

ภาคผนวกที่ 4

เอกสารการสอบเทียบความถูกต้องของเครื่องมือ

1. คุณภาพอากาศในบรรยากาศ
2. คุณภาพอากาศจากปล่อง
3. ระดับเสียงทั่วไป
4. คุณภาพน้ำ
5. คุณภาพน้ำใต้ดิน
6. ระดับเสียงในสถานประกอบการ
7. ปริมาณเสียงสะสม
8. ระดับความร้อนในสถานประกอบการ
9. คุณภาพอากาศในสถานประกอบการ

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
1. คุณภาพอากาศในบรรยากาศ		
Total Suspended Particulate (TSP)	High Volume Air Sampler No. R10, R13, R14, R16	Digital Balance
Particulate Matter less than 10 μm . (PM ₁₀)	High Volume PM ₁₀ Air Sampler No. R01, R02, R08, R09	Digital Balance
Nitrogen Dioxide (NO ₂)	NO/NO _x /NO ₂ Analyzer No. R01, R02, R06, R07	NO/NO _x /NO ₂ Analyzer No. R01, R02, R06, R07
Ethylene	Mass Flow Meter	GC/MS
Propylene	Mass Flow Meter	GC/MS
2. คุณภาพอากาศจากปล่องระบาย		
Total Suspended Particulate	Console No. R05 Pitot Tube No. B45	Digital Balance
3. ระดับเสียงในบรรยากาศ		
L _{eq} 1 hr, L _{eq} 24 hr, L _{max} , L ₉₀ และ L _{dn}	Acoustic Calibrator Sound Level Meter No. ACO-R11, R20, R34, R37, R43, R48	-
4. คุณภาพน้ำ		
pH	-	pH Meter
Temperature	-	Thermometer
Total Suspended Solids	-	Digital Balance
Total Dissolved Solids	-	Digital Balance
BOD ₅	-	BOD Analyzer
COD	-	COD Reactor
Grease & Oil	-	Digital Balance
Total Solids	-	Digital Balance
VOCs	-	GC/MS
5. คุณภาพน้ำใต้ดิน		
Total Petroleum Hydrocarbon (C ₅ -C ₃₅)	-	Infrared Spectrophotometric

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
6. ระดับเสียงในสถานประกอบการ L_{eq} 8 hr และ L_{max}	Acoustic Calibrator Sound Level Meter No. ACO-R10, R15, R20, R21, R22, R32, R37, R42, R45, R48,	-
7. ปริมาณเสียงสะสมติดตัวบุคคล Noise Dose	Acoustic Calibrator Sound Level Meter No. NMD-R02, R03, R04, R05, R07, R11, R16, R17, R19, R21, R22, R25, R27, R29, R32, R34, R35	-
8. ความร้อนในสถานประกอบการ ค่าเฉลี่ย WBGT	Heat Stress WBGT Meter NO. B37, R07, R08	Digital Thermometer
9. คุณภาพอากาศในสถานประกอบการ Total Dust	Personal Pump SKC No. B58, R08, R12, R13, R14, R38, R40, R46 Rotameter No. H-R02, R03	Digital Balance
Respirable Dust	Personal Pump SKC No. B05, B09, B67, R03, R07, R13, R17, R34, R42, R43, R45 Rotameter No. H-R02, R03	Digital Balance
Propylene	Personal Pump SKC No. B08, R07, R09, R10, R14, R17, R21, R25, R32, R34, R39, R42 Rotameter No. L-R02, R03	GC/MS
1-Butene	Personal Pump SKC No. B08, R07, R09, R14, R25, R32, R34, R39 Rotameter No. L-R02, R03	GC/MS

คุณภาพอากาศในบรรยากาศ



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

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

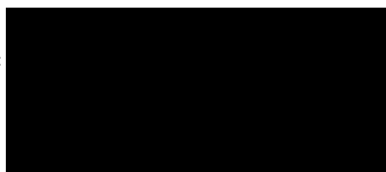
Model : TE 5025A

S/N : 3095

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	16/02/2022	y = 1.274x-9.241	0.999
B36	B36	15/02/2022	y = 1.132x-3.625	0.996
B37	B37	04/02/2022	y = 1.157x+2.640	0.999
B38	B38	15/02/2022	y = 1.1432x-2.720	0.999
B39	B39	07/02/2022	y = 1.256x-7.614	1.000
B40	B40	15/02/2022	y = 1.175x-4.385	0.998
B41	B41	07/02/2022	y = 1.133x-1.951	0.998
B42	B42	04/02/2022	y = 1.127x-1.985	1.000
B43	B43	16/02/2022	y = 1.089x+0.223	0.996
B44	B44	03/02/2022	y = 1.339x-11.636	0.997
R01	R01	02/02/2022	y = 1.196x-5.960	0.996
R02	R02	09/02/2022	y = 1.175x-5.572	1.000
R03	R03	02/02/2022	y = 1.187x-6.283	0.995
R04	R04	07/02/2022	y = 1.100x-1.352	0.997
R05	R05	09/02/2022	y = 1.238x-8.500	0.997
R06	R06	01/02/2022	y = 1.328x-11.118	0.996
R07	R07	07/02/2022	y = 1.039x+1.507	0.995
R08	R08	04/02/2022	y = 1.141x-3.942	0.997
R09	R09	01/02/2022	y = 1.192x-5.710	0.997
R10	R10	09/02/2022	y = 1.194x-5.807	1.000
R11	R11	01/02/2022	y = 1.054x+0.098	0.996
R12	R12	04/02/2022	y = 1.171x-5.349	0.996
R13	R13	04/02/2022	y = 1.114x-1.755	0.999
R14	R14	07/02/2022	y = 1.100x-0.965	0.997
R15	R15	14/02/2022	y = 1.047x+1.073	0.995
R16	R16	09/02/2022	y = 1.129x-3.642	0.999
R17	R17	03/02/2022	y = 1.198x-5.739	1.000
R18	R18	02/02/2022	y = 1.268x-9.241	0.998
R19	R19	03/02/2022	y = 1.216x-5.626	0.999
R20	R20	01/02/2022	y = 1.197x-5.676	0.997

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
R01	R01	04/02/2022	y = 1.238x-7.598	0.995
R02	R02	11/02/2022	y = 1.161x-3.899	0.996
R03	R03	04/02/2022	y = 1.154x+2.827	0.998
R04	R04	06/02/2022	y = 1.116x-1.752	0.995
R05	R05	07/02/2022	y = 1.125x-2.487	0.995
R06	R06	10/02/2022	y = 1.321x-9.065	0.998
R07	R07	04/02/2022	y = 1.138x-1.986	0.996
R08	R08	03/02/2022	y = 1.160x-3.759	0.996
R09	R09	10/02/2022	y = 1.209x-6.918	0.995
R10	R10	04/02/2022	y = 1.114x-1.889	0.995
R11	R11	03/02/2022	y = 1.272x-7.597	1.000
R12	R12	03/02/2022	y = 1.153x-3.385	0.995
R13	R13	02/02/2022	y = 1.207x-4.913	0.996
R14	R14	01/02/2022	y = 1.183x-3.660	0.996
R15	R15	02/02/2022	y = 1.247x-7.741	0.999
R16	R16	02/02/2022	y = 1.238x-6.677	0.996
R17	R17	01/02/2022	y = 1.203x-5.310	0.998
R18	R18	04/02/2022	y = 1.148x-3.211	0.998
R19	R19	04/02/2022	y = 1.220x-6.839	0.997
R20	R20	03/02/2022	y = 1.161x-5.047	0.997

Calibrated by :

Approved by :



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 28 February 2022

BRAND : API

MODEL : 200E

NO. NOX-R01

SERIAL NO. 769

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. : A00917SK

Certified Date : 01 June 2020

Expired Date : 01 June 2022

Cylinder Conc. : 49.9 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	1.006
NO _x Span	400	400.3	0.075	400.0	1.010

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	512	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.1	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.2	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	315.2	°C	315 ± 5
RCELL PRESS	8.4	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	1.5	mV	-20 to +150
NO _x Offset	0.9	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by :

Approved by :



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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 28 February 2022

BRAND : API

MODEL : 200E

NO. NOX-R02

SERIAL NO. 2285

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. : A00917SK

Certified Date : 01 June 2020

Expired Date : 01 June 2022

Cylinder Conc. : 49.9 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	1.004
NO _x Span	400	400.1	0.025	400.0	1.008

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	510	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.4	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	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	314.7	°C	315 ± 5
RCELL PRESS	8.3	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO _x Span Conc	400	PPB	20 - 20,000
NO Slope	1.004	-	1.0 ± 0.3
NO _x Slope	1.008	-	1.0 ± 0.3
NO Offset	1.1	mV	-20 to +150
NO _x Offset	0.7	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 : 28 February 2022

BRAND : API

MODEL : 200E

NO. NOX-R06

SERIAL NO. 4466

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. : A00917SK

Certified Date : 01 June 2020 Expired Date : 01 June 2022 Cylinder Conc. : 49.9 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	1.003
NO _x Span	400	399.9	-0.025	400.0	1.006

API Model 200E NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	505	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.0	mV	-20 - 150
AZERO	93.8	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.3	°C	8 - 48
PMT TEMP	7.1	°C	7 ± 2
MOLY TEMP	314.9	°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	1.006	-	1.0 ± 0.3
NO Offset	1.0	mV	-20 to +150
NO _x Offset	0.6	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by

Approved by



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	28 February 2022	BRAND :	API	MODEL :	200E
NO.	NOX-R07	SERIAL NO.	4468		
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.	: A00917SK	
Certified Date	: 01 June 2020	Expired Date	: 01 June 2022	Cylinder Conc.	: 49.9 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	-
NO Span	400	400.1	0.025	400.0	1.005
NO _x Span	400	400.3	0.075	400.0	1.009
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	675	V	420 - 900 constant		
RCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO _x Slope	1.009	-	1.0 ± 0.3		
NO Offset	1.4	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 :



Certificate of Calibration

Certificate Number : SPR21060189-1

Page : 1 of 3

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

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

Equipment Name : Mass Flow Meter

Manufacturer : Dwyer

Model : GMF-2101

Serial Number : N/A

ID. Number : N/A

Environmental Conditions

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

Received Date : 11 Jun 2021

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

Calibration Date : 12 Jun 2021

Location of Calibration : In-Lab

Recommend Due Date : 12 Jun 2022

Calibration Procedure : In-House Method

Date of Issue : 13 Jun 2021

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

All calibrations are performed within manufacture's specifications. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Jirasak Pumbut

Approved by :

Calibration Officer

Authorized Signatory



Calibration Report

Certificate Number : SPR21060189-1

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMplete-10	12532	AD2007-056-0001	09 Jul 2021

Traceability

This certification is traceable to the International System of Unit maintained at :
MIT - Miracle International Technology Co.,Ltd.



Result of Calibration

69/29 Moo 1 Klongsi Klonguang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ผู้ส่าย www.สอยเบียงบเครื่องมือวัด.com

Certificate No. : SPR21060189-1

Page : 3 of 3

Function : Air Flow Measurement

Unit : CFM

Calibration Point	UUC Reading	Standard Reading	UUC Error	K Factor Value	Uncertainty (±)
0.0	0.00	0.00	0.00	1.0	0.12
3.3	3.30	3.45	-0.15	1.0	0.26
7.3	7.30	7.62	-0.32	1.0	0.26
13.5	13.50	14.12	-0.62	1.0	0.26
17.0	17.00	17.65	-0.65	1.0	0.26

Note:

The result of calibration was found accurate as show on date and place of calibration only.
This Certificate is not certified for any commercial transaction.

Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor k = 2, providing a level of confidence approximately 95 %

- End of Certificate -

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.comNSC-TISI-TISI7025
CALIBRATION 0049

CERTIFICATE No : 21M3169

REFERENCE No : 60627-5

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 19-Mar-21

APPROVED BY : [REDACTED]

ISSUED DATE : 20-Mar-21

RECEIVED DATE : 19-Mar-21

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



CERTIFICATE No : 21M3169

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 19-Mar-21
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 19-Mar-21
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52 %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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-349	M2103235S	26-Mar-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

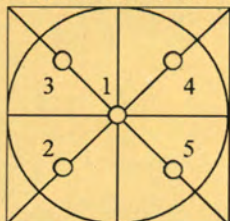
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 100 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000066
0.02	0.01998	0.00002	0.000066
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000067
0.50	0.49996	0.00004	0.000065
1.00	0.99997	0.00003	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00003	-0.00003	0.000070
20.00	20.0000	0.0000	0.000075
50.00	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT

Certificate of System Qualification

GC-OQ + GCMS-OQ

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

Date: March 22, 2021 10:41:18 AM
EQP Name: AgilentRecommended , AgilentRecommended
EQP Revision: GC.02.51, GCMS.02.51
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL
Setpoint Status: Pass

	Setpoint		Actual	
Inlet Pressure:	25.0	psi	24.9	psi
Accuracy:			0.1	psi
Agilent Recommended:			<= 1.2	

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Name: 7890
Back SSL

Setpoint Status:

Pass

Pressure:

25.0 psi

Pressure Change:

-0.1 psi /5 minutes

Agilent Recommended:

>= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

Setpoint Status:

Pass

Setpoint
Inlet Pressure: 25.0 psiActual
24.9 psi

Accuracy:

0.1 psi

Agilent Recommended:

<= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0 mL/min

Measured Flow:

29.9 mL/min

Accuracy:

0.1 mL/min

Agilent Recommended:

<= 10.0 % setpoint

(3.0 mL/min)

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

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

399.8

mL/min

Accuracy:

0.2

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

40.0

ml/min

)

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

Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

24.9

mL/min

Accuracy:

0.1

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

2.5

ml/min

)

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

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

230.0

°C

Accuracy:

0.0

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

(

-5.0

°C

)

<=

1.0

% setpoint in K

(

5.0

°C

)

Date:

March 22, 2021 10:41:18 AM

System ID:

GC/MS

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.0 °C

Accuracy:

0.0 °C

Agilent Recommended:

>= -1.0 % setpoint in K

(-3.7 °C)

<= 1.0 % setpoint in K

(3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.05 °C

Stability:

0.1 °C

Agilent Recommended:

<= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination2

Back

SSL

/ Front

FID

Manual Injection

Name:

Not applicable

Setpoint Status:

Completed

Injection Volume on Column:

1.0 µL

Overall Scouting Run Status

Completed

Signal to Noise

Tested Combination2

Back

SSL

/ Front

FID

Date:

March 22, 2021 10:41:18 AM

System ID:

GC/MS

Manual Injection

Name: 7890

Setpoint Status: Pass

Signal to Noise: 1711991

Agilent Recommended: \geq 300000

Overall Signal to Noise Test Status

Pass

Noise and Drift

Tested Combination2	Back	SSL	/ Front	FID
Name:	7890			

Setpoint Status: Pass

Base Signal: 14.0 pA

	ASTM Noise counts	Drift counts/Hr
	384.56	178.79
Agilent Recommended:	\leq 768.00	\leq 19200.00
Status:	Pass	Pass

Overall Noise and Drift Test Status

Pass

Log Amp

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			
Amu:	1050	m/z	Drift After Five Minutes:	RFP Voltage:
			4	485
			mV	mV
Agilent Recommended:	>=	-100	and	<= 100
				<= 1100

Overall RFP Test Status

Pass

Tune EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			
Filament:	1			
Setpoint Status:	Pass			
Filament:	2			

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Source:	EI - Standard (Stainless Steel)		Filament:	1
Setpoint Status:	Pass			
Signal to Noise:	925			
Agilent Recommended:	>= 320			

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Source: EI - Standard (Stainless Steel) Filament: 2

Setpoint Status: Pass

Signal to Noise: 672

Agilent Recommended: \geq 320

Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GC/MS
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

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

Tested Combination2

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

Sampler 1

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

Sampler 2

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

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Mainframe 1

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

Inlet 1

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

Inlet 2

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

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Detector 2

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

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C inert XL with TAD
Serial Number	US91732743
Firmware Revision	Not applicable
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Standard (Stainless Steel)
Number of filaments	2

Electronic Signature

Purpose

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

Details

Full Name of Signer:	Nattapat Hengcharoen
Logged On User Name:	nattapat.hengcharoen@agilent.com
Signature Creation Date:	March 22, 2021
Reason for Signature:	Executed protocol and published this original version of document

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Date:	March 22, 2021 10:41:18 AM
System ID:	GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 12:15:46 PM	Audit	SessionCreated	Session	None
March 19, 2021 12:15:46 PM	Start	Configuration	Session	None
March 19, 2021 12:15:46 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
March 19, 2021 12:21:07 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.51/Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.51/GcMs.02.51.eqp], EQP File Name: [GcMs.02.51.eqp], EQP Name: [AgilentRecommended]
March 19, 2021 12:21:16 PM	End	Configuration	Session	None
March 19, 2021 12:21:22 PM	Start	Qualification	Session	OQ
March 19, 2021 12:21:22 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:38:58 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 19, 2021 1:39:56 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 19, 2021 1:40:12 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
March 19, 2021 1:40:14 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 19, 2021 1:40:21 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 19, 2021 1:40:24 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 19, 2021 1:40:34 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 19, 2021 1:40:36 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 19, 2021 1:40:41 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:40:42 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:20 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:22 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:24 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:37 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:40 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:42 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:55 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:56 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:59 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:42:27 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:43:21 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over.
March 19, 2021 1:43:55 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:43:57 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 19, 2021 1:43:59 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 19, 2021 1:44:12 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:44:14 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 19, 2021 1:44:17 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
March 19, 2021 1:45:12 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:45:19 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 19, 2021 1:54:29 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:33:24 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:35:01 PM	Audit	AceClosed	Session	None
March 19, 2021 2:35:37 PM	Audit	AceRestarted	Session	None
March 19, 2021 2:35:38 PM	Audit	SessionReloaded	Session	None
March 19, 2021 2:35:41 PM	Start	Qualification	Session	OQ
March 19, 2021 2:35:41 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:36:12 PM	Audit	Data	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : E:\SPS\SCOUNT_FID.D\FID 1A.ch
March 19, 2021 2:36:32 PM	End	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 19, 2021 2:36:36 PM	Start	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	None

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 2:36:46 PM	Audit	Data	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : E:\SPS\SN_FID.D\FID1A.ch
March 19, 2021 2:37:00 PM	End	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 19, 2021 2:37:06 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 19, 2021 3:46:48 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 19, 2021 3:47:08 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : E:\SPS\ND_FID.D\FID1A.ch
March 19, 2021 3:47:30 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 19, 2021 3:47:32 PM	Start	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:49:54 PM	Start	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:52:45 PM	Start	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 3:53:16 PM	End	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	Run Count : 1
March 19, 2021 3:53:19 PM	Start	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:58:14 PM	End	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	Run Count : 1
March 19, 2021 3:59:01 PM	Start	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 1 (Qualitative - No setpoints associated)	None
March 19, 2021 3:59:37 PM	End	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 19, 2021 3:59:39 PM	Start	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 2 (Qualitative - No setpoints associated)	None
March 19, 2021 4:00:01 PM	End	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 19, 2021 4:00:05 PM	Audit	AceClosed	Session	None
March 22, 2021 9:39:45 AM	Audit	AceRestarted	Session	None
March 22, 2021 9:39:49 AM	Audit	SessionReloaded	Session	None
March 22, 2021 9:40:02 AM	Start	Qualification	Session	OQ

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 22, 2021 9:40:26 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	None
March 22, 2021 9:41:14 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	None
March 22, 2021 9:41:58 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	Data files Path : E:\SPS\SN_F1.D\DATA.MS
March 22, 2021 9:43:36 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	Run Count : 1
March 22, 2021 9:43:44 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	None
March 22, 2021 9:44:03 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	Data files Path : E:\SPS\SN_F2.D\DATA.MS
March 22, 2021 9:44:34 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	Run Count : 1

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
Hostname: 5CG70212Y1


System Id: GC/MS
Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 22, 2021 9:44:37 AM	End	Qualification	Session	OQ
March 22, 2021 9:44:37 AM	Start	Reporting	Session	None
March 22, 2021 10:40:26 AM	Audit	Reporting	Session	Report Generated : Certificate

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:	1 of 2
Service Engineer Name:	Pramote Chaisorn	Service Order Number:	WO-01624977
Date PM Performed: (DD-MMM-YYYY)	04-Mar-2022	Next PM Due Date: (DD-MMM-YYYY)	04-Sep-2022

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	_____ 0.91 _____ mV.
Detector Channel B	_____ NA _____ mV.

3. Diagnostics Tests:

- ☒ Run instrument diagnostics.

<input checked="" type="checkbox"/> BRAM	Pass
<input checked="" type="checkbox"/> EPROM	Pass
- ☒ Run Autosampler diagnostics.

<input checked="" type="checkbox"/> BRAM	Pass
<input checked="" type="checkbox"/> 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	<div style="background-color: black; width: 150px; height: 30px;"></div>
Authorized Customer Representative:	<div style="background-color: black; width: 150px; height: 30px;"></div>
Date: 04-Mar-2022 (DD-MMM-YYYY)	Date: 04-Mar-2022 (DD-MMM-YYYY)

คุณภาพอากาศจากปล่อง



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

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	02/03/2022	0.998	50.11
B02	8002514	02/03/2022	0.996	49.25
B03	1503016	03/03/2022	0.998	50.20
B04	00006659	03/03/2022	1.005	49.64
B05	00007428	03/03/2022	1.002	49.80
R01	1561	02/03/2022	1.003	50.18
R02	8002513	03/03/2022	0.999	49.38
R03	1570	04/03/2022	1.003	49.14
R04	8002519	04/03/2022	0.999	49.52
R05	1503015	01/03/2022	1.007	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 :



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

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

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

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

Calibrated by :

Approved by :

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.comNSC-TISI-TISI7025
CALIBRATION 0049

CERTIFICATE No : 21M3169

REFERENCE No : 60627-5

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

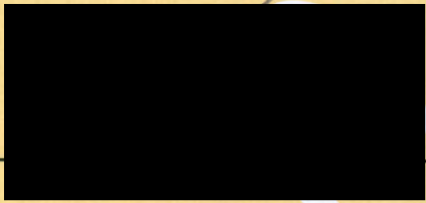
ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 19-Mar-21

APPROVED BY : 

ISSUED DATE : 20-Mar-21

RECEIVED DATE : 19-Mar-21

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



CERTIFICATE No : 21M3169

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 19-Mar-21
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 19-Mar-21
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52 %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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-349	M2103235S	26-Mar-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

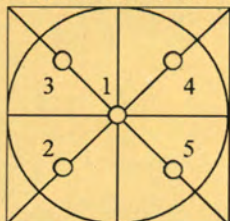
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 100 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000066
0.02	0.01998	0.00002	0.000066
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000067
0.50	0.49996	0.00004	0.000065
1.00	0.99997	0.00003	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00003	-0.00003	0.000070
20.00	20.00000	0.00000	0.000075
50.00	50.00000	0.00000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT

ระดับเสียงในบรรยากาศ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Services 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 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 : 6 May 2021

Date of Calibration : 15 May 2021

1 / 2 

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

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

FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

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

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

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	93.96	-0.04	± 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

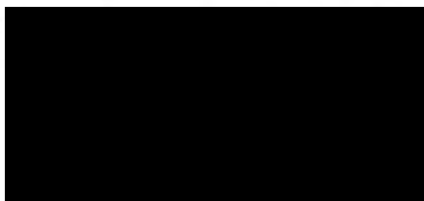
Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.26	± 0.50	$\pm 3.0\%$

Note : 1. No adjustment.

