
Certified Date : 16 April 2022 Expired Date : 15 April 2024 Cylinder Conc. : 4,570 ppm

Calibrating Condition

Pressure 1011 mmbar Temp. 24.5 °C % RH 48

Calibration Setting

Span Set Point	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	-0.10	-	0
CO Span	40.00	39.96	-0.100	40.00

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	3949.4	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	810	CC/Min	800 ± 10%
Sample Temperature	48.3	°C	48 ± 4
Bench Temperature	48.1	°C	48 ± 2
Wheel Temperature	68.2	°C	68 ± 2
Box Temperature	30.7	°C	Ambient Temp + 7 ± 10
Photo-Drive	3023.1	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 : 01 August 2022

Brand : API

Model : 300E

No. CO-B01

Serial No. 782

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 20 September 2021

Serial No. : 421

Reference Standard Gas

Standard Gas : Carbon Monoxide (CO)

Cylinder No. : D196045

Certified Date : 16 April 2022

Expired Date : 15 April 2024

Cylinder Conc. : 4,570 ppm

Calibrating Condition

Pressure 1011 mmbar

Temp. 24.6 °C

% RH 49

Calibration Setting

Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	-	0
CO Span	40.00	40.04	0.100	40.00

API Model 300E CO Analyzer Check List

Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	< 1 ppm With Zero Air
CO Measure	4014.7	mV	2500-4800 mV
CO Reference	3948.2	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	811	CC/Min	800 ± 10%
Sample Temperature	48.5	°C	48 ± 4
Bench Temperature	48.2	°C	48 ± 2
Wheel Temperature	68.3	°C	68 ± 2
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10
Photo-Drive	3021.3	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 :	01 September 2022	Brand :	API	Model :	300E
No.	CO-B01	Serial No.	782		
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 20 September 2021			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 ppm	
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.5	°C
				% RH	48
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	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	4015.3	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	28.6	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	807	CC/Min	800 ± 10%		
Sample Temperature	48.5	°C	48 ± 4		
Bench Temperature	48.3	°C	48 ± 2		
Wheel Temperature	68.5	°C	68 ± 2		
Box Temperature	30.6	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3024.8	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		

Calibrated by :

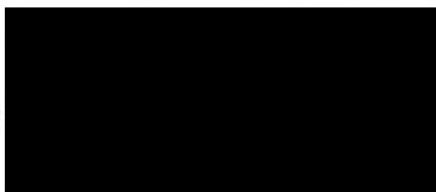
Approved by



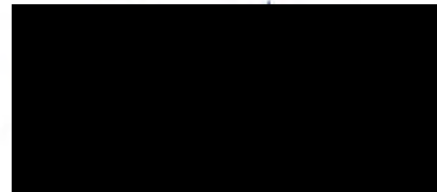
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Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sale@spscon.com, www.spscon.com

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	03 October 2022	Brand :	API	Model :	300E
No.	CO-B01			Serial No.	782
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 06 September 2022			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 ppm	
Calibrating Condition					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	49	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response		%Dif	Analyzer Response
Zero	0	0.10		-	0
CO Span	40.00	40.03		0.075	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	4016.4	mV	2500-4800 mV		
CO Reference	3948.2	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	810	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.1	°C	48 ± 2		
Wheel Temperature	68.2	°C	68 ± 2		
Box Temperature	30.7	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3026.1	mV	250 mV to 4750 mV		
Slope	1.017	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		

Calibrated by :



Approved by :

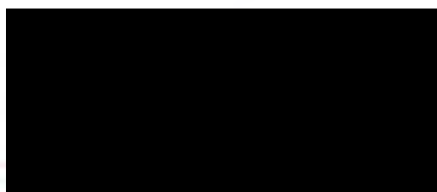




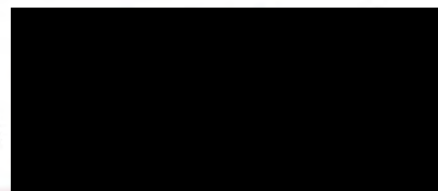
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	07 November 2022	Brand :	API	Model :	300E
No.	CO-B01			Serial No.	782
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 06 September 2022			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 ppm	
Calibrating Condition					
Pressure : 1011 mmbar		Temp. : 24.5 °C		% RH : 48	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	39.97	-0.075	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	4016.9	mV	2500-4800 mV		
CO Reference	3947.5	mV	2500-4800 mV		
Measure/Reference Ratio	1.180	-	1.1-1.3 W/Zero Air		
Sample Pressure	28.6	In-Hg-A	~2" < Ambient Absolute Pressure		
Sample Flow	808	CC/Min	800 ± 10%		
Sample Temperature	48.2	°C	48 ± 4		
Bench Temperature	48.0	°C	48 ± 2		
Wheel Temperature	68.4	°C	68 ± 2		
Box Temperature	30.9	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3025.2	mV	250 mV to 4750 mV		
Slope	1.018	-	1.0 ± 0.3		
Offset	0.2	-	0 ± 0.3		

Calibrated by :



Approved by :

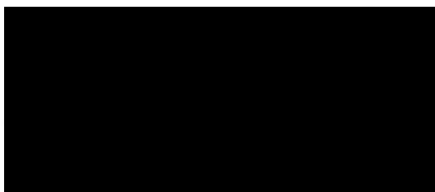




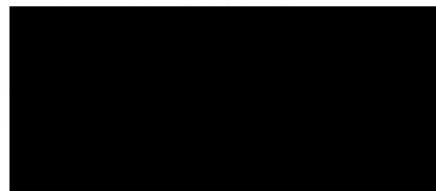
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Calibration Report					
Non-Dispersive Infrared CO Analyzer					
Date :	06 December 2022	Brand :	API	Model :	300E
No.	CO-B02			Serial No.	965
Calibrator (Dilution System)					
Brand : API			Model : 700		
Last Cal. Date : 06 September 2022			Serial No. : 421		
Reference Standard Gas					
Standard Gas : Carbon Monoxide (CO)			Cylinder No. : D196045		
Certified Date : 16 April 2022		Expired Date : 15 April 2024		Cylinder Conc. : 4,570 ppm	
Calibrating Condition					
Pressure : 1011 mmbar		Temp. : 24.6 °C		% RH : 49	
Calibration Setting					
Span	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	
Zero	0	-0.10	-	0	
CO Span	40.00	40.02	0.050	40.00	
API Model 300E CO Analyzer Check List					
Parameter		Units	Nominal Range		
Range	50	PPM	0-1000 ppm		
Stability	0.10	PPM	< 1 ppm With Zero Air		
CO Measure	4016.5	mV	2500-4800 mV		
CO Reference	3949.9	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	812	CC/Min	800 ± 10%		
Sample Temperature	48.3	°C	48 ± 4		
Bench Temperature	48.0	°C	48 ± 2		
Wheel Temperature	68.2	°C	68 ± 2		
Box Temperature	30.8	°C	Ambient Temp + 7 ± 10		
Photo-Drive	3020.1	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 : 

Date : Jan 5, 2022

(Mr. Channarong Khiao-Un)

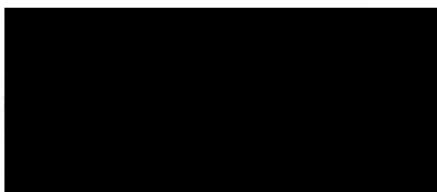
Test Engineer



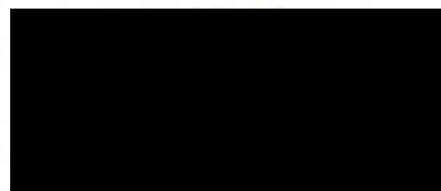
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Calibration Report			
Total Hydrocarbon Analyzer			
Date :	04 July 2022	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	Serial No.	4211954001
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	05 August 2021	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Methane (CH ₄)	Cylinder No. :	D595075
Certified Date :	17 March 2015	Expired Date :	17 March 2023
		Cylinder Conc. :	456 ppm
Calibrating Condition			
Pressure	1011	mmbar	Temp. 24.5 °C
		% RH	49
		Start Time :	1:00 PM
Pre-Calibration Checks			
Change Particulate Filter	Yes	Station Temp :	25.0 °C
Leak Test	Yes		
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.03	10
Calibration Setting (Final)			
Span Instrument Gain:	0.997	Finish Time:	2:00 PM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	910.5	mV	800-1,350
Signal (THC)	915.8	mV	800-1,350
Detector	78.1	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	kPa	8 - 25
NMC	258.3	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :



Approved by :

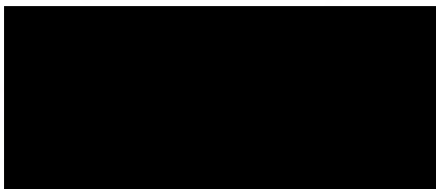




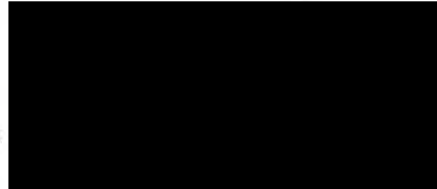
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Calibration Report Total Hydrocarbon Analyzer			
Date :	01 August 2022	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	Serial No.	4211954001
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	05 August 2021	Serial No.	911
Reference Standard Gas			
Standard Gas :	Methane (CH ₄)	Cylinder No.	D595075
Certified Date :	17 March 2015	Expired Date :	17 March 2023
		Cylinder Conc.	456 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	10.05	10
Calibration Setting (Final)			
Span Instrument Gain:	0.996	Finish Time:	11:00 AM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.3	mV	800-1,350
Signal (THC)	916.7	mV	800-1,350
Detector	78.2	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.3	kPa	8 - 25
NMC	259.2	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :



Approved by :





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

Calibration Report			
Total Hydrocarbon Analyzer			
Date :	01 September 2022	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	Serial No.	4211954001
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	04 August 2022	Serial No. :	911
Reference Standard Gas			
Standard Gas :	Methane (CH ₄)	Cylinder No. :	D595075
Certified Date :	17 March 2015	Expired Date :	17 March 2023
		Cylinder Conc. :	456 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.5 °C
		% RH	49
		Start Time :	9:00 AM
Pre-Calibration Checks			
Change Particulate Filter	Yes	Station Temp :	25.0 °C
Leak Test	Yes		
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.02	10
Calibration Setting (Final)			
Span Instrument Gain:	0.997	Finish Time:	10:00 AM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	910.4	mV	800-1,350
Signal (THC)	915.6	mV	800-1,350
Detector	77.8	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	kPa	8 - 25
NMC	258.9	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :

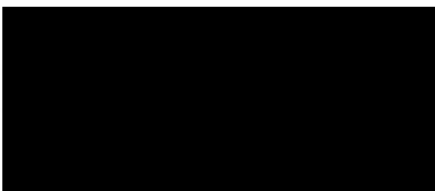
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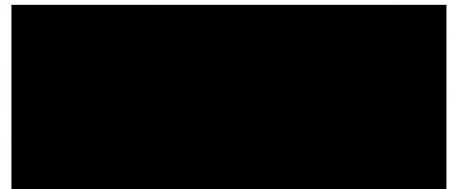
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Tel : (662) 939-4370-72. Fax : (662) 513-4221. E-mail : sale@spscon.com. www.spscon.com

Calibration Report Total Hydrocarbon Analyzer			
Date :	03 October 2022	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	Serial No.	4211954001
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	04 August 2022	Serial No.	911
Reference Standard Gas			
Standard Gas :	Methane (CH ₄)	Cylinder No.	D595075
Certified Date :	17 March 2015	Expired Date :	17 March 2023
		Cylinder Conc.	456 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	10.05	10
Calibration Setting (Final)			
Span Instrument Gain:	0.996	Finish Time:	11:00 AM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	911.2	mV	800-1,350
Signal (THC)	915.9	mV	800-1,350
Detector	78.0	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.1	kPa	8 - 25
NMC	258.4	°C	260 ± 10
Bypass	0.9	L / min	0.9 ± 0.3
Over Flow	0.8	L / Min	0.8

Calibrated by :



Approved by :