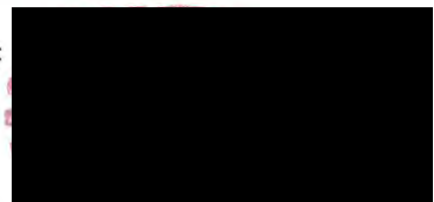
2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 15 May 2021

Date of Issue : 18 May 2021

Ref : 2011264050601894002

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev.4

Head Office

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

Office/Laboratory

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

Office

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



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 R_107/22

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	15 May 2021
		Due Date	15 May 2022

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R11	ACO	6236	00172038	28 February 2022	94.1	94.0
ACO-R20	ACO	6236	00182003	28 February 2022	94.0	94.0
ACO-R34	ACO	6236	00192046	28 February 2022	94.1	94.0
ACO-R37	ACO	6236	00192049	28 February 2022	94.0	94.0
ACO-R43	ACO	6236	00192055	28 February 2022	94.0	94.0
ACO-R48	ACO	6236	00192060	28 February 2022	94.1	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	

Calibrated by :

Approved by :

คุณภาพน้ำ



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-

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 21T3943

REFERENCE No : 60857-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL THERMOMETER WITH PROBE

MANUFACTURER : HANNA

MODEL : HI 3512

SERIAL No : TH118035

ID No : PH 04/56


PROBE TYPE : THERMOCOUPLE

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 : CHARUKIT L.

CALIBRATION DATE : 20-Apr-21

APPROVED BY : 

ISSUED DATE : 20-Apr-21

RECEIVED DATE : 09-Apr-21

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



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 : 21T3943

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL THERMOMETER WITH PROBE
MANUFACTURER : HANNA
MODEL : HI 3512
ID No : PH 04/56
RECEIVED DATE : 09-Apr-21
AMBIENT TEMPERATURE : 23 °C ± 3 °C

SERIAL NUMBER : TH118035
PROBE TYPE : THERMOCOUPLE
CALIBRATION DATE : 20-Apr-21
RELATIVE HUMIDITY : 50 %RH ± 20 %RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BASED ON WI-TQ-017 BY COMPARISON WITH STANDARD PLATINUM RESISTANCE THERMOMETER (SPRT) INTO LIQUID BATH TEMPERATURE CONTROLLER. THE TEMPERATURE SCALE USED WAS BASED ON ITS-90.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD THERMOMETER	1529	A22167	20T12169	10-Dec-21
2) SPRT PROBE	5612	587312	20T12169	10-Dec-21
3) MICRO-BATH	7103	A14258	20T12167	08-Dec-21
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).

RESULT OF CALIBRATION : WITHOUT ADJUSTMENT

STANDARD READING (°C)	UUC* READING (°C)	IMMERSION DEPTH (mm)	CORRECTION (°C)	UNCERTAINTY OF MEASUREMENT (±°C)
25.0035	24.8	80	0.2035	0.21

USER SHOULD EVALUATE THE UUC ERROR IF IT IS USED OUTSIDE THE AMBIENT TEMPERATURE RANGE DURING CALIBRATION.
UUC* : UNIT UNDER CALIBRATION
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

Certificate of Calibration

Certificate No. : 65-400210-1

Page : 1 of 2

Submitted by : S. P. S Consulting Service Co.,Ltd.
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900

Equipment : Liquid in Glass Thermometer
Manufacturer : SK **Model :** N/A
Range : 0 °C to 100 °C **Resolution :** 1 °C
Serial No. : N/A **Immersion :** Total
ID No. : TM21/59

Environment : Ambient Temperature : (23 ± 2) °C
 Relative Humidity : (50 ± 15) %
 Line Voltage : (220 ± 22) VAC

Date of Received : 19 April 2022

Date of Calibration : 23 April 2022

Date of Issue : 23 April 2022

Calibrated by : Chortip Samchusri

Calibration Method : This instrument was calibrated by In-house method comparison technique CAL-M4001 based on ASTM E77-07 by compared with PRT in the liquid bath at the constant controlled temperature.

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0016-22	07 Feb 2024	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)
400004	21E1850	14 Jun 2023	National Institute of Metrology Thailand (NIMT)

Approved by :

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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www.calibratech.co.th

Certificate of Calibration

Certificate No. : 65-400210-1

Page : 2 of 2

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 ° C Standard reading 0.6439 ° C

Standard Reading (° C)	UUC Reading (° C)	Correction (° C)	Uncertainty (± ° C)
20.6690	20	0.7	0.31

Remark

UUC : Unit Under Calibration

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

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

- o0o -





CERTIFICATE No : 21M3167

REFERENCE No : 60627-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 19-Mar-21

APPROVED BY : [REDACTED]

ISSUED DATE : 20-Mar-21

RECEIVED DATE : 19-Mar-21



CERTIFICATE No : 21M3167

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 19-Mar-21
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 19-Mar-21
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52 %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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-349	M2103235S	26-Mar-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

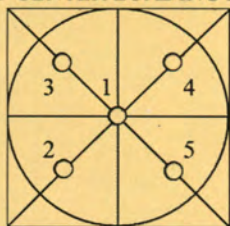
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000045 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000075
0.1	0.1000	0.0000	0.000075
0.2	0.2000	0.0000	0.000076
0.5	0.5000	0.0000	0.000076
1.0	1.0000	0.0000	0.000077
2.0	2.0000	0.0000	0.000077
5.0	5.0000	0.0000	0.000079
10.0	10.0000	0.0000	0.000082
20.0	20.0000	0.0000	0.000086
50.0	50.0000	0.0000	0.00013
100.0	100.0001	-0.0001	0.00019
200.0	199.9997	0.0003	0.00032

5. OFF CENTER LOADING ERROR



POINT	READING (g)
1	100.0000
2	100.0000
3	100.0001
4	100.0000
5	99.9999
OFF-CENTER LOADING	0.0001

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

END OF CALIBRATION REPORT



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

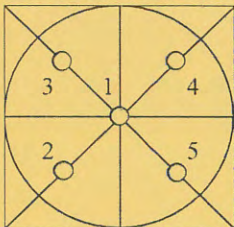
2. TARE FUNCTION : NORMAL

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



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000 FAX. 0-2719-9484

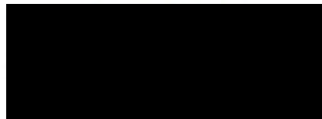
Cert.No.: 21TW92

Page.: 1 of 2

Certificate of Testing

Equipment :	DO Meter
Manufacturer :	YSI
Model :	5100
Serial No. :	01H1079 AB
ID No. :	-
Received Date :	19 April 2021
Test Date :	21 April 2021
Reference :	2104-0372WN-1
Submitted by :	S.P.S. Consulting Service Co.,Ltd. 7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Laboratory Condition :	Temperature (25 ± 5) °C Humidity (50 ± 20) %
Test Procedure :	In - house method : CP-CH9 by Comparison Technique with Azide Modification Method
Tested by :	Walalak Sirithean

Approved by :



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

Issue Date : 26 April 2021



Cert.No.: 21TW92

Page.: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

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

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency, The environmental impact control and present to organization it may concerned. Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full, without written approval of the laboratory

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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 22TW98

Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5000-230V
Serial No. : 15B100751
ID No. : -
Received Date : 20 April 2022
Test Date : 21 April 2022
Reference : 2204-0429WC-1
Submitted by : S.P.S. Consulting Service Co.,Ltd.
7 Phaholyothin 24, Phaholyothin Road.,
Jompol, Chatuchak, Bangkok 10900
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean

Approved by :



- (☒) Malee Butkruea
(☐) Saithip Meangmai
(☐) Warakorn Lerngagtrakul

Issue Date : 25 April 2022



Cert.No.: 22TW98

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

<u>Instruments</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Certificate No.</u>	<u>Due Date</u>
1) Burette	-	130BU10	21CG1389	25 Mar 2023
2) Balance	1126143764	140RC004	21MM430	21 Sep 2022

2. Standard Material :-

<u>Material</u>	<u>Manufacturer</u>	<u>Lot.No.</u>	<u>Assay</u>
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 14J100195

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.12	8.14	0.0084

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a 1105753



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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

www.qcalibration.com

CERTIFICATE No : 21T0599

REFERENCE No : 59852-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0235

ID No : DRB 02/59

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 21-Jan-21

APPROVED BY : 

ISSUED DATE : 25-Jan-21

RECEIVED DATE : 20-Jan-21



CERTIFICATE No : 21T0599

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 02/59
RECEIVED DATE : 20-Jan-21
AMBIENT TEMPERATURE : 23° C ± 1° C

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

CONDITION OF THIS RESULTS OF CALIBRATION

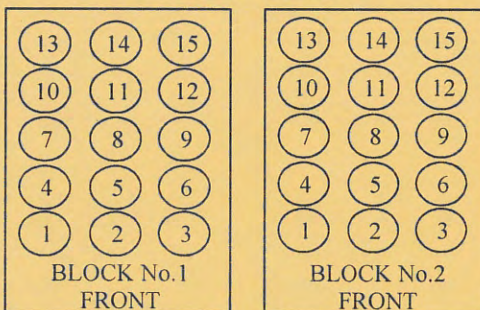
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO TLAS G-20 BY COMPARISON WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 19 POINTS AND LOCATED AS THE PICTURE BELOW AND WAS AWAY FROM THE EACH WALL OF 5 cm TO 10 cm. AND PLACED THE TENTH THERMOCOUPLE WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE CHAMBER. THE UNIFORMITY WAS MEASURED BETWEEN REFERENCE PROBE AND OTHER PROBES AT THE SAME TIME.

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	20T7223	11-Jul-21

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	150	150
Indicating Temperature	150	150
Measured Temperature (°C) at Spread Locations	1	150.4
	2	150.8
	3	150.7
	4	151.1
	5	151.0
	6	150.8
	7	150.9
	8	151.2
	9	150.9
	10	150.6
	11	150.4
	12	149.6
	13	149.3
	14	149.4
	15	149.9
Uncertainty of Measurement(± °C)	0.86	0.86

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

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT

F-G0



QUALITY CALIBRATION CO.,LTD.

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

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

www.qcalibration.com

CERTIFICATE No : 22T0570

REFERENCE No : 63773-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

SERIAL No : 15110C0498

ID No : DRB 06/59

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

CALIBRATED BY : CHAICHARN CH.