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Calibration Report			
Total Hydrocarbon Analyzer			
Date :	02 November 2022	Brand :	HORIBA
		Model :	APHA-360CE
No.	B01	Serial No.	4211954001
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	04 August 2022	Serial No.	911
Reference Standard Gas			
Standard Gas :	Methane (CH ₄)	Cylinder No.	D595075
Certified Date :	17 March 2015	Expired Date :	17 March 2023
		Cylinder Conc.	456 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.6 °C
		% RH	48
		Start Time :	9:00 AM
Pre-Calibration Checks			
Change Particulate Filter	Yes	Station Temp :	25.0 °C
Leak Test	Yes		
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	-0.10	0
Span	10	10.03	10
Calibration Setting (Final)			
Span Instrument Gain:	0.997	Finish Time:	10:00 AM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	912.3	mV	800-1,350
Signal (THC)	916.8	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 :



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

Calibration Report Total Hydrocarbon Analyzer			
Date :	02 December 2022	Brand :	HORIBA
No.	B01	Model :	APHA-360CE
		Serial No.	4211954001
Calibrator (Dilution System)			
Brand :	API	Model :	700
Last Cal. Date :	04 August 2022	Serial No.	911
Reference Standard Gas			
Standard Gas :	Methane (CH ₄)	Cylinder No.	D595075
Certified Date :	17 March 2015	Expired Date :	17 March 2023
		Cylinder Conc.	456 ppm
Calibrating Condition			
Pressure	1011 mmbar	Temp.	24.5 °C
		% RH	49
		Start Time :	10:00 AM
Pre-Calibration Checks			
Change Particulate Filter	Yes	Station Temp :	25.0 °C
Leak Test	Yes		
Calibration Setting			
Span Set Point	Initial Reading (Before Adj)		Final Reading (After Adj)
	Expected Concentration (PPM)	Analyzer Response (PPM)	Analyzer Response (PPM)
Zero	0	0.11	0
Span	10	10.02	10
Calibration Setting (Final)			
Span Instrument Gain:	0.997	Finish Time:	11:00 AM
APHA-360 Total Hydrocarbon Analyzer			
Test Values	Observed Value	Units	Nominal Range
Signal (CH ₄)	912.5	mV	800-1,350
Signal (THC)	917.1	mV	800-1,350
Detector	77.8	kPa	((Pressure Air/1013)x100)-20 ± 4 kPa
Purifier	19.0	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 :

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

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



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED July 11, 2022**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

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

☐ OK

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

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401DATE TESTED : July 11, 2022

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



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED July 11, 2022**Remarks :**

Commissioning follow as commissioning performance sheets.

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

☒

meets

☐

does not meet

the PerkinElmer Specifications listed on this certificate.


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

Service Department PerkinElmer Ltd.

**Authorized Representative:**

PinAAcle 900Z Preventive Maintenance (PM)

Company Name:	S.P.S.CONSULTING SERVICE CO.,LTD.		
Address (Instrument Location):	PHAHOLYOTHIN RD, JOMPON, BANGKOK, 51, TH, 10900		
Serial Number:	PZAS19090402	PM Number:	1/2
Customer Name (if applicable):	K. PHENPHA	Telephone Number:	083-926-9252
Customer Support Engineer Name:	K. DUANG	Service Order Number:	WO-01473846
Date PM Performed: (DD-MMM-YYYY)	01-Jun-2022	Next PM Due Date: (DD-MMM-YYYY)	01-Dec-2022
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370144 Rev.9	A	January 2018	

Scope

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

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes
AS900	AS9419052359	Syngistix 3.1

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	2
B3002013	THGA Contact Cylinders	1
B3141064	Glycerol for THGA Cooling	N/A

Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300244	GFAAS Mixed Standard	AR	56-021CRY1	30-Jun-2023

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

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

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary
- ☒ Inspect all gas and water lines for leaks and/or wear. Replace if needed. Thoroughly inspect all quick connects. Replace the Y connector, P/N 09921079, if needed.
- ☒ Clean exterior of the instrument.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Inspect the pole pieces and clean where the pole pieces contact the furnace. Replace the pole piece p-rings as needed, P/N's B0501018 & B0501250. Grease the O-rings as needed with Apiezon L grease, P/N 09905148
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function.
- ☒ Verify the operation of the GFTV Camera for proper operation and viewing alignment in the furnace camera Tube View window. Align if needed.
- ☒ Check the operation of the Halogen Light ASSY for the GFTV Camera. Replace if needed.
- ☒ Check the water level/quality in the recirculation (if applicable). Add distilled water if necessary.
- ☒ Check the cooling system fluid flow rate with the FCS In-Line Flow Meter for proper levels if needed. Refer to SDB# COSY008.STN
- ☒ Perform Cooling System maintenance if needed per SDB# COSY005.STN.
- ☒ Check auto sampler operation.
- ☒ Perform an auto sampler check valve test as described in the Service Manual.
- ☒ Lubricate the spindles of the auto sampler pumps and all moving parts of the tray mechanics as described in the Service Manual.
- ☒ Inspect the auto sampler sampling capillary as described in the Service Manual. Replace if necessary.
- ☒ Inspect the four insulation pads on the front contact housing of the THGA in furnace. If the pads are missing replace the THGA furnace or replace the insulator pads on the furnace.
- ☒ Inspect the graphite tube and clean the contact cylinders. Replace if necessary.
- ☒ Check internal and external gas flows with the Electronic Gas Flow Meter and the Gas Flow Test Probe as described in the Service Manual. Correct if necessary.
- ☒ Check furnace open/close function

4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary)
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

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

6. Gasses:

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

7. After PM Performance tests [THGA]:

7.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

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

7.2 Chromium Baseline Noise

Description: Signal to noise check.

Parameter	Specification	Results	Pass/Fail
Baseline Noise	\leq 0.005 Abs.	0.0001	Passed
Standard Deviation	\leq 0.005	0.0002	Passed

7.3 Chromium Characteristic Mass and Precision

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

Parameter	Specification	Results	Pass/Fail
Cr m_0 Results	\leq 7.0 pg/0.0044 A-s	5.6	Passed
Precision	\leq 2.0 %	0.56	Passed

7.4 Copper Characteristic Mass and Zeeman Ratio

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

Parameter	Specification	Results	Pass/Fail
Cu m ₀ Result	≤ 16.5 pg/0.0044 A-s	14.1	Passed
Zeeman Ratio	0.52 ± 0.04	0.53	Passed

8. Review:

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

Additional Comments


Additional Comments Regarding the PM	
Zeeman Ratio	$= \frac{\text{Atomic Signal (Peak area)}}{\text{Atomic Signal (Peak area)} + \text{Background Signal (Peak area)}}$ $= \frac{0.1609}{0.1609 + 0.1377}$ $= 0.53$
REPLACE PM KIT FOR PinAAcle900Z	

Review

<i>The preventive maintenance checks and if applicable performance tests for PinAAcle 900Z have been completed.</i>		
<i>This PinAAcle 900Z Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i>		
Review of Preventive Maintenance:		
Authorized PerkinElmer Representative:	[Redacted Signature]	Date: 01-Jun-2022 <small>(DD-MMM-YYYY)</small>
Authorized Customer Representative:	[Redacted Signature]	Date: 01-Jun-2022 <small>(DD-MMM-YYYY)</small>

GC Clarus 600/680 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:	680S14042502	Service Tag:	N68APSSFXMP
Customer Name (if applicable):	Ms.Sujinda	PM number :	2 of 2
Service Engineer Name:	Pramote Chaisorn	Service Order Number:	WO-01841730
Date PM Performed: (DD-MMM-YYYY)	02-Sep-2022	Next PM Due Date: (DD-MMM-YYYY)	02-Mar-2023

Part Number	Release	Publication Date	
TH09370070	C	August 2016	

Scope

The purpose of this PM is to ensure the continued functionality of the Clarus 600 and Clarus 680 GC 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	Totalchrom6.3.2	
Clarus SQ8T	648N4050804	Turbomass 6.4	
AtomX	US14113002	Tekma AtomX	

Parts Lists

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
LF21-0503	Fluke179 multimeter	1	22460228	04-Nov-2022
Additional Reagents and Standards Required for PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A				

Procedure Checklist

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

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.

- ☒ Check incoming AC line voltage for proper levels and grounding.

L-N 220 Volt

L-G 220 Volt

N-G 0.35 Volt

**Neutral to ground not more than 0.5 volts peak to peak*

- ☒ Inspect all gas line filters and traps; Replace if necessary with customer supplied spares.