CALIBRATION DATE : 21-Jan-22

APPROVED BY : 

ISSUED DATE : 21-Jan-22

RECEIVED DATE : 19-Jan-22



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 : 22T0570

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 06/59
RECEIVED DATE : 19-Jan-22
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200
SERIAL NUMBER : 15110C0498
CALIBRATION DATE : 21-Jan-22
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

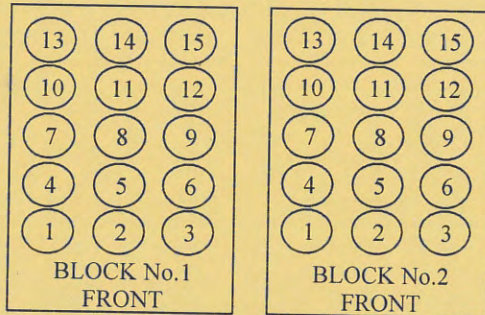
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations	1	150.5
	2	150.6
	3	149.7
	4	150.2
	5	149.9
	6	150.1
	7	150.1
	8	149.7
	9	150.6
	10	149.6
	11	149.9
	12	149.6
	13	149.7
	14	149.8
	15	149.6
Uncertainty of Measurement(± °C)	0.86	0.86

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.

NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.

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

END OF CALIBRATION REPORT

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID:

GC/MS

Organization Name:

S.P.S. Consulting service

Organization Location:

7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok, 10900

Date:

March 22, 2021 10:41:18 AM

EQP Name:

AgilentRecommended , AgilentRecommended

EQP Revision:

GC.02.51, GCMS.02.51

Overall Qualification Status:

Pass

System Inspection and Basic Safety and Operation

Name:

7890

Setpoint Status:

Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name:

7890

Front

SSL

Setpoint Status:

Pass

Setpoint

Actual

Inlet Pressure:

25.0

psi

24.9

psi

Accuracy:

0.1

psi

Agilent Recommended:

<=

1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Date:

March 22, 2021 10:41:18 AM

System ID:

GC/MS

Name: 7890
Back SSL

Setpoint Status:

Pass

Pressure:

25.0 psi

Pressure Change:

-0.1 psi /5 minutes

Agilent Recommended:

>= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

Setpoint Status:

Pass

Setpoint
Inlet Pressure: 25.0 psiActual
24.9 psi

Accuracy:

0.1 psi

Agilent Recommended:

<= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0 mL/min

Measured Flow:

29.9 mL/min

Accuracy:

0.1 mL/min

Agilent Recommended:

<= 10.0 % setpoint

(3.0 mL/min)

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

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

399.8

mL/min

Accuracy:

0.2

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

40.0

ml/min

)

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

Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

24.9

mL/min

Accuracy:

0.1

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

2.5

ml/min

)

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

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

230.0

°C

Accuracy:

0.0

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

(

-5.0

°C

)

<=

1.0

% setpoint in K

(

5.0

°C

)

Date:

March 22, 2021 10:41:18 AM

System ID:

GC/MS

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.0 °C

Accuracy:

0.0 °C

Agilent Recommended:

>= -1.0 % setpoint in K

(-3.7 °C)

<= 1.0 % setpoint in K

(3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.05 °C

Stability:

0.1 °C

Agilent Recommended:

<= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination2

Back

SSL

/ Front

FID

Manual Injection

Name:

Not applicable

Setpoint Status:

Completed

Injection Volume on Column:

1.0 µL

Overall Scouting Run Status

Completed

Signal to Noise

Tested Combination2

Back

SSL

/ Front

FID

Date:

March 22, 2021 10:41:18 AM

System ID:

GC/MS

Manual Injection

Name: 7890

Setpoint Status: Pass

Signal to Noise: 1711991

Agilent Recommended: \geq 300000

Overall Signal to Noise Test Status

Pass

Noise and Drift

Tested Combination2	Back	SSL	/ Front	FID
Name:	7890			

Setpoint Status: Pass

Base Signal: 14.0 pA

	ASTM Noise counts	Drift counts/Hr
	384.56	178.79
Agilent Recommended:	\leq 768.00	\leq 19200.00
Status:	Pass	Pass

Overall Noise and Drift Test Status

Pass

Log Amp

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			
Amu:	1050	m/z	Drift After Five Minutes:	RFPA Voltage:
			4	485
			mV	mV
Agilent Recommended:	>=	-100	and	<= 100
				<= 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			
Filament:	1			
Setpoint Status:	Pass			
Filament:	2			

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Source:	EI - Standard (Stainless Steel)		Filament:	1
Setpoint Status:	Pass			
Signal to Noise:	925			
Agilent Recommended:	>= 320			

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Source: EI - Standard (Stainless Steel) Filament: 2

Setpoint Status: Pass

Signal to Noise: 672

Agilent Recommended: \geq 320

Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GC/MS
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

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

Tested Combination2

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

Sampler 1

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

Sampler 2

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

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Mainframe 1

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

Inlet 1

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

Inlet 2

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

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Detector 2

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

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C inert XL with TAD
Serial Number	US91732743
Firmware Revision	Not applicable
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Standard (Stainless Steel)
Number of filaments	2

Electronic Signature

Purpose

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

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Full Name of Signer:	Nattapat Hengcharoen
Logged On User Name:	nattapat.hengcharoen@agilent.com
Signature Creation Date:	March 22, 2021
Reason for Signature:	Executed protocol and published this original version of document

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Date:	March 22, 2021 10:41:18 AM
System ID:	GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 12:15:46 PM	Audit	SessionCreated	Session	None
March 19, 2021 12:15:46 PM	Start	Configuration	Session	None
March 19, 2021 12:15:46 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
March 19, 2021 12:21:07 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.51/Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.51/GcMs.02.51.eqp], EQP File Name: [GcMs.02.51.eqp], EQP Name: [AgilentRecommended]
March 19, 2021 12:21:16 PM	End	Configuration	Session	None
March 19, 2021 12:21:22 PM	Start	Qualification	Session	OQ
March 19, 2021 12:21:22 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:38:58 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 19, 2021 1:39:56 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 19, 2021 1:40:12 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
March 19, 2021 1:40:14 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 19, 2021 1:40:21 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 19, 2021 1:40:24 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 19, 2021 1:40:34 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 19, 2021 1:40:36 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 19, 2021 1:40:41 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:40:42 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:20 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:22 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:24 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:37 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:40 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:42 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:55 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:56 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:59 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:42:27 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:43:21 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over.
March 19, 2021 1:43:55 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:43:57 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 19, 2021 1:43:59 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 19, 2021 1:44:12 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:44:14 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 19, 2021 1:44:17 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
March 19, 2021 1:45:12 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:45:19 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 19, 2021 1:54:29 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:33:24 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:35:01 PM	Audit	AceClosed	Session	None
March 19, 2021 2:35:37 PM	Audit	AceRestarted	Session	None
March 19, 2021 2:35:38 PM	Audit	SessionReloaded	Session	None
March 19, 2021 2:35:41 PM	Start	Qualification	Session	OQ
March 19, 2021 2:35:41 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:36:12 PM	Audit	Data	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : E:\SPS\SCOUNT_FID.D\FID 1A.ch
March 19, 2021 2:36:32 PM	End	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 19, 2021 2:36:36 PM	Start	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	None

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 2:36:46 PM	Audit	Data	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : E:\SPS\SN_FID.D\FID1A.ch
March 19, 2021 2:37:00 PM	End	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 19, 2021 2:37:06 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 19, 2021 3:46:48 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 19, 2021 3:47:08 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : E:\SPS\ND_FID.D\FID1A.ch
March 19, 2021 3:47:30 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 19, 2021 3:47:32 PM	Start	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:49:54 PM	Start	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:52:45 PM	Start	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 3:53:16 PM	End	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	Run Count : 1
March 19, 2021 3:53:19 PM	Start	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:58:14 PM	End	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	Run Count : 1
March 19, 2021 3:59:01 PM	Start	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 1 (Qualitative - No setpoints associated)	None
March 19, 2021 3:59:37 PM	End	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 19, 2021 3:59:39 PM	Start	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 2 (Qualitative - No setpoints associated)	None
March 19, 2021 4:00:01 PM	End	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 19, 2021 4:00:05 PM	Audit	AceClosed	Session	None
March 22, 2021 9:39:45 AM	Audit	AceRestarted	Session	None
March 22, 2021 9:39:49 AM	Audit	SessionReloaded	Session	None
March 22, 2021 9:40:02 AM	Start	Qualification	Session	OQ

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 22, 2021 9:40:26 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	None
March 22, 2021 9:41:14 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	None
March 22, 2021 9:41:58 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	Data files Path : E:\SPS\SN_F1.D\DATA.MS
March 22, 2021 9:43:36 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	Run Count : 1
March 22, 2021 9:43:44 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	None
March 22, 2021 9:44:03 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	Data files Path : E:\SPS\SN_F2.D\DATA.MS
March 22, 2021 9:44:34 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	Run Count : 1

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Date: March 22, 2021 10:41:18 AM
 System ID: GC/MS

User Name: nattapat.hengcharoen
Hostname: 5CG70212Y1


System Id: GC/MS
Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 22, 2021 9:44:37 AM	End	Qualification	Session	OQ
March 22, 2021 9:44:37 AM	Start	Reporting	Session	None
March 22, 2021 10:40:26 AM	Audit	Reporting	Session	Report Generated : Certificate

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:	1 of 2
Service Engineer Name:	Pramote Chaisorn	Service Order Number:	WO-01624977
Date PM Performed: (DD-MMM-YYYY)	04-Mar-2022	Next PM Due Date: (DD-MMM-YYYY)	04-Sep-2022

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	<u>6.5</u>
------------------	------------
- ☒ 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	<u>0.91</u> mV.
Detector Channel B	<u>NA</u> mV.

3. Diagnostics Tests:

- ☒ Run instrument diagnostics.

<input checked="" type="checkbox"/> BRAM	Pass
<input checked="" type="checkbox"/> EPROM	Pass
- ☒ Run Autosampler diagnostics.

<input checked="" type="checkbox"/> BRAM	Pass
<input checked="" type="checkbox"/> 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</i>	<i>Pass</i>
<i>the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Pramote Chaisorn	Date: 04-Mar-2022 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 04-Mar-2022 (DD-MMM-YYYY)

คุณภาพน้ำใต้ดิน

Spectrum BX Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd.		
Address:	7 Soi Phaholyothin 24 ,Phaholyothin Rd.,Jompol, Chatuchak,Bangkok 10900		
User Name:	K.Saratjan Wewsuwan	WO Number :	WO-01336830
Telephone No.:	088-316-2833	Certificate Number:	IR1057-2021
Customer Support Engineer:	Tanongsak	PM Number :	2 of 2
Date PM Performed: (DD-MMM-YYYY)	31-Aug-2021	Next PM Due Date: (DD-MMM-YYYY)	31-Aug-2022

Scope

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

The document can be used for spectrum One, Spectrum One, NTS, Spectrum 100, Spectrum 100N, Spectrum Optica, Spectrum 4000F and the Frontier Series of FTIR Spectrophotometers.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent instrument performance prior to starting the PM. Always check with the customer before making any changes that may affect the customer's analysis should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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
Spectrum BX	70366	5.3.1	Std	KBr B/S

Parts Lists

Parts Included with the PM				
Part Number (if applicable)	Description	Quantity	Batch/Lot/SN #	Expiration Date (MM/YY)
N0171159	Desiccant	2	NA	NA

Procedure Checklist

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

1. General:

- ☒ Source and Source Mirror
- ☒ Beam splitter
- ☒ Optical Unit Windows
- ☒ Mirror

2. Mechanical:

- ☒ Motors including Electronics unit fan
- ☒ Purge seals
- ☒ Change Desiccant

3. Electronics Check:

- ☒ Laser Output

1000, Paragon, RX or BX Laser Output	Specification	Value	Laser Gain
	16 +/- 1	16.03	3.68

- ☒ EndStop

End Stop	Specification	Value
	+/- 50	2.00

- ☒ Zero Path

Zero Path	Specification	Value
	+/- 20	-5.00

- ☒ Energy

Energy	Specification	Value
	NA	15015.00

☒ Gain

Gain	Specification	Value
	Less than +/- 9.5	7.11 / -8.63

☒ Match

Match	Specification	Value
	NA	3.36

3. Performance Test:

☒ Signal to Noise Ratio (SNR) – (Record typical SNR Value).

	Detector Type	Typical SNR
Signal to Noise Ratio	DTGS (MIR)	3457.81

4. Wavenumber Calibrate:

☒ Wavenumber Calibrate

Certified Value (cm-1)	Value	Specification	Difference (cm-1)
3082.22	3082.08	+/- 0.5	0.14
3060.14	3060.02	+/- 0.5	0.12
1601.38	1601.40	+/- 0.5	-0.02
1583.04	1583.29	+/- 0.5	-0.25
1028.42	1028.53	+/- 0.5	-0.11

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Reset desiccant and service intervals on maintenance dialog.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer-supplied materials to have on hand
- ☒ Attach PM sticker.
- ☐ Update Logbook.

Additional Comments

Additional Comments Regarding the PM

Review

<p><i>The preventive maintenance checks and if applicable performance tests for FTIR have been completed.</i></p> <p style="text-align: right;"><i>Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></p>	
Review of Preventive Maintenance:	
<p>Authorized PerkinElmer Representative:</p> <div style="background-color: black; width: 200px; height: 50px; margin: 10px auto;"></div>	<p>Date:</p> <p style="text-align: center;">31-Aug-2021 (DD-MMM-YYYY)</p>
<p>Authorized Customer Representative:</p>	<p>Date:</p> <p style="text-align: center;">31-Aug-2021 (DD-MMM-YYYY)</p>

ระดับเสียงในสถานประกอบการ

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

CALIBRATION CERTIFICATE

Submitted by : S.P.S. Consulting Services 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 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 : 6 May 2021

Date of Calibration : 15 May 2021

1 / 2

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

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

FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0528

MTC No. EEL. BP. 17/0564

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	93.96	-0.04	± 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	1.26	± 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 :



Acting Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 15 May 2021

Date of Issue : 18 May 2021

Ref : 2011264050601894002

End of Certificate

2 / 2

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FM.BL.MTC.002 Rev.4

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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 R_118/22

Sound Level Meter Calibration Report

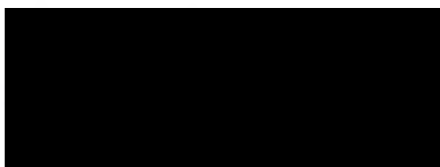
Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	15 May 2021
		Due Date	15 May 2022

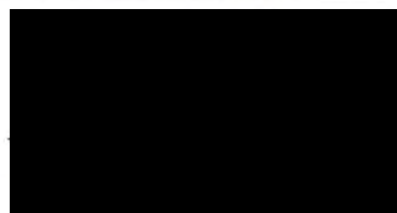
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R10	ACO	6236	00172037	23 March 2022	94.1	94.0
ACO-R15	ACO	6236	00172062	23 March 2022	94.0	94.0
ACO-R20	ACO	6236	00182003	23 March 2022	94.0	94.0
ACO-R21	ACO	6236	00182004	23 March 2022	94.1	94.0
ACO-R22	ACO	6236	00182010	23 March 2022	94.0	94.0
ACO-R24	ACO	6236	00192036	23 March 2022	94.0	94.0
ACO-R32	ACO	6236	00192044	23 March 2022	94.0	94.0
ACO-R34	ACO	6236	00192046	23 March 2022	94.1	94.0
ACO-R37	ACO	6236	00192049	23 March 2022	94.0	94.0
ACO-R42	ACO	6236	00192054	23 March 2022	94.0	94.0
ACO-R45	ACO	6236	00192057	23 March 2022	94.0	94.0
ACO-R48	ACO	6236	00192060	23 March 2022	94.1	94.0
ACO-R50	ACO	6236	00192062	23 March 2022	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.96 ± 0.40 dB	

Calibrated by :



Approved by :



ปริมาณเสียงสะสม

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0841

MTC No. EEL. BP. 45/0964

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 : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV34
Serial No. : 33146

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 Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 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 Sep. 2021

Date of Calibration : 17 Sep. 2021

1 / 2

The results relate only to the items tested or calibrated.

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.3

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

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

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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-64/0841

MTC No. EEL. BP. 45/0964

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 = 114 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 2
1/2 inch Bruel&Kjaer 4180	113.65	-0.35	± 0.10	± 0.75 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1000.0	0.0	± 1.5	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	0.48	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

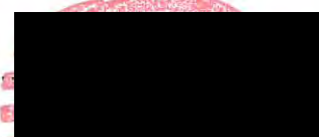
2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved by :



Acting Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 17 Sep. 2021

Date of Issue : 20 Sep. 2021

Ref : 2011264091403811001

End of Certificate

2 / 2

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FM.BL.MTC.002 Rev.3

Head Office

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Fax. (66) 0 2577 9009
E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

Office/Laboratory

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

Office

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



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 Dose R_199/22

Noise Dose Meter Calibration Report

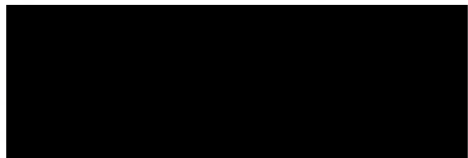
Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 05/62
Model	SV34	Serial No.	33146
Calibration Range	114 dB, 1000 Hz	Last Calibration	17 September 2021
		Due Date	17 September 2022

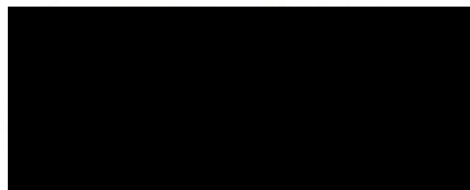
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R04	SVANTEK	SV-104IS	60154	23 March 2022	113.5	113.6
NMD-R07	SVANTEK	SV-104IS	60147	23 March 2022	113.6	113.6
NMD-R11	SVANTEK	SV-104IS	63435	23 March 2022	113.6	113.6
NMD-R16	SVANTEK	SV-104IS	63441	23 March 2022	113.5	113.6
NMD-R17	SVANTEK	SV-104IS	63442	23 March 2022	113.6	113.6
NMD-R19	SVANTEK	SV-104IS	70030	23 March 2022	113.6	113.6
NMD-R21	SVANTEK	SV-104IS	80800	23 March 2022	113.5	113.6
NMD-R25	SVANTEK	SV-104IS	80835	23 March 2022	113.6	113.6
NMD-R27	SVANTEK	SV-104IS	80837	23 March 2022	113.6	113.6
NMD-R29	SVANTEK	SV-104IS	80855	23 March 2022	113.6	113.6
NMD-R32	SVANTEK	SV-104IS	80862	23 March 2022	113.5	113.6
NMD-R34	SVANTEK	SV-104IS	80872	23 March 2022	113.6	113.6
Acoustic Certified Value : Thailand Institute of Scientific And Technological Research (TISTR)					113.65± 0.75 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 Dose R_336/22

Noise Dose Meter Calibration Report

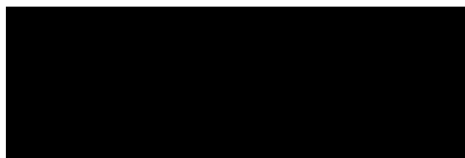
Acoustic Calibrator Data

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

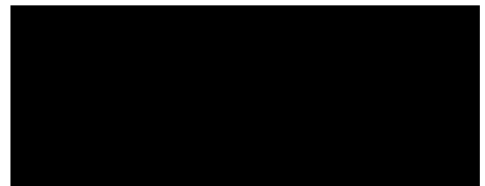
Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R02	SVANTEK	SV-104IS	60152	19 June 2022	113.5	113.6
NMD-R03	SVANTEK	SV-104IS	60153	19 June 2022	113.6	113.6
NMD-R05	SVANTEK	SV-104IS	60155	19 June 2022	113.6	113.6
NMD-R22	SVANTEK	SV-104IS	80801	19 June 2022	113.5	113.6
NMD-R27	SVANTEK	SV-104IS	80837	19 June 2022	113.6	113.6
NMD-R35	SVANTEK	SV-104IS	80873	19 June 2022	113.5	113.6
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.67± 0.10 dB	

Calibrated by :



Approved by :



ระดับความร้อนในสถานประกอบการ

CERTIFICATE OF CALIBRATION

FOR

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

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

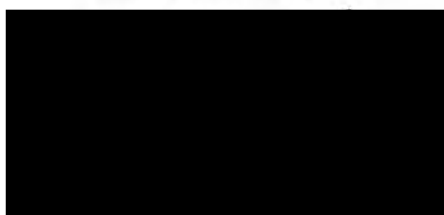
DATE OF RECEIVED : 26 October 2021

DATE OF ISSUED : 30 October 2021

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

Calibrated By : Oranut Kamchatphai
Calibration Engineer

Approved By :



Authorized Signatory
30 October 2021



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

Certificate No. Q21102933

F3-011-04/01-12

page 1 of 3



REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : QUEST TECHNOLOGIES

MODEL / TYPE : QUES TEMP ° 46

SERIAL NO. : TSI010004

DATE OF CALIBRATION : 27 October 2021

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

This instrument was calibrated under procedure No. **WI-305-74**. The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

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

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

TRACEABILITY :

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

Certificate No.18815, Due Date 11 November 2021.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2013)"

Certificate No. Q21102933

F3-011-04/01-12

page 2 of 3



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter (thermal environment monitor).

CALIBRATION DATA

*1. CORRECTION OF TEMPERATURE : WET

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

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

2. CORRECTION OF TEMPERATURE : DRY

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

3. CORRECTION OF TEMPERATURE : GLOBE

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

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

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

End of Certificate

Certificate No. Q21102933

F3-011-04/01-12

page 3 of 3





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

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

Heat B030_1/22

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B37	Verification Date	: 28 April 2022
Brand	: QUEST TECHNOLOGIES	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 46	Barometric Pressure	: 1011 mmbar
Serial No.	: TSI010004	Relative Humidity	: 49 %

Verification Module (Electronic Sensor Check) :

Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.3	0.2	± 0.5

Dry Probe Temperature Measurement

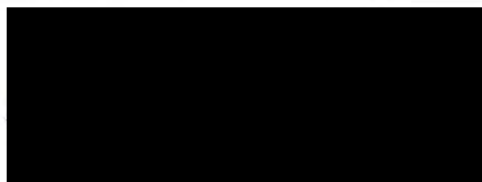
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5

Globe Probe Temperature Measurement

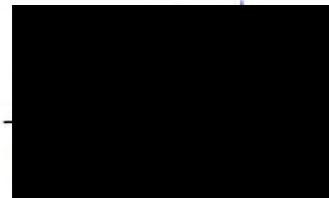
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by :



Approved by :



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp° 32

SERIAL NO. : TPE080058

CLID. NO. : 231802518

JOB CONTROL NO. : 220315027535

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

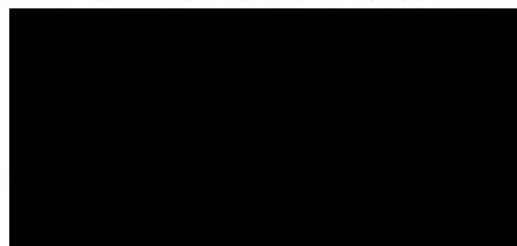
DATE OF RECEIVED : 15 March 2022

DATE OF ISSUED : 21 March 2022

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

Calibrated By : Tanawan Seenam-Ngoen
Calibration Engineer

Approved By :



Authorized Signatory

21 March 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. Q22027535

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp° 32

SERIAL NO. : TPE080058

DATE OF CALIBRATION : 17 March 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. **WI-305-74**. The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.
Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.
Certificate No. 19317, Due Date 09 July 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2021)"

Certificate No. **Q22027535**

F3-011-04/01-12

page 2 of 3



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter (thermal environment monitor).

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	29.6	+0.41	0.40
35.0	35.00	34.7	+0.30	
40.0	39.98	39.7	+0.28	

2. CORRECTION OF TEMPERATURE : DRY BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	29.6	+0.41	0.40
35.0	35.00	34.6	+0.40	
40.0	39.98	39.6	+0.38	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	29.8	+0.21	0.40
35.0	35.00	34.8	+0.20	
40.0	39.98	39.8	+0.18	

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

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

End of Certificate

Certificate No. Q22027535

F3-011-04/01-12

page 3 of 3



@clccalibration

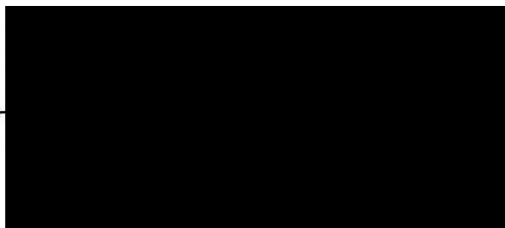


บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

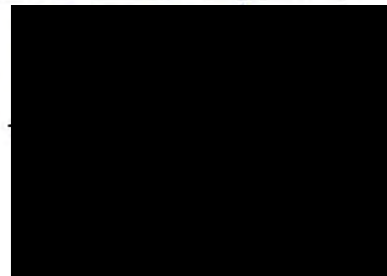
Heat B001_4/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R07	Verification Date	: 06/04/2022
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPE080058	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp° 34

SERIAL NO. : TEH090208

CLID. NO. : 231802513

JOB CONTROL NO. : 220315027537

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

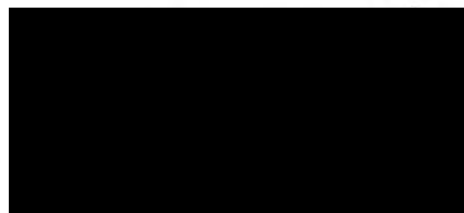
DATE OF RECEIVED : 15 March 2022

DATE OF ISSUED : 21 March 2022

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

Calibrated By : Tanawan Seenam-Ngoen
Calibration Engineer

Approved By :



Authorized Signatory

21 March 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. Q22027537

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : DIGITAL THERMOHYGRO METER
(THERMAL ENVIRONMENT MONITOR)

MANUFACTURER : 3M

MODEL / TYPE : QUESTemp° 34

SERIAL NO. : TEH090208

DATE OF CALIBRATION : 17 March 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. **WI-305-74**. The calibration was performed by using Chilled Mirror Hygrometer and Temperature & Humidity Chamber which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Chilled Mirror Hygrometer, Edgetech Model Dew Master S/N. 36151.

Temperature & Humidity Chamber, PGC Model 9141-5114 S/N.0802282.

TRACEABILITY :

The measurements are traceable to International System of Units (SI) , through Thunder Scientific Corporation.
Certificate No. 19317, Due Date 09 July 2022.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2021)"

Certificate No. **Q22027537**

F3-011-04/01-12



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of the measuring digital thermohygro meter (thermal environment monitor).

CALIBRATION DATA

1. CORRECTION OF TEMPERATURE : WET BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	29.8	+0.21	0.40
35.0	35.00	34.8	+0.20	
40.0	39.98	39.7	+0.28	

2. CORRECTION OF TEMPERATURE : DRY BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	29.7	+0.31	0.40
35.0	35.00	34.7	+0.30	
40.0	39.98	39.6	+0.38	

3. CORRECTION OF TEMPERATURE : GLOBE BULB

Test point (° C)	Actual Temperature (° C)	DUC Reading (° C)	Correction (° C)	Uncertainty ± (° C)
30.0	30.01	30.0	+0.01	0.40
35.0	35.00	35.0	0.00	
40.0	39.98	40.0	-0.02	

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

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

End of Certificate

Certificate No. Q22027537

F3-011-04/01-12

page 3 of 3



@clccalibration

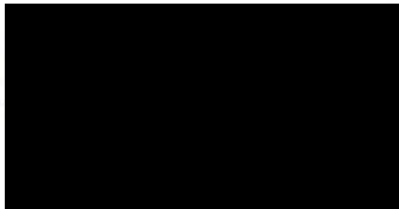


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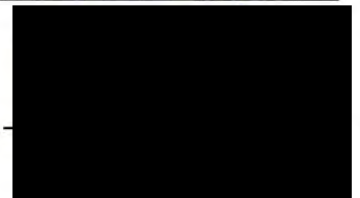
Heat B002_4/22

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R08	Verification Date	: 06/04/2022
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp ^o 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEH090208	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C , DB = 47.1 °C , G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.0	0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.4	-0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :



Approved by :



คุณภาพอากาศในสถานประกอบการ



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

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

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

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
R40	SKC	224-PCXR4	612753	07/01/2022	1,000	1,500	2,000	1,003	1,500	2,003	1.013x – 24.242	0.999
R41	SKC	224-PCXR4	626140	07/01/2022	1,000	1,500	2,000	991	1,507	2,001	1.018x – 35.034	0.999
R42	SKC	224-PCXR4	626463	11/01/2022	1,000	1,500	2,000	993	1,496	1,997	1.002x – 6.685	1.000
R43	SKC	224-PCXR4	626129	11/01/2022	1,000	1,500	2,000	1,002	1,501	2,004	1.013x – 23.691	0.999
R44	SKC	224-PCXR4	602753	11/01/2022	1,000	1,500	2,000	1,001	1,495	1,994	0.993x + 5.600	1.000
R45	SKC	224-PCXR4	626137	11/01/2022	1,000	1,500	2,000	992	1,505	2,001	1.018x – 36.115	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	04/04/2022	1,000	1,500	2,000	998	1,496	1,989	0.994x + 3.829	1.000
B42	SKC	224-PCXR4	626041	01/04/2022	1,000	1,500	2,000	1,003	1,498	1,993	0.990x + 12.348	1.000
B43	SKC	224-PCXR4	034636	11/04/2022	1,000	1,500	2,000	1,001	1,501	1,992	0.990x + 12.839	1.000
B44	SKC	224-PCXR8	529341	01/04/2022	1,000	1,500	2,000	1,002	1,501	2,002	1.011x - 21.577	0.999
B45	SKC	224-PCXR8	529594	12/04/2022	1,000	1,500	2,000	997	1,498	1,992	0.995x + 2.928	1.000
B46	SKC	224-PCXR8	566743	04/04/2022	1,000	1,500	2,000	994	1,504	2,002	1.016x - 33.204	0.999
B47	SKC	224-PCXR8	566747	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 24.202	0.999
B48	SKC	224-PCXR8	566753	01/04/2022	1,000	1,500	2,000	999	1,494	1,997	0.999x + 1.795	1.000
B49	SKC	224-PCXR8	566780	12/04/2022	1,000	1,500	2,000	1,003	1,502	2,003	1.011x - 21.031	0.999
B50	SKC	224-PCXR8	500400	01/04/2022	1,000	1,500	2,000	1,002	1,495	2,002	1.001x + 2.900	1.000
B51	SKC	224-PCXR8	500363	01/04/2022	1,000	1,500	2,000	995	1,504	2,000	1.012x - 26.268	0.999
B52	SKC	224-PCXR8	093186	11/04/2022	1,000	1,500	2,000	995	1,498	1,994	0.997x - 1.240	1.000
B53	SKC	224-PCXR8	707670	01/04/2022	1,000	1,500	2,000	1,002	1,499	2,004	1.012x - 22.742	0.999
B54	SKC	224-PCXR3	509821	11/04/2022	1,000	1,500	2,000	993	1,501	2,001	1.016x - 33.718	0.999
B55	SKC	224-PCXR3	510710	01/04/2022	1,000	1,500	2,000	1,000	1,494	1,994	0.994x + 4.635	1.000
B56	SKC	224-PCXR3	511450	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x - 20.684	0.999
B57	SKC	224-PCXR3	510798	12/04/2022	1,000	1,500	2,000	997	1,493	1,998	1.001x + 3.398	1.000
B58	SKC	224-PCXR3	509852	04/04/2022	1,000	1,500	2,000	1,001	1,498	2,000	1.007x - 19.631	0.999
B59	SKC	224-PCXR3	509862	01/04/2022	1,000	1,500	2,000	996	1,503	1,995	0.998x + 2.916	1.000
B60	SKC	224-PCXR3	512655	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x - 23.891	0.999
B61	SKC	224-PCXR3	503915	12/04/2022	1,000	1,500	2,000	994	1,489	1,999	1.004x - 11.786	1.000
B62	SKC	224-PCXR3	505975	12/04/2022	1,000	1,500	2,000	999	1,494	1,995	0.997x - 0.503	1.000
B63	SKC	224-PCXR3	511432	01/04/2022	1,000	1,500	2,000	991	1,501	2,000	1.017x - 36.139	0.999
B64	SKC	224-PCXR3	508302	04/04/2022	1,000	1,500	2,000	997	1,493	1,990	0.994x + 3.992	1.000
B65	SKC	224-PCXR3	508310	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,003	1.012x - 23.109	0.999
B66	SKC	224-PCXR3	509861	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,991	0.987x + 14.701	1.000
B67	SKC	224-PCXR3	506295	12/04/2022	1,000	1,500	2,000	993	1,507	2,004	1.017x - 33.104	0.999
B68	SKC	224-PCXR3	505872	12/04/2022	1,000	1,500	2,000	1,002	1,491	1,997	0.994x + 5.556	1.000
B69	SKC	224-PCXR3	508375	01/04/2022	1,000	1,500	2,000	1,001	1,500	2,000	1.010x - 21.689	0.999
B70	SKC	224-PCXR3	510623	11/04/2022	1,000	1,500	2,000	992	1,503	1,997	1.002x - 6.693	1.000
B71	SKC	224-PCXR3	508367	12/04/2022	1,000	1,500	2,000	991	1,506	2,002	1.018x - 36.227	0.999
B72	SKC	224-PCXR3	505977	12/04/2022	1,000	1,500	2,000	1,001	1,498	1,993	0.992x + 7.087	1.000
B73	SKC	224-PCXR3	512606	01/04/2022	1,000	1,500	2,000	1,001	1,501	2,005	1.014x - 24.517	0.999
B74	SKC	224-PCXR3	505993	12/04/2022	1,000	1,500	2,000	996	1,495	1,994	0.999x - 4.363	1.000
B75	SKC	224-PCXR3	509820	12/04/2022	1,000	1,500	2,000	996	1,499	1,992	0.995x + 2.429	1.000
B76	SKC	224-PCXR3	509811	12/04/2022	1,000	1,500	2,000	992	1,498	1,998	1.007x - 15.040	1.000
B77	SKC	224-PCXR3	508301	12/04/2022	1,000	1,500	2,000	1,000	1,501	2,003	1.014x - 26.643	0.999
B78	SKC	224-PCXR3	510677	01/04/2022	1,000	1,500	2,000	996	1,503	1,999	1.012x - 27.520	0.999
B79	SKC	224-PCXR3	510920	01/04/2022	1,000	1,500	2,000	994	1,493	1,994	0.999x - 3.705	1.000

Calibrated 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
R01	SKC	224-PCXR4	602467	04/04/2022	1,000	1,500	2,000	993	1,508	2,004	1.020x – 38.784	0.999
R02	SKC	224-PCXR4	626450	04/04/2022	1,000	2,000	3,000	999	1,499	1,990	0.989x + 12.627	1.000
R03	SKC	224-PCXR4	691592	04/04/2022	1,000	1,500	2,000	1,003	1,500	2,004	1.012x – 22.479	0.999
R04	SKC	224-PCXR4	691672	01/04/2022	1,000	1,500	2,000	996	1,493	1,993	0.998x – 2.561	1.000
R05	SKC	224-PCXR4	798470	01/04/2022	1,000	1,500	2,000	994	1,506	1,999	1.015x – 30.635	0.999
R06	SKC	224-PCXR4	798456	04/04/2022	1,000	1,500	2,000	994	1,498	1,994	1.002x – 7.438	1.000
R07	SKC	224-PCXR4	798480	04/04/2022	1,000	1,500	2,000	994	1,490	2,000	1.008x – 16.831	1.000
R08	SKC	224-PCXR4	883215	01/04/2022	1,000	1,500	2,000	1,001	1,502	2,005	1.015x – 26.627	0.999
R09	SKC	224-PCXR4	034650	01/04/2022	1,000	1,500	2,000	991	1,504	2,002	1.018x – 36.538	0.999
R10	SKC	224-PCXR4	091765	01/04/2022	1,000	1,500	2,000	996	1,512	1,993	1.000x + 0.219	1.000
R11	SKC	224-PCXR4	091763	12/04/2022	1,000	1,500	2,000	1,001	1,499	2,002	1.012x – 23.923	0.999
R12	SKC	224-PCXR4	091568	12/04/2022	1,000	1,500	2,000	997	1,501	1,999	1.001x – 4.986	1.000
R13	SKC	224-PCXR4	091638	04/04/2022	1,000	1,500	2,000	1,002	1,498	1,993	0.991x + 10.793	1.000
R14	SKC	224-PCXR4	091764	04/04/2022	1,000	1,500	2,000	994	1,502	1,998	1.013x – 29.256	0.999
R15	SKC	224-PCXR8	529457	01/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x – 24.345	0.999
R16	SKC	224-PCXR8	529643	04/04/2022	1,000	1,500	2,000	998	1,497	1,994	0.997x + 0.060	1.000
R17	SKC	224-PCXR8	529645	04/04/2022	1,000	1,500	2,000	994	1,509	2,000	1.015x – 30.571	0.999
R18	SKC	224-PCXR8	566756	04/04/2022	1,000	1,500	2,000	991	1,496	1,998	1.002x – 7.678	1.000
R19	SKC	224-PCXR8	566802	01/04/2022	1,000	1,500	2,000	1,003	1,499	2,000	1.010x – 20.189	0.999
R20	SKC	224-PCXR8	529089	04/04/2022	1,000	1,500	2,000	990	1,501	2,003	1.020x – 40.036	0.999
R21	SKC	224-PCXR8	665728	01/04/2022	1,000	1,500	2,000	999	1,493	1,999	1.000x – 5.364	1.000
R22	SKC	224-PCXR8	707444	04/04/2022	1,000	1,500	2,000	1,002	1,500	2,001	1.011x – 21.215	0.999
R23	SKC	224-PCXR8	761067	11/04/2022	1,000	1,500	2,000	998	1,494	1,992	0.994x + 3.095	1.000
R24	SKC	224-PCXR8	707893	01/04/2022	1,000	1,500	2,000	996	1,505	2,001	1.014x – 29.040	0.999
R25	SKC	224-PCXR8	761052	01/04/2022	1,000	1,500	2,000	998	1,500	1,992	0.992x + 7.630	1.000
R26	SKC	224-PCXR8	707956	12/04/2022	1,000	1,500	2,000	1,002	1,500	2,004	1.013x – 24.417	0.999
R27	SKC	224-PCXR8	707398	04/04/2022	1,000	1,500	2,000	996	1,503	2,001	1.013x – 28.725	0.999
R28	SKC	224-PCXR8	707481	11/04/2022	1,000	1,500	2,000	1,004	1,500	2,003	1.010x – 19.368	0.999
R29	SKC	224-PCXR8	707402	01/04/2022	1,000	1,500	2,000	1,005	1,491	1,991	0.988x + 14.326	1.000
R30	SKC	224-PCXR8	093811	01/04/2022	1,000	1,500	2,000	998	1,495	1,994	0.998x – 1.268	1.000
R31	SKC	224-PCXR8	093183	01/04/2022	1,000	1,500	2,000	1,001	1,501	2,001	1.012x – 23.001	0.999
R32	SKC	224-PCXR8	671950	04/04/2022	1,000	1,500	2,000	1,000	1,498	1,994	0.994x + 7.762	1.000
R33	SKC	224-PCXR4	626254	12/04/2022	1,000	1,500	2,000	992	1,502	1,999	1.016x – 34.141	0.999
R34	SKC	224-PCXR4	626131	01/04/2022	1,000	1,500	2,000	1,002	1,498	2,004	1.012x – 24.294	0.999
R35	SKC	224-PCXR8	707460	04/04/2022	1,000	1,500	2,000	998	1,498	1,995	0.994x + 5.672	1.000
R36	SKC	224-PCXR8	707446	01/04/2022	1,000	1,500	2,000	1,003	1,500	2,001	1.010x – 19.192	0.999
R37	SKC	224-PCXR8	707432	01/04/2022	1,000	1,500	2,000	999	1,499	1,998	0.999x + 0.554	1.000
R38	SKC	224-PCXR8	707349	01/04/2022	1,000	1,500	2,000	996	1,500	2,002	1.015x – 31.640	0.999
R39	SKC	224-PCXR8	761095	12/04/2022	1,000	1,500	2,000	1,001	1,496	1,994	0.997x + 2.652	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 $^{\circ}\text{C}$
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
R40	SKC	224-PCXR4	612753	01/04/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.012x – 23.005	0.999
R41	SKC	224-PCXR4	626140	01/04/2022	1,000	1,500	2,000	991	1,509	2,002	1.018x – 35.114	0.999
R42	SKC	224-PCXR4	626463	01/04/2022	1,000	1,500	2,000	995	1,493	2,000	1.003x – 7.470	1.000
R43	SKC	224-PCXR4	626129	04/04/2022	1,000	1,500	2,000	1,002	1,501	2,003	1.012x – 22.495	0.999
R44	SKC	224-PCXR4	602753	01/04/2022	1,000	1,500	2,000	1,002	1,495	1,994	0.996x + 1.133	1.000
R45	SKC	224-PCXR4	626137	01/04/2022	1,000	1,500	2,000	992	1,505	2,002	1.019x – 37.368	0.999

Calibrated by :

Approved by



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	05/01/2022	500	1,000	2,000	502.4	997.7	1997.7	0.996x + 3.587	1.000
H-R02	Dwyer	VFB-65	05/01/2022	500	1,000	2,000	500.5	998.1	1995.7	0.992x + 7.068	1.000
H-R03	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	497.1	994.3	1976.7	0.990x + 4.620	1.000
H-R04	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	495.2	990.5	1995.3	1.001x – 7.907	1.000
H-R05	Dwyer	VFB-65	06/01/2022	500	1,000	2,000	495.3	999.3	1995.6	1.003x – 3.4893	1.000
H-R06	Dwyer	VFB-65	07/01/2022	500	1,000	2,000	493.0	1000.9	1990.9	0.996x + 1.905	1.000

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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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	R²
H-R01	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	503.1	992.4	1979.1	0.999x + 3.360	0.999
H-R02	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	500.8	995.3	1986.1	1.002x + 5.536	1.000
H-R03	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	502.1	987.7	1997.3	0.994x + 1.910	1.000
H-R04	Dwyer	VFB-65	04/04/2022	500	1,000	2,000	496.4	989.6	2019.5	1.009x - 13.763	1.000
H-R05	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	496.8	987.7	1987.7	1.004x - 9.632	1.000
H-R06	Dwyer	VFB-65	01/04/2022	500	1,000	2,000	505.2	992.4	1979.4	0.999x + 2.749	0.999

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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R²
L-R01	Dwyer	VFA-21	05/01/2022	50	100	200	50.0	100.0	202.1	1.000x + 0.189	1.000
L-R02	Dwyer	VFA-21	05/01/2022	50	100	200	49.5	100.9	198.9	1.002x - 0.324	1.000
L-R03	Dwyer	VFA-21	06/01/2022	50	100	200	49.8	99.4	201.7	1.004x - 0.164	1.000
L-R04	Dwyer	VFA-21	06/01/2022	50	100	200	49.6	100.3	200.0	1.002x - 0.421	1.000
L-R05	Dwyer	VFA-21	06/01/2022	50	100	200	50.0	99.8	202.4	0.987x + 1.729	1.000
L-R06	Dwyer	VFA-21	07/01/2022	50	100	200	49.8	99.5	198.1	1.005x - 1.417	1.000

Calibrated by :

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	04/04/2022	50	100	200	50.2	100.6	203.5	0.983x + 2.458	1.000
L-R02	Dwyer	VFA-21	01/04/2022	50	100	200	49.7	100.9	200.5	1.008x - 1.306	0.999
L-R03	Dwyer	VFA-21	04/04/2022	50	100	200	50.1	99.8	202.3	1.018x - 1.156	1.000
L-R04	Dwyer	VFA-21	04/04/2022	50	100	200	49.8	100.9	200.6	1.009x - 1.349	0.999
L-R05	Dwyer	VFA-21	01/04/2022	50	100	200	49.8	100.4	203.4	0.992x + 1.525	1.000
L-R06	Dwyer	VFA-21	01/04/2022	50	100	200	50.2	99.1	201.9	1.003x - 0.172	1.000

Calibrated by :

Approved by :

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 21M3169

REFERENCE No : 60627-5

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

ID No : BA 05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 19-Mar-21

APPROVED BY : 

ISSUED DATE : 20-Mar-21

RECEIVED DATE : 19-Mar-21

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

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 21M3169

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA 05/50 RECEIVED DATE : 19-Mar-21
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 19-Mar-21
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52 %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 :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-I-151	C02210415	09-Feb-23
2) STANDARD WEIGHT	E2	15843	C02210419	10-Feb-23
3) STANDARD WEIGHT	E2	QK-I-349	M2103235S	26-Mar-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

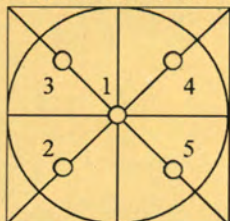
1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 100 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.00	0.00000	0.00000	0.000066
0.02	0.01998	0.00002	0.000066
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000067
0.50	0.49996	0.00004	0.000065
1.00	0.99997	0.00003	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00003	-0.00003	0.000070
20.00	20.00000	0.00000	0.000075
50.00	50.00000	0.00000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

5. OFF CENTER LOADING ERROR

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

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

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

END OF CALIBRATION REPORT



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

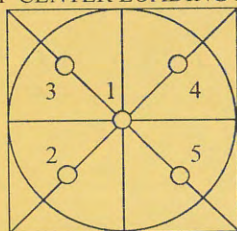
3. REPEATABILITY OF READING AT 20 g WAS 0.000004 g

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	100.0001	-0.0001	0.00019
120.00	120.0001	-0.0001	0.00022

6. OFF CENTER LOADING ERROR



POINT	READING (g)	
1	10.00001	50.0000
2	10.00002	50.0000
3	10.00001	50.0000
4	10.00001	50.0000
5	10.00002	50.0001
OFF-CENTER LOADING	0.00001	0.0001

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

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

END OF CALIBRATION REPORT

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID:

GC/MS

Organization Name:

S.P.S. Consulting service

Organization Location:

7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok, 10900

Date:

March 22, 2021 10:41:18 AM

EQP Name:

AgilentRecommended , AgilentRecommended

EQP Revision:

GC.02.51, GCMS.02.51

Overall Qualification Status:

Pass

System Inspection and Basic Safety and Operation

Name:

7890

Setpoint Status:

Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name:

7890

Front

SSL

Setpoint Status:

Pass

Setpoint

Actual

Inlet Pressure:

25.0

psi

24.9

psi

Accuracy:

0.1

psi

Agilent Recommended:

<=

1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Date:

March 22, 2021 10:41:18 AM

System ID:

GC/MS

Name: 7890
Back SSL

Setpoint Status:

Pass

Pressure:

25.0 psi

Pressure Change:

-0.1 psi /5 minutes

Agilent Recommended:

>= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

Setpoint Status:

Pass

Setpoint

Actual

Inlet Pressure: 25.0 psi

24.9 psi

Accuracy:

0.1 psi

Agilent Recommended:

<= 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0 mL/min

Measured Flow:

29.9 mL/min

Accuracy:

0.1 mL/min

Agilent Recommended:

<= 10.0 % setpoint

(3.0 mL/min)

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

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

399.8

mL/min

Accuracy:

0.2

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

40.0

ml/min

)

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

Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

24.9

mL/min

Accuracy:

0.1

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

2.5

ml/min

)

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

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

230.0

°C

Accuracy:

0.0

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

(

-5.0

°C

)

<=

1.0

% setpoint in K

(

5.0

°C

)

Date:

March 22, 2021 10:41:18 AM

System ID:

GC/MS

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0 100.0 °C

Accuracy:

0.0 °C

Agilent Recommended:

>= -1.0 % setpoint in K

(-3.7 °C)

<= 1.0 % setpoint in K

(3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0 100.05 °C

Stability:

0.1 °C

Agilent Recommended:

<= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination2

Back

SSL

/ Front

FID

Manual Injection

Name:

Not applicable

Setpoint Status:

Completed

Injection Volume on Column:

1.0 µL

Overall Scouting Run Status

Completed

Signal to Noise

Tested Combination2

Back

SSL

/ Front

FID

Date:

March 22, 2021 10:41:18 AM

System ID:

GC/MS

Manual Injection

Name: 7890

Setpoint Status: Pass

Signal to Noise: 1711991

Agilent Recommended: \geq 300000

Overall Signal to Noise Test Status

Pass

Noise and Drift

Tested Combination2	Back	SSL	/ Front	FID
Name:	7890			

Setpoint Status: Pass

Base Signal: 14.0 pA

	ASTM Noise counts	Drift counts/Hr
	384.56	178.79
Agilent Recommended:	\leq 768.00	\leq 19200.00
Status:	Pass	Pass

Overall Noise and Drift Test Status

Pass

Log Amp

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			
Amu:	1050	m/z	Drift After Five Minutes:	RFPA Voltage:
			4	485
			mV	mV
Agilent Recommended:	>=	-100	and	<= 100
				<= 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Setpoint Status:	Pass			
Filament:	1			
Setpoint Status:	Pass			
Filament:	2			

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination1	Front	SSL	/ External	SQ
Name:	5975C inert XL with TAD			
Source:	EI - Standard (Stainless Steel)		Filament:	1
Setpoint Status:	Pass			
Signal to Noise:	925			
Agilent Recommended:	>= 320			

Date: March 22, 2021 10:41:18 AM
System ID: GC/MS

Source: EI - Standard (Stainless Steel) Filament: 2

Setpoint Status: Pass

Signal to Noise: 672

Agilent Recommended: \geq 320

Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GC/MS
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

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

Tested Combination2

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

Sampler 1

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

Sampler 2

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

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Mainframe 1

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

Inlet 1

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

Inlet 2

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

Detector 1

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Detector 2

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

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C inert XL with TAD
Serial Number	US91732743
Firmware Revision	Not applicable
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Standard (Stainless Steel)
Number of filaments	2

Electronic Signature

Purpose

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Full Name of Signer:	Nattapat Hengcharoen
Logged On User Name:	nattapat.hengcharoen@agilent.com
Signature Creation Date:	March 22, 2021
Reason for Signature:	Executed protocol and published this original version of document

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Date:	March 22, 2021 10:41:18 AM
System ID:	GC/MS

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 12:15:46 PM	Audit	SessionCreated	Session	None
March 19, 2021 12:15:46 PM	Start	Configuration	Session	None
March 19, 2021 12:15:46 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
March 19, 2021 12:21:07 PM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.51/Gc.02.51.eqp], EQP File Name: [Gc.02.51.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.51/GcMs.02.51.eqp], EQP File Name: [GcMs.02.51.eqp], EQP Name: [AgilentRecommended]
March 19, 2021 12:21:16 PM	End	Configuration	Session	None
March 19, 2021 12:21:22 PM	Start	Qualification	Session	OQ
March 19, 2021 12:21:22 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

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OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:38:58 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 19, 2021 1:39:56 PM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
March 19, 2021 1:40:12 PM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
March 19, 2021 1:40:14 PM	Start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 19, 2021 1:40:21 PM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
March 19, 2021 1:40:24 PM	Start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
March 19, 2021 1:40:34 PM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
March 19, 2021 1:40:36 PM	Start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
March 19, 2021 1:40:41 PM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1

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User Name: nattapat.hengcharoen
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OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:40:42 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:20 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:22 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:24 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:37 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:40 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:42 PM	Start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 19, 2021 1:41:55 PM	Audit	Data	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Manual Data Entry
March 19, 2021 1:41:56 PM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 19, 2021 1:41:59 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None

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 Hostname: 5CG70212Y1

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 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:42:27 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:43:21 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over.
March 19, 2021 1:43:55 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:43:57 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 19, 2021 1:43:59 PM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 19, 2021 1:44:12 PM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 19, 2021 1:44:14 PM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 19, 2021 1:44:17 PM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
March 19, 2021 1:45:12 PM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry

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User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
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OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 1:45:19 PM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 19, 2021 1:54:29 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:33:24 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:35:01 PM	Audit	AceClosed	Session	None
March 19, 2021 2:35:37 PM	Audit	AceRestarted	Session	None
March 19, 2021 2:35:38 PM	Audit	SessionReloaded	Session	None
March 19, 2021 2:35:41 PM	Start	Qualification	Session	OQ
March 19, 2021 2:35:41 PM	Start	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	None
March 19, 2021 2:36:12 PM	Audit	Data	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : E:\SPS\SCOUNT_FID.D\FID 1A.ch
March 19, 2021 2:36:32 PM	End	Execution	GC Scouting Run - Manual Injection, Back SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 19, 2021 2:36:36 PM	Start	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	None

User Name: nattapat.hengcharoen
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OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 2:36:46 PM	Audit	Data	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : E:\SPS\SN_FID.D\FID1A.ch
March 19, 2021 2:37:00 PM	End	Execution	Signal to Noise - Manual Injection, Back SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
March 19, 2021 2:37:06 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 19, 2021 3:46:48 PM	Start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 19, 2021 3:47:08 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : E:\SPS\ND_FID.D\FID1A.ch
March 19, 2021 3:47:30 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 19, 2021 3:47:32 PM	Start	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:49:54 PM	Start	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:52:45 PM	Start	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None

User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
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OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 19, 2021 3:53:16 PM	End	Execution	Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	Run Count : 1
March 19, 2021 3:53:19 PM	Start	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	None
March 19, 2021 3:58:14 PM	End	Execution	RFPA - 5975C inert XL with TAD SQ: - Source: EI - Standard (Stainless Steel)	Run Count : 1
March 19, 2021 3:59:01 PM	Start	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 1 (Qualitative - No setpoints associated)	None
March 19, 2021 3:59:37 PM	End	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 19, 2021 3:59:39 PM	Start	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 2 (Qualitative - No setpoints associated)	None
March 19, 2021 4:00:01 PM	End	Execution	Tune EI - 5975C inert XL with TAD SQ: - Source: - EI - Standard (Stainless Steel) Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 19, 2021 4:00:05 PM	Audit	AceClosed	Session	None
March 22, 2021 9:39:45 AM	Audit	AceRestarted	Session	None
March 22, 2021 9:39:49 AM	Audit	SessionReloaded	Session	None
March 22, 2021 9:40:02 AM	Start	Qualification	Session	OQ

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User Name: nattapat.hengcharoen
 Hostname: 5CG70212Y1

System Id: GC/MS
 Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 22, 2021 9:40:26 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	None
March 22, 2021 9:41:14 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	None
March 22, 2021 9:41:58 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	Data files Path : E:\SPS\SN_F1.D\DATA.MS
March 22, 2021 9:43:36 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 1 - L: >= 320	Run Count : 1
March 22, 2021 9:43:44 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	None
March 22, 2021 9:44:03 AM	Audit	Data	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	Data files Path : E:\SPS\SN_F2.D\DATA.MS
March 22, 2021 9:44:34 AM	End	Execution	Signal to Noise EI - Liquid Injection, Front SSL, SQ: - Source: EI - Standard (Stainless Steel) using Filament 2 - L: >= 320	Run Count : 1

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User Name: nattapat.hengcharoen
Hostname: 5CG70212Y1


System Id: GC/MS
Print Date: March 22, 2021 10:41:24 AM

OQ_SPS_GC-MS Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 22, 2021 9:44:37 AM	End	Qualification	Session	OQ
March 22, 2021 9:44:37 AM	Start	Reporting	Session	None
March 22, 2021 10:40:26 AM	Audit	Reporting	Session	Report Generated : Certificate

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:	1 of 2
Service Engineer Name:	Pramote Chaisorn	Service Order Number:	WO-01624977
Date PM Performed: (DD-MMM-YYYY)	04-Mar-2022	Next PM Due Date: (DD-MMM-YYYY)	04-Sep-2022

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	<u>6.5</u>
------------------	------------
- ☒ 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	<u>0.91</u> mV.
Detector Channel B	<u>NA</u> mV.

3. Diagnostics Tests:

- ☒ Run instrument diagnostics.

<input checked="" type="checkbox"/> BRAM	Pass
<input checked="" type="checkbox"/> EPROM	Pass
- ☒ Run Autosampler diagnostics.

<input checked="" type="checkbox"/> BRAM	Pass
<input checked="" type="checkbox"/> 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	<div style="background-color: black; width: 150px; height: 30px;"></div>
Authorized Customer Representative:	Date: 04-Mar-2022 (DD-MMM-YYYY)
	Date: 04-Mar-2022 (DD-MMM-YYYY)