Carrier gas ☒ Helium ☐ Nitrogen ☐ Hydrogen

Moisture level ☒ Good ☐ Need to replace ☐ Other _____

Detector gas ☒ Air Zero ☒ Hydrogen ☐ Nitrogen ☐ Helium

Moisture level ☒ Good ☐ Need to replace ☐ Other _____

- ☒ Inspect the customer log book and make any appropriate PM entries.

- ☒ Leak check all fittings from the gas source to instrument.

Gas leakage ☒ Pass ☐ Fail Comment _____

- ☒ Perform general inspection of system for cleanliness.

- ☒ Inspect for functional and clean electronic cooling and oven vent fans

Electronic cooling fan ☒ Yes ☐ No

Oven cooling fan ☒ Yes ☐ No

2. Electronic :

- ☒ Check oven temperature. Calibrate if necessary.

Oven temperature set point 150 °C ☒ Pass ☐ Fail

- ☐ Check sub-ambient option. (If installed).

Oven temperature set point 5 °C ☐ Pass ☐ Fail

- ☒ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.



- ☒ Check flows, including split flows if applicable. Calibrate if necessary.
Carrier flow Pass
Split flow Pass
- ☒ Check detector gas flows and adjust if necessary.
Detector flow Pass
- ☒ Autosampler installed ☒ Yes ☐ No
Check autosampler sensor for wear and replace if necessary.
Vial sensor Pass
Door sensor Pass
Tower sensor Pass
Plunger sensor Pass
Elevator sensor Pass
- ☒ Remove syringe, manually flush. Replace with customer supplied spare if necessary.
- ☒ Check firmware version. Upgrade to current levels if necessary.
Firmware version 6.5
- ☒ Measure all accessible power supply voltages.
5 Volt Pass
+15 Volt Pass
-15 Volt Pass
24 Volt Pass
- ☒ Record all detector voltage signal.
Detector Channel A 0.89 mV.
Detector Channel B NA mV.

3. Diagnostics Tests:

- ☒ Run instrument diagnostics.
☒ BRAM Pass
☒ EPROM Pass
- ☒ Run Autosampler diagnostics.
☒ BRAM Pass
☒ EPROM Pass

4. Review:

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



Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed.</i>	
<i>This Clarus600/680 GC Pass the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Pramote Chaisorn	Date: 02-Sep-2022 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 02-Sep-2022 (DD-MMM-YYYY)



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



Cert.No.: 21CH1216

Page.: 1 of 2

Certificate of Calibration

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

Calibrated by : Walalak Sirithean

Approved by :

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

Issue Date : 22 September 2021

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

A 0032410



Cert. No.: 21CH1216

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument : -

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

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

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

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

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

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

Calibration Results**Function : mV Measurement**

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

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

Function : pH Measurement

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

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

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

-o0o-

a 1072797

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

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



CERTIFICATE No : 22E9693

REFERENCE No : 66476-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER

MANUFACTURER : HANNA

MODEL : HI 3512

SERIAL No : TH118035

ID No : pH 04/56

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 15-Sep-22

APPROVED BY : 

ISSUED DATE : 15-Sep-22

RECEIVED DATE : 14-Sep-22

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



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

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CERTIFICATE No : 22E9693

PAGE : 2 OF 3

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

SLOPE FACTOR k = 2.303 RT/F = 59 mV/pH

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

END OF CALIBRATION REPORT PAGE 2 OF 3



QUALITY CALIBRATION CO.,LTD.

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

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

CERTIFICATE No : 22E9693

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

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

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

3. DISPLAY UNIT WITH TEMPERATURE

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

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



CERTIFICATE No : 22M2569

REFERENCE No : 64386-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : TETNITHI W.

CALIBRATION DATE : 11-Mar-22

APPROVED BY : 

ISSUED DATE : 17-Mar-22

RECEIVED DATE : 11-Mar-22



CERTIFICATE No : 22M2569

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

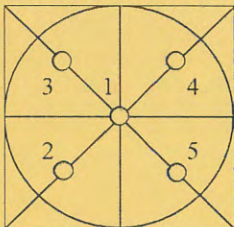
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000048 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT