

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

เอกสารแนบ 5-1	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ
เอกสารแนบ 5-2	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง
เอกสารแนบ 5-3	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ
เอกสารแนบ 5-4	เอกสารสอบเทียบเครื่องมือการตรวจวัดคราะห์คุณภาพน้ำทิ้ง
เอกสารแนบ 5-5	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในสถานประกอบการ
เอกสารแนบ 5-6	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานประกอบการ
เอกสารแนบ 5-7	เอกสารสอบเทียบเครื่องมือการตรวจวัดปริมาณเสียงสะสมตัวพนักงาน
เอกสารแนบ 5-8	เอกสารสอบเทียบเครื่องมือการตรวจวัดแสงสว่างในสถานประกอบการ
เอกสารแนบ 5-9	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับความร้อนในสถานประกอบการ

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ T

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ TSPT	T High Volume Air SamplerT No. R04, R05, R06, R07, R09T	T Digital BalanceT
PM ₁₀ T	High Volume PM ₁₀ Air SamplerT No. R08, R09, R12, R13, R18T	Digital BalanceT
SO ₂ T	SO ₂ AnalyzerT No. R04, R06, R07, R08T	SO ₂ AnalyzerT No. R04, R06, R07, R08T
NO ₂ T	NO AnalyzerT No. R05, R06, R07, R11T	NO AnalyzerT No. R05, R06, R07, R11T
AcetaldehydeT	Mass Flow MeterT	GC/MST
คุณภาพอากาศจากปล่อง TSPT	Console No. R05T Pitot Tube No. B08, B24, B38T	Digital BalanceT
NO _x T	Vacuum GaugeT	Spectrophotometer T
SO ₂ T	Personal Pump SKC No. R36T Rotameter No. H-B08T	-T
AcetaldehydeT	Personal Pump SKC No. R24, R36T Rotameter No. L-R01T	GC/FIDT
Ethylene GlycolT	Personal Pump SKC No. R24, R36T Rotameter No. L-R01T	GC/FIDT
ระดับเสียง Leq 24 hrT LmaxT L90T	T Acoustic CalibratorT	T -T
	Sound Level Meter No. ACO-R17, R18T	
	T	
คุณภาพน้ำ pHT	T - T	T pH MeterT
BOD ₅ T	- T	DO MeterT
CODT	- T	COD ReactorT
Total Suspended SolidsT	- T	Digital balancesT
Total Dissolved SolidsT	- T	Digital balancesT
Grease and OilT	- T	Digital balancesT
Ethylene GlycolT	- T	GC/FIDT
AcetaldehydeT	- T	GC/MST

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)T

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ AcetaldehydeT	T Personal Pump No. B11, B40, B52, B55, R01, R06, R32, R35, R40T Rotameter No. L-R01, R02T	T GC/FIDT
Ethylene GlycolT	Personal Pump No. B40, B46, B52, R01, R06, R07, R32, R35T Rotameter No. H-R01, R02T	GC/FIDT
Total DustT	Personal Pump No. B21, B27, B34, B71, R17, R37, R43T Rotameter No. H-R01, R02T	Digital Balance T
Respirable DustT	Personal Pump No. B30, B31, B65, B72, R07, R32, R44T Rotameter No. H-R01, R02T	Digital BalanceT
Phosphoric AcidT	Personal Pump No. B11, B55, B65, R30, R37, R40T Rotameter No. L-R01, R02T	ICT
Sodium HydroxideT	Personal Pump No. B03, B24, B72, R17, R43T Rotameter No. H-R01, R02T	-T
Sodium Hypochlorite as SodiumT	Personal Pump No. B23, R44T Rotameter No. H-R01, R02T	ICPT
Hydrogen SulfideT	Personal Pump No B41, R32T Rotameter No. L-R01, R02T	ICT
AcetoneT	Personal Pump No. B23, R30T Rotameter No. L-R01, R02T	GC/FIDT
EthanolT	Personal Pump No. B23, R30T Rotameter No. L-R01, R02T	GC/FIDT
ChloroformT	Personal Pump No. B21, R07T Rotameter No. L-R01, R02T	GC/FIDT
PhenolT	Personal Pump No. B21, R37T Rotameter No. L-R01, R02T	GC/FIDT
Isopropyl AlcoholT	Personal Pump No. B42, R43T Rotameter No. L-R01, R02T	GC/FIDT
Sulfuric AcidT	Personal Pump No. B07, R32T Rotameter No. L-R01, R02T	ICT
Hydrochloric AcidT	Personal Pump No. B39, R07T Rotameter No. H-R01, R02T	ICT
Acetic AcidT	Personal Pump No. B41, R07, R30T Rotameter No. L-R01, R02T	GC/FIDT

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)T

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
ระดับความร้อนในสถานประกอบการT WBGT	Heat Stress WBGT MeterT	-T
	No. R04, R05, R06, R12T	
ระดับความเข้มของแสงสว่างในสถาน ประกอบการT Light IntensityT		T
	Light Meter No. R07T	-T
ระดับเสียงในสถานประกอบการ Leq 12 hrT LmaxT	T	T
	Acoustic Calibrator T	-T
	Sound Level MeterT	-T
ปริมาณเสียงสะสมติดตัวพนักงานT Noise DoseT T	No. ACO- R04, R05, R06, R40, R41, R50, R51T	
	T	T
	Acoustic CalibratorT	-T
	Noise DosimeterT	-T
	No. NMD-B01, B16, B17, B18, B19T	

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เอกสารแนบ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ



High Volume Air Sampler Calibration Report

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

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l/min)	R ²
B35	B35	03/08/2023	$y = 1.021x - 4.136$	0.999
B36	B36	03/08/2023	$y = 1.247x - 6.527$	0.999
B37	B37	03/08/2023	$y = 1.313x - 8.352$	0.997
B38	B38	03/08/2023	$y = 1.279x - 8.340$	0.999
B39	B39	03/08/2023	$y = 1.286x - 6.520$	0.999
B40	B40	03/08/2023	$y = 1.241x - 6.104$	1.000
B41	B41	03/08/2023	$y = 1.203x - 4.249$	0.999
B42	B42	03/08/2023	$y = 1.236x - 8.828$	0.999
B43	B43	04/08/2023	$y = 1.245x - 5.710$	0.997
B44	B44	04/08/2023	$y = 1.262x - 5.417$	0.999
R01	R01	04/08/2023	$y = 1.285x - 6.963$	0.999
R02	R02	04/08/2023	$y = 1.268x - 6.283$	0.998
R03	R03	04/08/2023	$y = 1.283x - 9.563$	0.999
R04	R04	04/08/2023	$y = 1.234x - 5.231$	0.999
R05	R05	04/08/2023	$y = 1.203x - 10.068$	0.999
R06	R06	04/08/2023	$y = 1.287x - 7.927$	0.997
R07	R07	04/08/2023	$y = 1.094x - 0.577$	0.999
R08	R08	04/08/2023	$y = 1.304x - 9.667$	0.998
R09	R09	04/08/2023	$y = 1.288x - 8.387$	0.998
R10	R10	03/08/2023	$y = 1.241x - 8.099$	0.996
R11	R11	03/08/2023	$y = 1.112x - 1.473$	0.996
R12	R12	03/08/2023	$y = 1.200x - 6.933$	0.997
R13	R13	02/08/2023	$y = 1.142x - 2.469$	0.998
R14	R14	02/08/2023	$y = 1.205x - 3.813$	0.998
R15	R15	01/08/2023	$y = 1.160x - 3.518$	0.999
R16	R16	01/08/2023	$y = 1.229x - 7.416$	0.998
R17	R17	01/08/2023	$y = 1.203x - 4.808$	0.998
R18	R18	01/08/2023	$y = 1.257x - 6.979$	0.999
R19	R19	01/08/2023	$y = 1.268x - 7.076$	0.998
R20	R20	01/08/2023	$y = 1.279x - 8.603$	0.998

Calibrated by :

(Mr. Adul Dangdom)

Approved by :



High Volume PM-10 Air Sampler Calibration Report

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

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (l/min)	R ²
R01	R01	01/08/2023	$y = 1.244x - 6.482$	0.998
R02	R02	01/08/2023	$y = 1.274x - 8.620$	0.996
R03	R03	02/08/2023	$y = 1.266x - 7.028$	0.999
R04	R04	02/08/2023	$y = 1.259x - 8.726$	0.998
R05	R05	02/08/2023	$y = 1.210x - 5.918$	0.999
R06	R06	03/08/2023	$y = 1.246x - 8.062$	0.998
R07	R07	02/08/2023	$y = 1.222x - 4.950$	0.999
R08	R08	02/08/2023	$y = 1.287x - 8.890$	0.998
R09	R09	02/08/2023	$y = 1.245x - 8.340$	0.998
R10	R10	02/08/2023	$y = 1.228x - 6.133$	0.999
R11	R11	04/08/2023	$y = 1.282x - 6.014$	0.997
R12	R12	04/08/2023	$y = 1.303x - 9.748$	0.998
R13	R13	04/08/2023	$y = 1.305x - 8.462$	0.997
R14	R14	04/08/2023	$y = 1.299x - 7.936$	0.997
R15	R15	03/08/2023	$y = 1.291x - 7.250$	0.999
R16	R16	02/08/2023	$y = 1.275x - 7.402$	0.998
R17	R17	02/08/2023	$y = 1.292x - 8.739$	0.999
R18	R18	02/08/2023	$y = 1.215x - 5.881$	0.998
R19	R19	02/08/2023	$y = 1.375x - 7.472$	0.999
R20	R20	02/08/2023	$y = 1.288x - 10.308$	0.997

Calibrated by :

(Mr. Adul Dangdom)

Approved by :



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA 05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 10-Mar-23

APPROVED BY :

ISSUED DATE : 16-Mar-23

RECEIVED DATE : 10-Mar-23



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULT OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	M2102013S	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M2102014S	02-Feb-25

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR:



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

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

END OF CALIBRATION REPORT

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	08 August 2023	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R04	SERIAL NO.	3489		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	06 September 2022	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Sulphur Dioxide (SO ₂)	Cylinder No. :	A00814SK		
Certified Date :	21 June 2021	Expiry Date :	21 June 2029	Cylinder Conc. :	150.0 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	400.2	0.050	400.0	1.014
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	26.7	in-Hg	25-35		
SAMPLE FLOW	559	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	2026.4	mV	1000-4900		
STR. LGT	61.6	PPB	+100		
DRK PMT	60.0	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	670	V	550-900 constant		
DCPS	2527	mV	2500 ± 100		
RECELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.4	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.014	-	1.0 ± 0.3		
SO ₂ Offset	0.1	mV	<250		
Stability at Zero	0.1	PPB	±0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by : 
(Mr. Adul Dangkhon)

Approved by : 

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	08 August 2023	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R06	SERIAL NO.	066		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	06 September 2022	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Sulphur Dioxide (SO ₂)	Cylinder No. :	A00814SK		
Certified Date :	21 June 2021	Expiry Date :	21 June 2029	Cylinder Conc. :	150.0 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO ₂ Span	400.0	399.7	-0.075	400.0	1.009
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	26.4	in-Hg	25-35		
SAMPLE FLOW	556	cc/min	650 ± 10%		
PMT	103.1	mV	-20-150 with Zero Air		
UV LAMP	2043.8	mV	1000-4900		
STR. LGT	61.9	PPB	+100		
DRK PMT	63.5	mV	-50 - 200		
DRK LMP	58.4	mV	-50 - 200		
HVPS	672	V	550-900 constant		
DCPS	2517	mV	2500 ± 100		
RECELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.2	°C	5-40		
PMT TEMP	7.4	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.009	-	1.0 ± 0.3		
SO ₂ Offset	0.1	mV	<250		
Stability at Zero	0.1	PPB	±0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by : 
(Mr. Adul Dangkhon)

Approved by : 

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	08 August 2023	BRAND :	TELEDYNE	MODEL :	TML-60
NO.	SO ₂ -R07	SERIAL NO.	TR51068		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	06 September 2022	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Sulphur Dioxide (SO ₂)	Cylinder No. :	A00814SK		
Certified Date :	21 June 2021	Expiry Date :	21 June 2029	Cylinder Conc. :	150.0 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	400.3	0.075	400.0	1.016
API Model TML-60 SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	26.8	in-Hg	25-35		
SAMPLE FLOW	553	cc/min	650 ± 10%		
PMT	103.5	mV	-20-150 with Zero Air		
UV LAMP	2037.1	mV	1000-4900		
STR. LGT	61.5	PPB	+100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.6	mV	-50 - 200		
HVPS	672	V	550-900 constant		
DCPS	2521	mV	2500 ± 100		
RECELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.016	-	1.0 ± 0.3		
SO ₂ Offset	0.1	mV	<250		
Stability at Zero	0.1	PPB	±0.2		
Stability at Span	0.3	PPB	0.5% of reading (above 50 ppb)		

Calibrated by : 
(Mr. Adul Dangkhon)

Approved by : 

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	08 August 2023	BRAND :	TELEDYNE	MODEL :	TML-60
NO.	SO ₂ -R08	SERIAL NO.	TR51064		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	06 September 2022	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Sulphur Dioxide (SO ₂)	Cylinder No. :	A00814SK		
Certified Date :	21 June 2021	Expiry Date :	21 June 2029	Cylinder Conc. :	150.0 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.8	-0.050	400.0	1.011
API Model TML-60 SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	26.5	in-Hg	25-35		
SAMPLE FLOW	555	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	2029.7	mV	1000-4900		
STR. LGT	61.7	PPB	+100		
DRK PMT	63.2	mV	-50 - 200		
DRK LMP	58.0	mV	-50 - 200		
HVPS	669	V	550-900 constant		
DCPS	2516	mV	2500 ± 100		
RECELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.5	°C	5-40		
PMT TEMP	7.3	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.011	-	1.0 ± 0.3		
SO ₂ Offset	0.1	mV	<250		
Stability at Zero	0.1	PPB	±0.2		
Stability at Span	0.3	PPB	0.5% of reading (above 50 ppb)		

Calibrated by : 
(Mr. Adul Dangkhon)

Approved by : 



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T: 06-2551-939-72 Fax: 06-2551-4221 E-mail: sales@spsc.com, www.spsc.com

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	08 August 2023	BRAND :	API	MODEL :	200E
NO.	NOX-R08	SERIAL NO.	4413		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	06 September 2022	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	D636192		
Certified Date :	20 April 2022	Expired Date :	20 April 2024	Cylinder Conc. :	49.1 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.005
NO ₂ Span	400	400.1	0.025	400.0	1.008
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	504	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.9	mV	-20 ~ 150		
AZERO	93.8	mV	-20 ~ 150		
HVPS	675	V	420 ~ 900 constant		
RCCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.2	°C	8 ~ 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	314.7	°C	315 ± 5		
RCCELL 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 ₂ Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO ₂ Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO ₂ Offset	0.8	mV	-20 to +150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : (Mr.Adid Bungkum)

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	08 August 2023	BRAND :	API	MODEL :	200E
NO.	NOX-R06	SERIAL NO.	4466		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	06 September 2022	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	D636192		
Certified Date :	20 April 2022	Expired Date :	20 April 2024	Cylinder Conc. :	49.1 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.008
NO ₂ Span	400	400.3	0.075	400.0	1.012
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	509	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.3	mV	-20 ~ 150		
AZERO	94.1	mV	-20 ~ 150		
HVPS	671	V	420 ~ 900 constant		
RCCELL 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		
RCCELL PRESS	8.5	IN-Hg-A	2 ~ 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 ~ 30 constant		
NO Span Conc	400	PPB	20 ~ 20,000		
NO ₂ Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.008	-	1.0 ± 0.3		
NO ₂ Slope	1.012	-	1.0 ± 0.3		
NO Offset	1.6	mV	-20 to +150		
NO ₂ Offset	1.0	mV	-20 to +150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : (Mr.Adid Bungkum)

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	08 August 2023	BRAND :	API	MODEL :	200E
NO.	NOX-R07	SERIAL NO.	4468		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	06 September 2022	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	D636192		
Certified Date :	20 April 2022	Expired Date :	20 April 2024	Cylinder Conc. :	49.1 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.8	-0.100	400.0	0.999
NO ₂ Span	400	399.9	-0.025	400.0	1.004
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	103.0	mV	-20 ~ 150		
AZERO	93.7	mV	-20 ~ 150		
HVPS	672	V	420 ~ 900 constant		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°C	8 ~ 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCCELL PRESS	8.2	IN-Hg-A	2 ~ 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 ~ 30 constant		
NO Span Conc	400	PPB	20 ~ 20,000		
NO ₂ Span Conc	400	PPB	20 ~ 20,000		
NO Slope	0.999	-	1.0 ± 0.3		
NO ₂ Slope	1.004	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO ₂ Offset	0.6	mV	-20 to +150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : (Mr.Adid Bungkum)

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	08 August 2023	BRAND :	API	MODEL :	200E
NO.	NOX-R11	SERIAL NO.	2621		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	06 September 2022	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	D636192		
Certified Date :	20 April 2022	Expired Date :	20 April 2024	Cylinder Conc. :	49.1 ppm
CALIBRATING CONDITION					
Pressure :	1011 mmbar	Temp. :	24.6 °C	% RH :	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.2	0.050	400.0	1.009
NO ₂ Span	400	400.3	0.075	400.0	1.014
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	513	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.2	mV	-20 ~ 150		
AZERO	94.0	mV	-20 ~ 150		
HVPS	673	V	420 ~ 900 constant		
RCCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.5	°C	8 ~ 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCCELL PRESS	8.2	IN-Hg-A	2 ~ 10 constant		
SAMPLE PRESS	28.4	IN-Hg-A	25 ~ 30 constant		
NO Span Conc	400	PPB	20 ~ 20,000		
NO ₂ Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.009	-	1.0 ± 0.3		
NO ₂ Slope	1.014	-	1.0 ± 0.3		
NO Offset	1.7	mV	-20 to +150		
NO ₂ Offset	1.0	mV	-20 to +150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : (Mr.Adid Bungkum)

Approved by :

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GC_MS_03_62_CN10925102
Organization Name: S.P.S Consulting service
Organization Location: 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900

Date: March 31, 2023 1:21:52 PM
EQP Name: AgilentRecommended , AgilentRecommended
EQP Revision: GC.02.50, GCMS.02.50
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
Front SSL

Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_62_CN10925102

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Setpoint Status: Pass
Setpoint Actual
Inlet Pressure: 25.0 psi 25.0 psi
Accuracy: 0.0 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

Setpoint Status: Pass
Setpoint Actual
Inlet Pressure: 25.0 psi 25.2 psi
Accuracy: 0.2 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status: Pass
Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 30.3 mL/min
Accuracy: 0.3 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_62_CN10925102

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Setpoint Status: Pass
Flow Type: Oxidizer
Setpoint: 400.0 mL/min Measured Flow: 396.2 mL/min
Accuracy: 3.8 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Setpoint Status: Pass
Flow Type: Makeup
Setpoint: 25.0 mL/min Measured Flow: 25.1 mL/min
Accuracy: 0.1 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890
Setpoint Status: Pass
Zone: Oven
Setpoint/Actual
Temperature: 230.0 230.6 °C
Accuracy: 0.6 °C
Agilent Recommended: ≥ -1.0 % setpoint in K (-5.0 °C)
 ≤ 1.0 % setpoint in K (5.0 °C)

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_62_CN10925102

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Setpoint Status: Pass
Zone: Oven
Setpoint/Actual
Temperature: 100.0 100.4 °C
Accuracy: 0.4 °C
Agilent Recommended: ≥ -1.0 % setpoint in K (-3.7 °C)
 ≤ 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890
Setpoint Status: Pass
Setpoint/Average
Temperature: 100.0 100.3833 °C
Stability: 0.1 °C
Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID
Manual Injection
Name: Not applicable

Setpoint Status: Completed
Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID

Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_62_CN10925102

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Name: 7890

Setpoint Status: Pass

Base Signal: 89800 Ab

ASTM Noise counts	Drift counts/Hr
285.31	96.04
Agilent Recommended: Status: Pass	Agilent Recommended: Status: Pass

Overall Noise and Drift Test Status

Pass

Signal to Noise

Tested Combination1 Front SSL / Front FID

Name: 7890

Manual Injection

Setpoint Status: Pass

Signal to Noise: 3814254

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

Log Amp

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

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

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Annu: 1050 m/z

Drift After Five Minutes: 1 mV

RFPA Voltage: 479 mV

Agilent Recommended: >= -100 end <= 100 ~ 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination2 Back SSL / External SQ

Name: 5975C

Source: EI - Inert Filament: 1

Setpoint Status: Pass

Signal to Noise: 425

Agilent Recommended: >= 180

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

Source: EI - Inert Filament: 2

Setpoint Status: Pass

Signal to Noise: 566

Agilent Recommended: >= 180

Overall Signal to Noise EI Test Status

Pass

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

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GC_MS_03_52_CN10925102
Manufacturer	Agilent Technologies
Name	7890

Tested Combination1

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

Tested Combination2

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

Sampler 1

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

Sampler 2

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

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

Mainframe 1

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

Inlet 1

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

Inlet 2

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

Detector 1

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

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

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Detector 2

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5975C
Serial Number	US91732743
Firmware Revision	5975 5.02.07
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std

MS EI Source 1

Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of filaments	2

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

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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 login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

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

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-QQ3BK0NV

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

GC_MS_03_52_CN10925120 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:12:28 AM	Audit	SessionCreated	Session	None
March 31, 2023 9:12:29 AM	Start	Configuration	Session	None
March 31, 2023 9:12:28 AM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
March 31, 2023 9:20:14 AM	Audit	EqpLoaded	Session	EQP details for primary technique [GC] - File path: [ProtocolPacks/Gc/Configuration/02.50/Gc.02.50.eqp], EQP Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended] Protocol Revision: [Gc.02.50] EQP details for hyphenated technique [GCMS] - File path: [ProtocolPacks/Gc/Ms/Configurations/02.50/GcMs.02.50.eqp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
March 31, 2023 9:20:17 AM	End	Configuration	Session	None
March 31, 2023 9:20:27 AM	Start	Qualification	Session	OQ
March 31, 2023 9:20:27 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	None
March 31, 2023 9:21:33 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	Run Count: 1

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV
System ID: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

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

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV
System ID: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:22:42 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: ≤ 10.0% setpoint	None
March 31, 2023 9:22:46 AM	End	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: ≤ 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:49 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND ≤ 1.0 % setpoint in K	None
March 31, 2023 9:23:31 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND ≤ 1.0 % setpoint in K	Manual Data Entry
March 31, 2023 9:23:34 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND ≤ 1.0 % setpoint in K	Run Count : 1
March 31, 2023 9:23:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND ≤ 1.0 % setpoint in K	None
March 31, 2023 9:26:00 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND ≤ 1.0 % setpoint in K	Manual Data Entry
March 31, 2023 9:26:03 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND ≤ 1.0 % setpoint in K	Run Count : 1
March 31, 2023 9:26:05 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: ≤ 0.5°C	None

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV
System ID: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:26:42 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: ≤ 0.5°C	None
March 31, 2023 9:27:36 AM	Audit	Data	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: ≤ 0.5°C	Manual Data Entry
March 31, 2023 9:27:46 AM	End	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: ≤ 0.5°C	Run Count : 1
March 31, 2023 9:27:51 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID - - Part of System Preparation - No limits associated	None
March 31, 2023 9:54:35 AM	Start	Execution	Log Amp - 5975C SQ - Source: None EI - Inert	None
March 31, 2023 9:55:59 AM	Start	Execution	RFP A - 5975C SQ - Source: EI None - Inert	None
March 31, 2023 10:23:19 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L: >= 100	None
March 31, 2023 10:37:53 AM	Start	Execution	Tune EI - 5975C SQ - Source: - None EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:04 AM	Start	Execution	Tune EI - 5975C SQ - Source: - None EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:11 AM	Start	Execution	Tune EI - 5975C SQ - Source: - None EI - Inert Filament 1 (Qualitative - No setpoints associated)	None

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV
System ID: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 10:38:14 AM	Start	Execution	Noise and Drift - Front FID - Palustris ETM - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:38:17 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID - - Part of System Preparation - No limits associated	None
March 31, 2023 10:46:28 AM	Audit	Data	GC Scouting Run - Manual Injection, Front SSL, Front FID - - Part of System Preparation - No limits associated	Data files Path: F:\Data\GC_FID.D\FID1A.ch
March 31, 2023 10:47:01 AM	End	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID - - Part of System Preparation - No limits associated	Run Count : 1
March 31, 2023 10:58:27 AM	Start	Execution	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:58:52 AM	Audit	Data	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path: F:\Data\GC_FID.D\FID1A.ch
March 31, 2023 11:00:53 AM	End	Execution	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 31, 2023 11:02:02 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID - - Detector FID - L: >= 300000	None
March 31, 2023 11:14:32 AM	Audit	AccClosed	Session	None

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

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User Name: saenguthai.sarak
Hostname: LAPTOP-GQ3SK0MV

System Id: GC_MS_01_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

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

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

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User Name: saenguthai.sarak
Hostname: LAPTOP-GQ3SK0MV

System Id: GC_MS_01_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:24:33 AM	Start	Execution	RPFA - 5975C SQ - Source: EI - None - Inert	
March 31, 2023 11:27:22 AM	End	Execution	RPFA - 5975C SQ - Source: EI - Run Count: 1 - Inert	
March 31, 2023 11:27:25 AM	Start	Execution	Tune EI - 5975C SQ - Source: - None EI - Inert Filament 1 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:04 AM	End	Execution	Tune EI - 5975C SQ - Source: - Run Count: 1 EI - Inert Filament 1 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:56 AM	Start	Execution	Tune EI - 5975C SQ - Source: - None EI - Inert Filament 2 (Qualitative - No setpoints associated)	
March 31, 2023 11:29:26 AM	End	Execution	Tune EI - 5975C SQ - Source: - Run Count: 1 EI - Inert Filament 2 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:28 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 12:59:45 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 1:00:09 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Data files Path : F:\SN_F1_01.D\DATASIMMS
March 31, 2023 1:00:41 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 160	Run Count: 1

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

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User Name: saenguthai.sarak
Hostname: LAPTOP-GQ3SK0MV

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

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 1:00:43 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	None
March 31, 2023 1:01:52 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Data files Path : F:\SN_F2_01.D\DATASIMMS
March 31, 2023 1:02:59 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 160	Run Count: 1
March 31, 2023 1:02:13 PM	End	Qualification	Session	OQ
March 31, 2023 1:02:13 PM	Start	Reporting	Session	None
March 31, 2023 1:20:27 PM	Audit	Reporting	Session	Report Generated : Certificate

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

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เอกสารแนบ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง

Console Calibration Report

Calibration Method

Critical Orifices

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

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

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

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Signature - Blank)

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

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

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

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	01/08/2023	0.85	0.84
B37	S	0.99	02/08/2023	0.84	0.84
B38	S	0.99	03/08/2023	0.84	0.83
B39	S	0.99	03/08/2023	0.84	0.84
B40	S	0.99	01/08/2023	0.85	0.84
B41	S	0.99	02/08/2023	0.84	0.85
B44	S	0.99	01/08/2023	0.84	0.84
B45	S	0.99	01/08/2023	0.85	0.84
B46	S	0.99	01/08/2023	0.84	0.85
B47	S	0.99	01/08/2023	0.84	0.84
B48	S	0.99	01/08/2023	0.84	0.85
B49	S	0.99	03/08/2023	0.85	0.84
B54	S	0.99	03/08/2023	0.83	0.84
B56	S	0.99	03/08/2023	0.84	0.85
B57	S	0.99	03/08/2023	0.84	0.83
B58	S	0.99	03/08/2023	0.85	0.84

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

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA 05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 10-Mar-23
APPROVED BY :
ISSUED DATE : 16-Mar-23
RECEIVED DATE : 10-Mar-23

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

F-0010 REV 02



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	M23020135	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M23020148	02-Feb-25

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

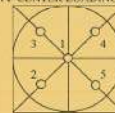
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g was 0 g

4. REFERENCE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY A

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

END OF CALIBRATION REPORT



CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

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

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

DATE OF RECEIVED : 25 July 2023

DATE OF ISSUED : 31 July 2023

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

Calibrated By : Sitipong Pimdee
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
31 July 2023



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

Certificate No. Q23081570

F3-011-04/01-12

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CALIBRATION LABORATORY Co.,LTD.

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



REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

Temperature : (23 \pm 2) °C

Relative Humidity : (55 \pm 10) %RH

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).

Certificate No. MP-0935-23, Due Date 02 February 2024.

UNCERTAINTY :

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

Certificate No. Q23081570

F3-011-04/01-12

page 2 of 3





CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Prasert Manukit 20 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0354 Fax: 02-578-2672 www.cal-laboratory.com E-mail: info@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

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

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note: Conversion factor 1 kPa ; 0.2953003 inHg

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

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

End of Certificate

Certificate No. Q23081570

F3-011-04/01-12

page 3 of 3



clc@calibration

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

NSC-TIS-115 17025
CALIBRATION 0354

Cert. No. : SP23016

Pages : 1 of 3

Calibration Certificate

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)



SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP23016
Job No. : VC66SP0014
Pages : 2 of 3

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

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

Continuation of Calibration Certificate

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

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0564	0.0047	0.0031	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0032	2.00
		29381	0.5	0.5416	0.5429	0.0013	0.0032	2.00
	546.1	29360	1.0	0.9821	0.9849	0.0028	0.0030	2.00
		29914	0.7	0.6961	0.6961	0.0000	0.0030	2.00
		29381	0.5	0.5073	0.5073	0.0000	0.0030	2.00
	590.0	29360	1.0	1.0222	1.0244	0.0022	0.0030	2.00
		29914	0.7	0.7237	0.7234	-0.0003	0.0030	2.00
		29381	0.5	0.5361	0.5360	-0.0001	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9775	0.0022	0.0030	2.00
		29914	0.7	0.6910	0.6910	0.0000	0.0030	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
RM-0204000810	20	20	0.2422	0.2462	0.0040	0.0101	2.00
		40	0.4866	0.4900	0.0034	0.0115	2.00
	235.0	60	0.7414	0.7390	-0.0024	0.0068	2.00
		80	0.9858	0.9871	0.0013	0.0093	2.00
	100	1.2442	1.2480	0.0038	0.0087	2.00	

UUC* - Unit Under Calibration

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

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

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

QF-TS12-04-4-020664

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter										Model : Defender 510-H										S/N : 136164									
Environmental Conditions																													
Temperature																													
Pressure																													
25 ± 3 °C																													
1010 ± 15 mmbar																													
Personal Pump Data										Calibration Data										Value From Calibration Curve									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Actual (Q std.)					Y					R ²									
					1	2	3	1	2	3																			
R01	SNC	224-PCV04	602407	06/07/2023	1.000	1.500	2.000	991	1.506	2.002	1.007x - 14.479	1.000																	
R02	SNC	224-PCV04	624550	06/07/2023	1.000	2.000	3.000	997	1.987	1.988	0.988x - 12.256	1.000																	
R03	SNC	224-PCV04	691592	06/07/2023	1.000	1.500	2.000	1.002	1.498	2.002	1.003x - 5.881	1.000																	
R04	SNC	224-PCV04	691672	06/07/2023	1.000	1.500	2.000	995	1.991	1.994	0.997x - 2.717	1.000																	
R05	SNC	224-PCV04	769470	06/07/2023	1.000	1.500	2.000	992	1.505	1.997	1.001x - 6.538	1.000																	
R06	SNC	224-PCV04	769456	06/07/2023	1.000	1.500	2.000	994	1.497	1.993	0.994x - 0.976	1.000																	
R07	SNC	224-PCV04	769480	06/07/2023	1.000	1.500	2.000	993	1.490	1.997	1.007x - 14.177	1.000																	
R08	SNC	224-PCV04	848315	06/07/2023	1.000	1.500	2.000	1.010	1.499	2.003	0.988x - 11.332	0.999																	
R09	SNC	224-PCV04	834650	06/07/2023	1.000	1.500	2.000	996	1.503	2.000	0.013x - 29.598	1.000																	
R10	SNC	224-PCV04	091765	07/07/2023	1.000	1.500	2.000	996	1.502	1.992	0.996x - 0.299	1.000																	
R11	SNC	224-PCV04	091763	07/07/2023	1.000	1.500	2.000	999	1.497	1.985	1.000x - 9.834	0.999																	
R12	SNC	224-PCV04	091566	07/07/2023	1.000	1.500	2.000	995	1.499	1.996	1.001x - 6.774	1.000																	
R13	SNC	224-PCV04	091658	07/07/2023	1.000	1.500	2.000	1.001	1.501	1.989	0.988x + 14.559	1.000																	
R14	SNC	224-PCV04	091764	07/07/2023	1.000	1.500	2.000	993	1.501	1.997	1.013x - 30.102	0.999																	
R15	SNC	224-PCV08	520457	07/07/2023	1.000	1.500	2.000	1.000	1.499	2.001	0.998x - 3.682	0.999																	
R16	SNC	224-PCV08	520443	08/07/2023	1.000	1.500	2.000	997	1.494	1.992	0.992x - 2.530	1.000																	
R17	SNC	224-PCV08	520445	08/07/2023	1.000	1.500	2.000	994	1.507	1.998	1.006x - 12.440	0.999																	
R18	SNC	224-PCV08	566756	08/07/2023	1.000	1.500	2.000	996	1.496	1.996	1.000x - 6.873	1.000																	
R19	SNC	224-PCV08	566802	09/07/2023	1.000	1.500	2.000	1.001	1.497	1.998	1.003x - 14.352	0.999																	
R20	SNC	224-PCV08	520489	09/07/2023	1.000	1.500	2.000	999	1.499	2.001	0.019x - 39.318	0.999																	
R21	SNC	224-PCV08	665728	09/07/2023	1.000	1.500	2.000	997	1.493	1.997	0.996x - 3.765	1.000																	
R22	SNC	224-PCV08	701444	09/07/2023	1.000	1.500	2.000	1.002	1.511	2.001	1.000x - 2.666	0.999																	
R23	SNC	224-PCV08	761067	09/07/2023	1.000	1.500	2.000	1.011	1.475	1.989	0.960x + 20.504	0.999																	
R24	SNC	224-PCV08	707893	04/07/2023	1.000	1.500	2.000	995	1.507	1.998	1.007x - 14.619	0.999																	
R25	SNC	224-PCV08	761052	04/07/2023	1.000	1.500	2.000	1.099	1.494	1.993	0.984x - 21.169	1.000																	
R26	SNC	224-PCV08	707936	06/07/2023	1.000	1.500	2.000	1.011	1.499	2.004	1.001x - 3.674	0.999																	
R27	SNC	224-PCV08	707398	06/07/2023	1.000	1.500	2.000	995	1.499	1.999	1.005x - 14.830	1.000																	
R28	SNC	224-PCV08	701481	07/07/2023	1.000	1.500	2.000	1.003	1.499	2.000	1.001x - 11.858	0.998																	
R29	SNC	224-PCV08	701402	04/07/2023	1.000	1.500	2.000	1.002	1.492	1.987	0.865x - 16.145	1.000																	
R30	SNC	224-PCV08	093811	07/07/2023	1.000	1.500	2.000	999	1.492	1.991	0.994x + 4.391	1.000																	
R31	SNC	224-PCV08	093183	07/07/2023	1.000	1.500	2.000	1.000	1.499	1.999	0.998x + 8.339	0.999																	
R32	SNC	224-PCV08	671950	06/07/2023	1.000	1.500	2.000	997	1.499	1.991	0.995x + 0.048	1.000																	
R33	SNC	224-PCV08	626254	04/07/2023	1.000	1.500	2.000	993	1.501	1.998	1.014x - 32.194	0.999																	
R34	SNC	224-PCV08	626131	04/07/2023	1.000	1.500	2.000	1.001	1.494	2.002	1.004x - 12.316	1.000																	
R35	SNC	224-PCV08	701446	07/07/2023	1.000	1.500	2.000	998	1.496	1.993	0.993x + 5.945	1.000																	
R36	SNC	224-PCV08	701446	07/07/2023	1.000	1.500	2.000	1.003	1.497	1.999	1.008x - 18.814	0.999																	
R37	SNC	224-PCV08	701432	07/07/2023	1.000	1.500	2.000	995	1.497	1.998	0.995x + 5.662	1.000																	
R38	SNC	224-PCV08	701349	07/07/2023	1.000	1.500	2.000	996	1.498	1.999	1.002x - 7.660	1.000																	
R39	SNC	224-PCV08	761095	04/07/2023	1.000	1.500	2.000	1.004	1.514	1.992	1.004x - 18.826	0.999																	

Calibrated by :

Approved by :



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7 ซอยพหลโยธิน 24 แขวงพหลโยธิน เขตพหลโยธิน กรุงเทพมหานคร 10000
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Tel : (662) 539-4370-71, Fax : (662) 513-4211, E-mail : info@spscon.com, www.spscon.com

Rotameter Calibration Report (For Personal Pump High Flow Adjust)												
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 310-H				S/N : 136164				
Rotameter Data			Calibration Data									
No.	Brand	Model	Date	Flow Rate (m/min)			Actual (Q std.)			Value From Calibration Curve		
				1	2	3	1	2	3	y	x ²	
H-801	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	902.4	995.1	1978.7	6.995x + 7.025	1.000	
H-802	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	895.6	994.6	1944.1	6.995x + 2.972	1.000	
H-803	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	497.1	989.8	2007.6	1.000x + 12.719	0.999	
H-804	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	300.3	999.5	2004.4	0.995x + 0.709	1.000	
H-805	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	499.3	996.7	1972.3	0.995x + 17.215	0.999	
H-806	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	104.0	991.4	1942.0	0.998x + 8.735	1.000	
H-807	Dwyer	VFB-65	04/07/2023	500	1,000	2,000	311.5	989.4	2014.7	0.999x + 0.490	1.000	
H-808	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	495.2	994.1	1977.8	0.995x + 2.247	0.999	
H-809	Dwyer	VFB-65	07/07/2023	500	1,000	2,000	304.0	990.4	2008.7	0.991x + 16.315	1.000	
H-810	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	495.7	993.0	2011.6	1.000x + 1.820	1.000	
Calibrated by :			Approved by :									
Mr. Adu Dangkom												



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Tel : (662) 539-4370-71, Fax : (662) 513-4211, E-mail : info@spscon.com, www.spscon.com

Rotameter Calibration Report (For Personal Pump High Flow Adjust)												
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 310-H				S/N : 136164				
Rotameter Data			Calibration Data									
No.	Brand	Model	Date	Flow Rate (m/min)			Actual (Q std.)			Value From Calibration Curve		
				1	2	3	1	2	3	y	x ²	
H-801	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	501.2	993.0	1978.7	0.999x + 3.853	0.999	
H-802	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	501.3	996.1	1966.7	1.000x + 2.024	1.000	
H-803	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	501.2	989.3	1995.7	0.992x + 3.827	1.000	
H-804	Dwyer	VFB-65	10/07/2023	500	1,000	2,000	096.3	991.2	2014.5	1.005x + 10.883	1.000	
H-805	Dwyer	VFB-65	05/07/2023	500	1,000	2,000	499.3	987.9	1968.7	1.003x + 6.676	1.000	
H-806	Dwyer	VFB-65	06/07/2023	500	1,000	2,000	500.7	994.0	1985.0	0.998x + 1.539	0.999	
Calibrated by :			Approved by :									
Mr. Adu Dangkom												



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Tel : (662) 539-4370-71, Fax : (662) 513-4211, E-mail : info@spscon.com, www.spscon.com

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)												
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 310-H				S/N : 136164				
Rotameter Data			Calibration Data									
No.	Brand	Model	Date	Flow Rate (m/min)			Actual (Q std.)			Value From Calibration Curve		
				1	2	3	1	2	3	y	x ²	
L-801	Dwyer	VFA-21	04/07/2023	50	100	200	50.2	99.7	195.7	0.998x + 0.939	0.999	
L-802	Dwyer	VFA-21	07/07/2023	50	100	200	49.1	98.9	195.5	0.999x + 0.773	1.000	
L-803	Dwyer	VFA-21	07/07/2023	50	100	200	49.1	99.3	196.1	1.005x + 0.411	1.000	
L-804	Dwyer	VFA-21	04/07/2023	50	100	200	49.2	100.7	202.6	1.005x + 0.415	1.000	
L-805	Dwyer	VFA-21	07/07/2023	50	100	200	50.1	98.9	198.0	0.999x + 0.013	0.999	
L-806	Dwyer	VFA-21	06/07/2023	50	100	200	50.4	99.9	200.4	1.007x + 0.221	1.000	
L-807	Dwyer	VFA-21	04/07/2023	50	100	200	50.5	99.6	199.1	0.995x + 1.029	0.999	
L-808	Dwyer	VFA-21	03/07/2023	50	100	200	49.4	101.7	197.5	1.001x + 0.312	1.000	
L-809	Dwyer	VFA-21	07/07/2023	50	100	200	49.7	98.3	199.6	1.003x + 0.788	1.000	
L-810	Dwyer	VFA-21	10/07/2023	50	100	200	49.9	99.4	200.4	1.007x + 1.204	1.000	
Calibrated by :			Approved by :									
Mr. Adu Dangkom												



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)												
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 310-H				S/N : 136164				
Rotameter Data			Calibration Data									
No.	Brand	Model	Date	Flow Rate (m/min)			Actual (Q std.)			Value From Calibration Curve		
				1	2	3	1	2	3	y	x ²	
L-801	Dwyer	VFA-21	05/07/2023	50	100	200	50.6	100.9	200.1	0.985x + 2.913	1.000	
L-802	Dwyer	VFA-21	05/07/2023	50	100	200	50.4	99.4	200.8	1.003x + 0.894	0.999	
L-803	Dwyer	VFA-21	04/07/2023	50	100	200	50.1	100.1	203.1	1.005x + 0.170	1.000	
L-804	Dwyer	VFA-21	10/07/2023	50	100	200	50.3	100.8	203.3	1.002x + 0.562	1.000	
L-805	Dwyer	VFA-21	05/07/2023	50	100	200	50.1	101.1	202.8	0.999x + 0.445	0.999	
L-806	Dwyer	VFA-21	06/07/2023	50	100	200	50.7	100.3	203.3	0.995x + 1.439	1.000	
Calibrated by :			Approved by :									
Mr. Adu Dangkom												



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkokunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawat@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0823/21044

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

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

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladao Chatuchak Bangkok 10900

Date : 09/08/2023

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1 min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14, C15, C16 in hexane

SENSITIVITY TEST: C15, (Area count) = 362,972 Counts.



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04

บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkokunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawat@thaiunique.com, Website : www.thaiunique.com

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	1.47	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	19,600	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (° C)	80	80	± 5
Injector (° C)	220	220	± 5
Detector (° C)	300	300	± 5
Incubator (° C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.52	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature :

Engineer : Suwarat Trikanut

Date : 09/08/2023



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04

บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkokunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawat@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	357,863
C15 Area 2	357,824
C15 Area 3	367,724
C15 Area 4	361,724
C15 Area 5	369,724
C15 Area Average	362,972
* % RSD (< 5 %)	1.52

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

% RSD = (std.dev / avg) * 100

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	09/08/2023	



Comments	-		
Reviewed by		Date	09/08/2023



VARIAN

1/1

SERVICE DEPARTMENT



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkokunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawat@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.125
C15 RT 2	4.125
C15 RT 3	4.125
C15 RT 4	4.124
C15 RT 5	4.124
C15 RT Average	4.122
* % RSD (< 0.5 %)	0.01

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

% RSD = (std.dev / avg) * 100

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	09/09/2023	



Comments	-		
Reviewed by		Date	09/08/2023



VARIAN

1/1

SERVICE DEPARTMENT

Sample ID: fid std

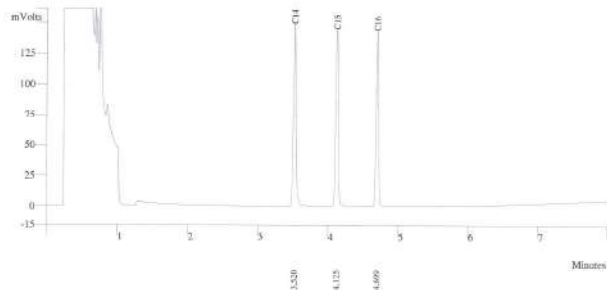
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	359491	BB	2.2
2	C15	33.4804	4.125	357863	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9312		1062305		



THAI UNIQUE CO.,LTD.

1 OF 1

Sample ID: fid std

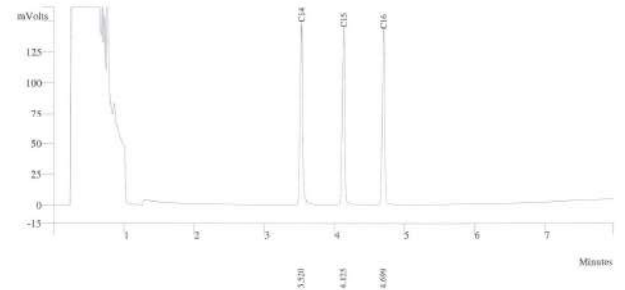
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):

**VARIAN**

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4804	4.125	357824	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9332		1065270		



THAI UNIQUE CO.,LTD.

1 OF 1

Sample ID: fid std

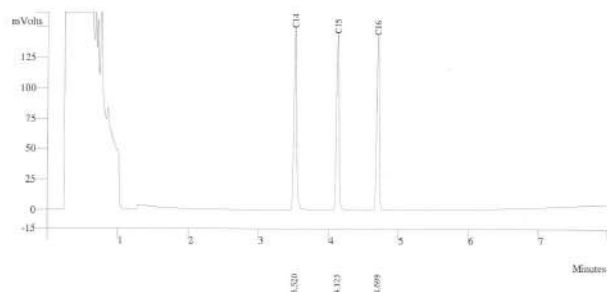
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.125	367724	BB	2.3
3	C16	32.6143	4.699	354951	BB	2.2
Totals		99.9352		1085170		



THAI UNIQUE CO.,LTD.

1 OF 1

Sample ID: fid std

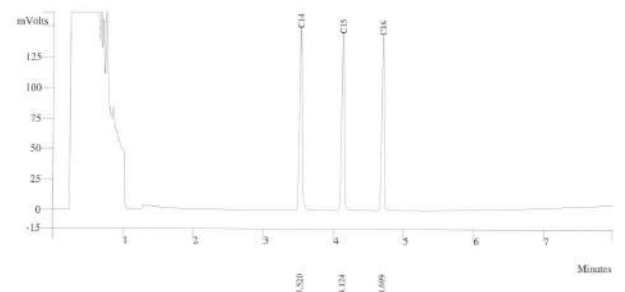
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):

**VARIAN**

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	361724	BB	2.3
3	C16	32.6143	4.699	354991	BB	2.2
Totals		99.9352		1079210		



THAI UNIQUE CO.,LTD.

1 OF 1

Sample ID: fid std

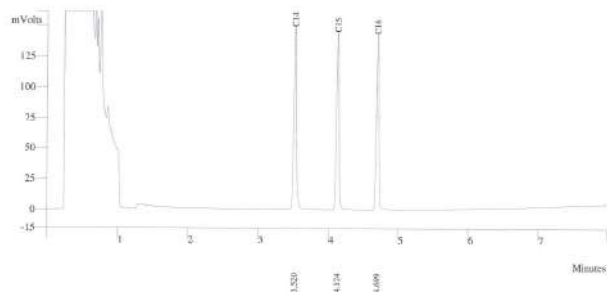
Operator (In): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (In):



Run Mode: Analysis
 Peak Measurement: Peak Area
 Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
Totals		99.9552		1087210		



THAI UNIQUE CO.,LTD.

1 of 1

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006637856

This analytical reference material was manufactured and verified in accordance with an ISO 9001 registered quality system, and the analyte concentrations were verified by an ISO 17025 accredited laboratory. The certified value for each analyte was determined gravimetrically.

Concentrations:		
n-tetradecane	0.218 g/L (\pm 0.5%)	0.033 w/w %
n-pentadecane	0.218 g/L (\pm 0.5%)	0.033 w/w %
n-hexadecane	0.218 g/L (\pm 0.5%)	0.033 w/w %

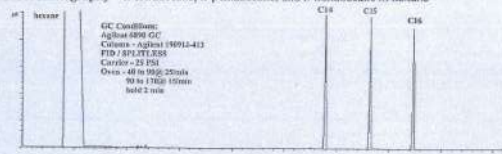
Solvent: hexane

Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NCCL Z-540-1 and ISO 9001.

Purities:	
n-tetradecane	99.6%
n-pentadecane	99%
n-hexadecane	99%
hexane	99%

Typical Analytical Spectrum or Chromatography

GC Chromatography - n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 September 2021
 Date of expiration: 31 October 2023

Monica Bourgeois
 Monica Bourgeois
 QMS Representative

Certificate

It is hereby certified that

Suwarot Trikinut

Has successfully completed the Application Training for

Basic Gas Chromatography and Sampler

Training Contents were:

Hardware Operation, Software Operation, Data analysis and**Troubleshooting : Model****CP-3800, 3900, 450-GC, 430-GC, 456-GC, 436-GC**

At Thai Unique Co., Ltd, Bangkok, Thailand

On 15th March, 2019

S. Pohtongkam
 Service Manager

เอกสารแนบ 5-3

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0413

MTC No. EEL. BP. 109/0366

CALIBRATION CERTIFICATE

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

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

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

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

Instrument Calibrated :

Ambient Environment

Description : Sound Calibrator

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

Manufacturer : ACO

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

Model : 2127

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

Serial No. : 130006

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

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

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

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

Date of Receipt : 27 Mar. 2023

Date of Calibration : 29 Mar. 2023

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

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

FM.BLMTC.002 Rev.4

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. 21-66/0413

MTC No. EEL. BP. 109/0366

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

Nominal Output of Unit Under Test = 94 dB re 20 μPa at 1000 HzAcoustic Output in dB re 20 μPa , Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ and 50 %RH

1. Sound Pressure Level

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

2. Frequency

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

3. Total distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Klaiyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 29 Mar. 2023

Date of Issue : 30 Mar. 2023

Ref : 2011266032701228001

End of Certificate

2 / 2

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

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

FM.BLMTC.002 Rev.4

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 R_422/23

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R17	ACO	6236	00172064	08 August 2023	94.0	94.0
ACO-R18	ACO	6236	00172065	08 August 2023	94.1	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

เอกสารแนบ 5-4

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง



CERTIFICATE No : 22E9693
REFERENCE No : 66476-1

PAGE : 1 OF 3

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 15-Sep-22
APPROVED BY :
ISSUED DATE : 15-Sep-22
RECEIVED DATE : 14-Sep-22

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

F-G010 REV 02



CERTIFICATE No : 22E9693

PAGE : 2 OF 3

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC719181	4880-12119147	05-Apr-23
2) pH STANDARD SOLUTION	00651-08	CC718727	4881-12110709	31-Mar-23
3) pH STANDARD SOLUTION	00651-10	CC717045	4882-12065386	17-Mar-23
4) PROCESS CALIBRATOR	CA150	91S6079	22E1145	31-Mar-23
5) BATH	269014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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

RESULT OF CALIBRATION : ADJUSTMENT

- DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3



CERTIFICATE No : 22E9693

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

2. DISPLAY UNIT WITH pH ELECTRODE S/N: 0908106M

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

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.003	25.0	0.003	---	0.0085	2.0

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

**QUALITY CALIBRATION CO.,LTD.**235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584CERTIFICATE No : 23E8494
REFERENCE No : 70413-1

PAGE : 1 OF 3

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.**CALIBRATION DATE** : 06-Sep-23**APPROVED BY** : **ISSUED DATE** : 06-Sep-23**RECEIVED DATE** : 31-Aug-23THIS CERTIFICATE MAY NOT BE REPRODUCED OTHER THAN IN FULL EXCEPT WITH THE PRIOR WRITTEN APPROVAL OF
QUALITY CALIBRATION CO., LTD.

F-C010 REV 03

**QUALITY CALIBRATION CO.,LTD.**235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23E8494

PAGE : 2 OF 3

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No/ LOT No	CERTIFICATE No	DUE DATE
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Aug-24
5) BATH	260014	1247 48074	2219870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	52000379	2219904	13-Sep-23

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

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

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3

**QUALITY CALIBRATION CO.,LTD.**235 Petchkasem 63/2 Road, Laksong, Bangkok, Bangkok 10160
Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 23E8494

PAGE : 3 OF 3

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

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

3. DISPLAY UNIT WITH TEMPERATURE

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

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



Harikul Science Co.,Ltd.
694 Soi Ratchadaniwet 24, Pracharabamphen,
Samsaenok, Huakhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com
Certificate of Calibration

CERT.No.: HS-U017D

Calibration Date : 3 Apr 23

Submitted by : S.P.S CONSULTING SERVICE CO.,LTD
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,
Chatuchak, Bangkok, Thailand 10900

Model : YSI 5000
S/N : 15B100751
Probe : YSI 5010
S/N : 22D100097
ID NO. : -
Air Temp ref : S/N. E00522
Barometric ref : S/N. E00522
Water Temp ref : S/N. 11431
Technician : Kittipong M.

Avg Room Temp : 20 °C
Avg Water Temp : 20 °C
Air Pressure : 760.00 mmHg
Salinity : 0 ppt

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.08	(PASS)	-
Measurement 3 (mg/l)	9.08	(PASS)	-
Measurement 4 (mg/l)	9.08	(PASS)	-
Measurement 5 (mg/l)	9.08	(PASS)	-
Measurement 6 (mg/l)	9.08	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.08	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.08	(PASS)	-

Mean Measurement : 9.08 mg/l
Inaccuracy : 0.01 mg/l

Overall Status : (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.

Technician Signature
(Kittipong Maekwong)

Laboratory Manager
(Nalapha Pisakunchon)



QUALITY CALIBRATION CO.,LTD.

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

CERTIFICATE No : 23T0959
REFERENCE No : 68047-2

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB200
SERIAL No : 15110C0235
ID No : CRB 05/59
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 : 07-Feb-23

APPROVED BY : [Signature]

ISSUED DATE : 07-Feb-23

RECEIVED DATE : 31-Jan-23

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

F-G010 REV : 02



QUALITY CALIBRATION CO.,LTD.

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

CERTIFICATE No : 23T0959

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : CRB 05/59
RECEIVED DATE : 31-Jan-23
AMBIENT TEMPERATURE : 23° C ± 1° C
MODEL : DRB200
SERIAL NUMBER : 15110C0235
CALIBRATION DATE : 07-Feb-23
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	23T7511	10-Jul-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 QUALITY CALIBRATION CO.,LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

13 14 15 10 11 12 7 8 9 4 5 6 1 2 3 BLOCK No.1 FRONT	13 14 15 10 11 12 7 8 9 4 5 6 1 2 3 BLOCK No.2 FRONT
--	--

TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	145	145
Indicating Temperature	145	145
Measured Temperature (°C) at Spread Locations		
1	149.4	149.5
2	149.5	149.4
3	149.4	149.4
4	149.7	149.6
5	149.4	149.3
6	149.6	149.3
7	149.6	149.6
8	149.7	149.4
9	149.7	149.3
10	149.5	149.5
11	149.7	149.5
12	149.3	149.4
13	149.5	149.5
14	149.8	149.4
15	149.6	149.3
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 BY A COVERAGE FACTOR k = 2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%
END OF CALIBRATION REPORT

F-G010



CERTIFICATE No : 23M2442
REFERENCE No : 68471-2

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 10-Mar-23

APPROVED BY :

ISSUED DATE : 16-Mar-23

RECEIVED DATE : 10-Mar-23

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

F-G010 REV 02



CERTIFICATE No : 23M2442

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : SARTORIUS
ID No : BA 09/61
AIR PRESSURE : 1010mmbar \pm 1mmbar
AMBIENT TEMPERATURE : 23°C \pm 1°C
MODEL : BSA224S-CW
S/N : 36591843
RECEIVED DATE : 10-Mar-23
CALIBRATION DATE : 10-Mar-23
RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (\pm g)
0.0	0.0000	0.0000	0.000038
0.1	0.1000	0.0000	0.000039
0.2	0.2000	0.0000	0.000039
0.5	0.5000	0.0000	0.000060
1.0	1.0000	0.0000	0.000060
2.0	2.0000	0.0000	0.000061
5.0	5.0000	0.0000	0.000063
10.0	10.0000	0.0000	0.000067
20.0	20.0001	-0.0001	0.000073
50.0	50.0000	0.0000	0.00011
100.0	100.0001	-0.0001	0.00019
200.0	200.0000	0.0000	0.00032

5. OFF-CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

F-C



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย์ แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thuwat@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0822/20530

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

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

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 10/08/2022

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column:Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 118,103 Counts.



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย์ แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thuwat@thaiunique.com, Website : www.thaiunique.com

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.94	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	4,000	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (° C)	80	80	± 5
Injector (° C)	220	220	± 5
Detector (° C)	300	300	± 5
Incubator (° C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.68	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature: _____

Engineer : Suwarot Trikanunt

Date : 10/08/2022





Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	117,172
C15 Area 2	119,182
C15 Area 3	117,982
C15 Area 4	118,589
C15 Area 5	117,592
C15 Area Average	118,103
* % RSD (< 5 %)	1.68

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)
% RSD = (std.dev / avg) * 100

Compliance	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Performance by	
Date	10/08/2022



Comments			
Reviewed by		Date	10/08/2022



Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.048
C15 RT 2	4.048
C15 RT 3	4.048
C15 RT 4	4.048
C15 RT 5	4.048
C15 RT Average	4.000
* % RSD (< 0.5 %)	0.01

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)
% RSD = (std.dev / avg) * 100

Compliance	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Performance by	
Date	10/09/2022



Comments			
Reviewed by		Date	10/09/2022



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

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

Sample ID: fid std

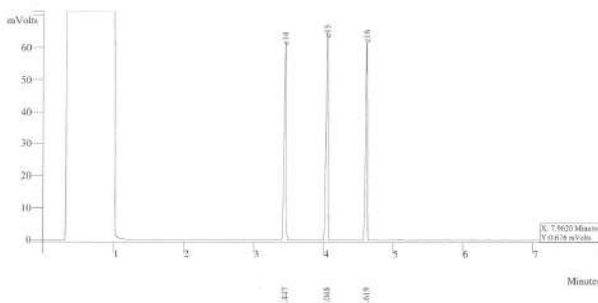
Operator (Inj): suwarot
Injection Date: 16/08/2022
Calc Date: 16/08/2022
Run Time (min): 7.993
Workstation:
Instrument (Inj): Varian Star #1



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

c:\star\data\tu\cal2022\fid2022001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.477	112355	VP	1.7
2	c15	33.6834	4.048	117172	VV	1.5
3	c16	34.0178	4.619	118335	VP	1.5
Totals		100.0000		347862		

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

Sample ID: fid std

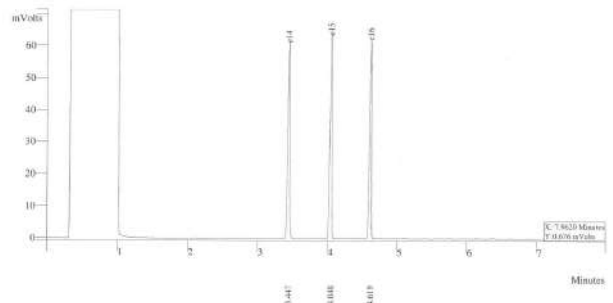
Operator (Inj): suwarot
Injection Date: 16/08/2022
Calc Date: 16/08/2022
Run Time (min): 7.993
Workstation:
Instrument (Inj): Varian Star #1



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: Percent

c:\star\data\tu\cal2022\fid2022002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.477	112755	VP	1.7
2	c15	33.6834	4.048	119182	VV	1.5
3	c16	34.0178	4.619	118265	VP	1.5
Totals		100.0000		348205		



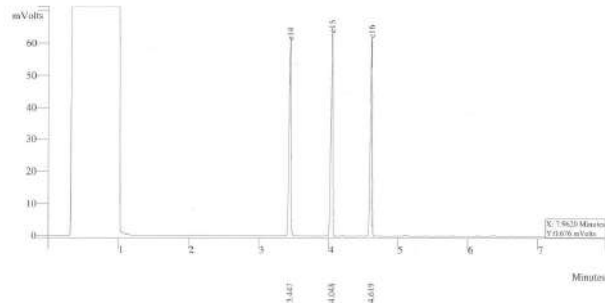
Sample ID: fid std

Operator (Inj): suwarot
Injection Date: 16/08/2022
Calc Date: 16/08/2022
Run Time (min): 7.993
Workstation:
Instrument (Inj): Varian Star #1



c:\star\data\tu\cal2022\fid2022003.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.477	112755	VP	1.7
2	c15	33.6834	4.048	117982	VV	1.5
3	c16	34.0178	4.619	118265	VP	1.5
Totals		100.0000		348205		



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1 Of 1

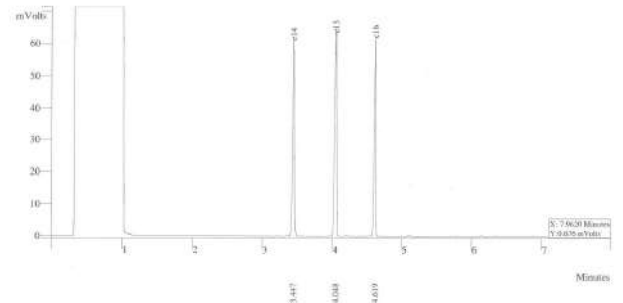
Sample ID: fid std

Operator (Inj): suwarot
Injection Date: 16/08/2022
Calc Date: 16/08/2022
Run Time (min): 7.993
Workstation:
Instrument (Inj): Varian Star #1



c:\star\data\tu\cal2022\fid2022004.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.377	113755	VP	1.7
2	c15	33.6834	4.048	118589	VV	1.5
3	c16	34.3178	4.619	128265	VP	1.5
Totals		100.0000		360292		



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1 Of 1

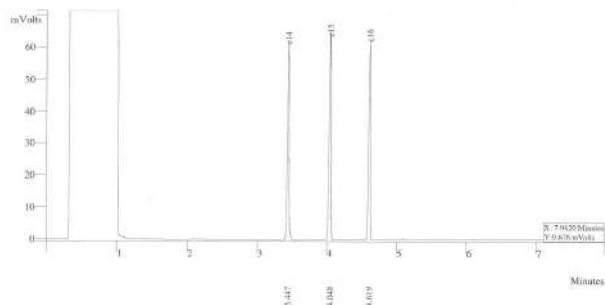
Sample ID: fid std

Operator (Inj): suwarot
Injection Date: 16/08/2022
Calc Date: 16/08/2022
Run Time (min): 7.993
Workstation:
Instrument (Inj): Varian Star #1



c:\star\data\tu\cal2022\fid2022005.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.377	115755	VP	1.7
2	c15	33.6834	4.048	117592	VV	1.5
3	c16	34.3178	4.619	138265	VP	1.5
Totals		100.0000		369202		



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1 Of 1



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0823/21044

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

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

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladao Chatuchak Bangkok 10900

Date : 09/08/2023

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1 min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14, C15, C16 in hexane

SENSITIVITY TEST: C15, (Area count) = 362,972 Counts.



VARIAN

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SERVICE DEPARTMENT
FR-SV-029 Rev. 04

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	1.47	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	19,600	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (° C)	80	80	± 5
Injector (° C)	220	220	± 5
Detector (° C)	300	300	± 5
Incubator (° C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.52	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature: [Redacted]

Engineer : Suwatt Trikanut

Date : 09/08/2023



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	357,863
C15 Area 2	357,824
C15 Area 3	367,724
C15 Area 4	361,724
C15 Area 5	369,724
C15 Area Average	362,972
* % RSD (< 5 %)	1.52

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

% RSD = (std.dev / avg) * 100

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	[Redacted]	
Date	09/08/2023	



Comments	[Redacted]		
Reviewed by	[Redacted]	Date	09/08/2023



VARIAN

1/1

SERVICE DEPARTMENT



Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.125
C15 RT 2	4.125
C15 RT 3	4.125
C15 RT 4	4.124
C15 RT 5	4.124
C15 RT Average	4.122
* % RSD (< 0.5 %)	0.01

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

% RSD = (std.dev / avg) * 100

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by	[Redacted]	
Date	09/09/2023	



Comments	[Redacted]		
Reviewed by	[Redacted]	Date	09/08/2023



VARIAN

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SERVICE DEPARTMENT

Sample ID: fid std

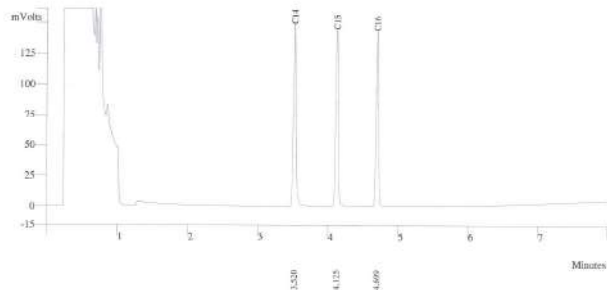
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	359491	BB	2.2
2	C15	33.4804	4.125	357863	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9312		1062305		



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1 OF 1

Sample ID: fid std

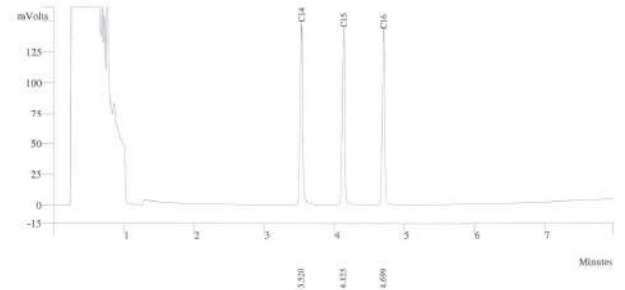
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4804	4.125	357824	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9332		1065270		



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1 OF 1

Sample ID: fid std

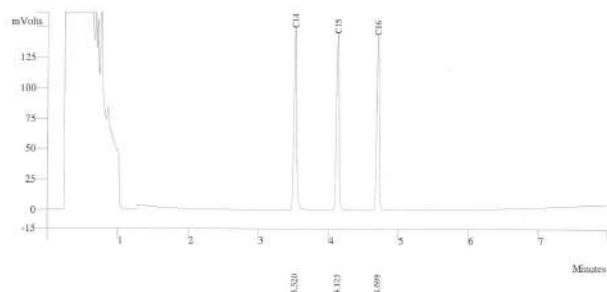
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.125	367724	BB	2.3
3	C16	32.6143	4.699	354951	BB	2.2
Totals		99.9352		1085170		



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Sample ID: fid std

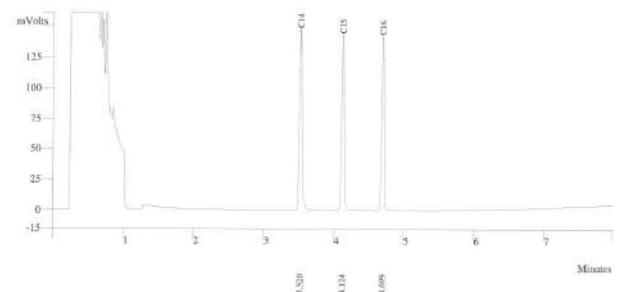
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	361724	BB	2.3
3	C16	32.6143	4.699	354991	BB	2.2
Totals		99.9352		1079210		




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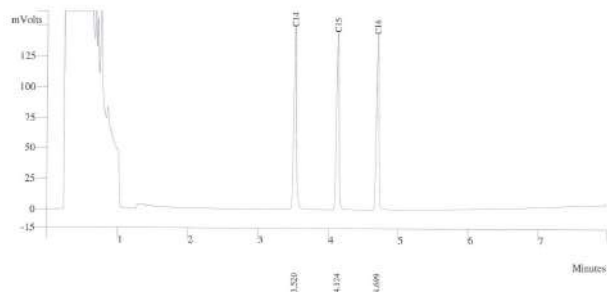
Sample ID: fid std

Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):


VARIAN
Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
Totals		99.9552		1087210		



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Agilent CrossLab Compliance Services

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GC_MS_03_52_CN10925102
Organization Name: S.P.S Consulting service
Organization Location: 7 Soi Phaholyothin Road, Ladyao, Khet Jatujak, Bangkok 10900
Date: March 31, 2023 1:21:52 PM
EQP Name: AgilentRecommended , AgilentRecommended
EQP Revision: GC.02.50, GCMS.02.50
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 7890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 7890
Front SSL
Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: ≥ -2.0 and ≤ 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Front SSL

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

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Agilent CrossLab Compliance Services

Setpoint Status: Pass
Setpoint Actual
Inlet Pressure: 25.0 psi 25.0 psi
Accuracy: 0.0 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Accuracy

Name: 7890
Back SSL

Setpoint Status: Pass
Setpoint Actual
Inlet Pressure: 25.0 psi 25.2 psi
Accuracy: 0.2 psi
Agilent Recommended: ≤ 1.2

Overall Inlet Pressure Accuracy Test Status

Pass

Detector Flow Accuracy

Name: 7890
Front FID

Setpoint Status: Pass
Flow Type: Fuel
Setpoint: 30.0 mL/min Measured Flow: 30.3 mL/min
Accuracy: 0.3 mL/min
Agilent Recommended: ≤ 10.0 % setpoint (3.0 mL/min)
Limit is percentage of setpoint or 0.5 mL/minute, whichever is largest.

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

Setpoint Status: Pass

Flow Type: Oxidizer

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

Accuracy: 3.8 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (40.0 mL/min)

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

Setpoint Status: Pass

Flow Type: Makeup

Setpoint: 25.0 mL/min Measured Flow: 25.1 mL/min

Accuracy: 0.1 mL/min

Agilent Recommended: ≤ 10.0 % setpoint (2.5 mL/min)

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

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.6 °C

Accuracy: 0.6 °C

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

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

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Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.4 °C

Accuracy: 0.4 °C

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

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.3833 °C

Stability: 0.1 °C

Agilent Recommended: ≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1 Front SSL / Front FID

Manual Injection

Name: Not applicable

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1 Front SSL / Front FID

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

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Name: 7890

Setpoint Status: Pass

Base Signal: 89800 Ab

ASTM Noise counts 395.31

Drift counts/Hr 90.04

Agilent Recommended: ≤ 768.00 ≤ 19200.00

Status: Pass

Overall Noise and Drift Test Status

Pass

Signal to Noise

Tested Combination1 Front SSL / Front FID

Manual Injection

Name: 7890

Setpoint Status: Pass

Signal to Noise: 3814254

Agilent Recommended: ≥ 300000

Overall Signal to Noise Test Status

Pass

Log Amp

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass**Overall Log Amp Test Status**

Pass

RFPA

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

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Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Amu: 1050 m/z

Drift After Five Minutes: 1 mV

RFPA Voltage: 479 mV

Agilent Recommended: ~ 100 end ~ 100 ~ 1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination2 Back SSL / External SQ

Name: 5975C

Setpoint Status: Pass

Filament: 1

Setpoint Status: Pass

Filament: 2

Overall Tune EI Test Status

Pass

Signal to Noise EI

Tested Combination2 Back SSL / External SQ

Name: 5975C

Source: EI - Inert Filament: 1

Setpoint Status: Pass

Signal to Noise: 425

Agilent Recommended: ≥ 160

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

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Source: EI - Inert Filament: 2

Setpoint Status: Pass

Signal to Noise: 566

Agilent Recommended: >= 160

Overall Signal to Noise EI Test Status

Pass

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

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GC_MS_03_52_CN10925102
Manufacturer	Agilent Technologies
Name	7890

Tested Combination1

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

Tested Combination2

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

Sampler 1

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

Sampler 2

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

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

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

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

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Detector 2	
Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External
Mass Spectrometer 1	
Manufacturer	Agilent Technologies
Type	SQ
Name	5975C
Serial Number	US91732743
Firmware Revision	5975 5.02.07
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std
MS EI Source 1	
Manufacturer	Agilent Technologies
Source Type	EI - Inert
Number of Filaments	2

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

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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 login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV
System ID: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:12:28 AM	Audit	SessionCreated	Session	None
March 31, 2023 9:12:29 AM	Start	Configuration	Session	None
March 31, 2023 9:12:28 AM	Audit	Entitlement	Logging	User is Nonpaying and does not require an unlock code
March 31, 2023 9:20:14 AM	Audit	EqpLoaded	Session	EQP details for primary technique [GC] - File path: [ProtocolPacks\GC\Config\ions\02.50\GC_02.50.eqp], EQP File Name: [GC_02.50.eqp], EQP Name: [AgilentRecommended] Protocol Revision: [GC_02.50] EQP details for hyphenated technique [GCMS] - File path: [ProtocolPacks\GCMS\Config\ions\02.50\GCMS_02.50.eqp], EQP File Name: [GCMS_02.50.eqp], EQP Name: [AgilentRecommended]
March 31, 2023 9:20:17 AM	End	Configuration	Session	None
March 31, 2023 9:20:27 AM	Start	Qualification	Session	OQ
March 31, 2023 9:20:27 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	None
March 31, 2023 9:21:33 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890 - Qualitative Test - No setpoints associated	Run Count : 1

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

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

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV
System ID: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

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

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SKOMV
System ID: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925120 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:22:42 AM	Start	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
March 31, 2023 9:22:48 AM	End	Execution	Detector Flow Accuracy - Front FID - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
March 31, 2023 9:22:49 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:23:31 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 31, 2023 9:23:34 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 31, 2023 9:23:37 AM	Start	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
March 31, 2023 9:28:00 AM	Audit	Data	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
March 31, 2023 9:29:03 AM	End	Execution	GC Oven Temperature Accuracy - 7890 - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
March 31, 2023 9:26:05 AM	Start	Execution	GC Oven Temperature Stability - 7890 - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None

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

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

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0MIV
System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 9:20:42 AM	Start	Execution	GC Oven Temperature Stability - 7990 - Temperature - Oven S: 100.0°C - L: <= 0.5°C	None
March 31, 2023 9:27:35 AM	Audit	Data	GC Oven Temperature Stability - 7990 - Temperature - Oven S: 100.0°C - L: <= 0.5°C	Manual Data Entry
March 31, 2023 9:27:46 AM	End	Execution	GC Oven Temperature Stability - 7990 - Temperature - Oven S: 100.0°C - L: <= 0.5°C	Run Count : 1
March 31, 2023 9:27:51 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 31, 2023 9:54:35 AM	Start	Execution	Log Amp - 5975C SQ - Source: None EI - Inert	None
March 31, 2023 9:55:58 AM	Start	Execution	RPPA - 5975C SQ - Source: EI - Inert	None
March 31, 2023 10:23:19 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 10:37:53 AM	Start	Execution	Tune EI - 5975C SQ - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:04 AM	Start	Execution	Tune EI - 5975C SQ - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 31, 2023 10:38:11 AM	Start	Execution	Tune EI - 5975C SQ - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	None

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0MIV
System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 10:38:14 AM	Start	Execution	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:38:17 AM	Start	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
March 31, 2023 10:45:28 AM	Audit	Data	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data file Path: F:\Data\GC_FID.D\FID1A.ch
March 31, 2023 10:47:01 AM	End	Execution	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
March 31, 2023 10:56:27 AM	Start	Execution	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
March 31, 2023 10:58:52 AM	Audit	Data	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data file Path: F:\Data\GC_FID.D\FID1A.ch
March 31, 2023 11:00:53 AM	End	Execution	Noise and Drift - Front FID - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1
March 31, 2023 11:02:02 AM	Start	Execution	Signal to Noise - Manual Injection, Front SSL, Front FID: - Detector FID - L: >= 300000	None
March 31, 2023 11:14:32 AM	Audit	AccClosed	Session	None

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0MIV
System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

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

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

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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3SK0MIV
System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:53 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 11:24:33 AM	Start	Execution	RPPA - 5975C SQ - Source: EI - Inert	None
March 31, 2023 11:27:22 AM	End	Execution	RPPA - 5975C SQ - Source: EI - Inert	Run Count : 1
March 31, 2023 11:27:25 AM	Start	Execution	Tune EI - 5975C SQ - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	None
March 31, 2023 11:28:04 AM	End	Execution	Tune EI - 5975C SQ - Source: - EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
March 31, 2023 11:28:06 AM	Start	Execution	Tune EI - 5975C SQ - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
March 31, 2023 11:28:26 AM	End	Execution	Tune EI - 5975C SQ - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
March 31, 2023 11:28:28 AM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 12:59:45 PM	Start	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L: >= 160	None
March 31, 2023 1:00:09 PM	Audit	Data	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L: >= 160	Data file Path: F:\SN_F1_01.D\DATA1.M
March 31, 2023 1:00:41 PM	End	Execution	Signal to Noise EI - Liquid Injection, Back SSL, SQ - Source: EI - Inert using Filament 1 - L: >= 160	Run Count : 1

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

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User Name: saangulthai.sarak
Hostname: LAPTOP-QJ3SK0MV

System Id: GC_MS_03_52_CN10925102
Print Date: March 31, 2023 1:21:03 PM

GC_MS_03_52_CN10925102 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
March 31, 2023 1:00:43 PM Start		Execution	Signal to Noise EI - Liquid Injection, Back SSI, SD - Source: EI - Inert using Filament 2 - L: >= 150	None
March 31, 2023 1:01:52 PM Audit		Data	Signal to Noise EI - Liquid Injection, Back SSI, SQ: - Source: EI - Inert using Filament 2 - L: >= 150	Data files Path : F:\SN_F2_01\DATA\SIM.MS
March 31, 2023 1:02:09 PM End		Execution	Signal to Noise EI - Liquid Injection, Back SSI, SQ: - Source: EI - Inert using Filament 2 - L: >= 150	Run Count : 1
March 31, 2023 1:02:13 PM End		Qualification	Session	OQ
March 31, 2023 1:02:13 PM Start		Reporting	Session	None
March 31, 2023 1:20:27 PM Audit		Reporting	Session	Report Generated : Certificate

เอกสารแนบ 5-5

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในสถานประกอบการ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10000
Tel : (062) 935-4370-72 Fax : (062) 513-4221 E-mail : info@spsconsulting.com www.spsconsulting.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-II

S/N : 130164

Environmental Conditions
Temperature : 25 ± 3 °C
Pressure : 1010 ± 10 mmHg

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve				
					Setting		Actual (Q cal.)			f		R ²		
					1	2	1	2	3					
801	SKC	224-PCX04	262101	04/04/2023	1,000	1,000	3,000	994	1,494	2,000	1.0004 ± 0.007	1.000		
802	SKC	224-PCX04	262166	04/04/2023	1,000	1,000	3,000	1,004	1,503	2,000	1.0104 ± 0.004	0.999		
803	SKC	224-PCX04	011960	07/04/2023	1,000	1,000	3,000	996	1,494	2,000	1.0074 ± 0.004	1.000		
804	SKC	224-PCX04	002024	05/04/2023	1,000	1,000	3,000	998	1,499	1,994	0.9996 ± 0.001	1.000		
805	SKC	224-PCX04	011992	07/04/2023	1,000	1,200	2,000	1,002	1,401	2,004	1.0144 ± 0.004	0.999		
806	SKC	224-PCX04	262188	07/04/2023	1,000	1,200	3,000	994	1,499	2,000	1.0124 ± 0.004	0.999		
807	SKC	224-PCX04	026362	04/04/2023	1,000	1,200	3,000	997	1,494	1,400	0.9944 ± 0.004	1.000		
808	SKC	224-PCX04	026100	04/04/2023	1,000	1,200	3,000	1,001	1,499	2,000	1.0114 ± 0.007	0.999		
809	SKC	224-PCX04	026472	05/04/2023	1,000	1,200	3,000	997	1,492	1,404	0.9964 ± 0.001	1.000		
810	SKC	224-PCX04	001950	03/04/2023	1,000	1,200	3,000	992	1,494	2,000	1.0104 ± 0.007	1.000		
811	SKC	224-PCX04	364311	10/04/2023	1,000	1,200	3,000	999	1,499	1,998	1.0004 ± 0.001	1.000		
812	SKC	224-PCX04	004605	09/04/2023	1,000	1,200	3,000	1,002	1,494	2,000	1.0004 ± 0.004	0.999		
813	SKC	224-PCX04	002070	04/04/2023	1,000	1,200	3,000	997	1,491	2,000	1.0044 ± 0.001	1.000		
814	SKC	224-PCX04	026313	03/04/2023	1,000	1,200	3,000	997	1,492	1,401	0.9994 ± 0.001	1.000		
815	SKC	224-PCX04	026474	07/04/2023	1,000	1,200	3,000	1,000	1,501	2,000	1.0134 ± 0.004	0.999		
816	SKC	224-PCX04	026477	03/04/2023	1,000	1,200	3,000	996	1,496	2,000	1.0114 ± 0.001	0.999		
817	SKC	224-PCX04	026580	04/04/2023	1,000	1,200	3,000	996	1,491	1,993	1.0004 ± 0.001	1.000		
818	SKC	224-PCX04	001484	04/04/2023	1,000	1,200	3,000	1,001	1,494	2,002	1.0104 ± 0.001	0.999		
819	SKC	224-PCX04	003880	04/04/2023	1,000	1,200	3,000	994	1,494	2,000	1.0064 ± 0.001	1.000		
820	SKC	224-PCX04	001687	05/04/2023	1,000	1,200	3,000	991	1,500	2,000	1.0104 ± 0.001	0.999		
821	SKC	224-PCX04	003883	04/04/2023	1,000	1,200	3,000	994	1,491	1,995	1.0024 ± 0.001	1.000		
822	SKC	224-PCX04	001654	07/04/2023	1,000	1,200	3,000	1,000	1,500	2,004	1.0144 ± 0.001	0.999		
823	SKC	224-PCX04	798393	05/04/2023	1,000	1,200	3,000	990	1,500	2,004	1.0134 ± 0.004	1.000		
824	SKC	224-PCX04	026363	03/04/2023	1,000	1,200	3,000	1,002	1,500	1,999	1.0094 ± 0.001	0.999		
825	SKC	224-PCX04	798489	07/04/2023	1,000	1,200	3,000	1,002	1,494	2,000	0.9974 ± 0.001	1.000		
826	SKC	224-PCX04	798479	07/04/2023	1,000	1,200	3,000	1,001	1,501	1,994	0.9954 ± 0.001	1.000		
827	SKC	224-PCX04	001673	04/04/2023	1,000	1,200	3,000	996	1,500	2,004	1.0134 ± 0.001	0.999		
828	SKC	224-PCX04	001670	04/04/2023	1,000	1,200	3,000	1,002	1,501	2,001	1.0104 ± 0.001	0.999		
829	SKC	224-PCX04	001672	05/04/2023	1,000	1,200	3,000	1,001	1,494	2,000	0.9994 ± 0.001	1.000		
830	SKC	224-PCX04	001489	04/04/2023	1,000	1,200	3,000	1,002	1,501	2,003	1.0094 ± 0.001	0.999		
831	SKC	224-PCX04	001509	07/04/2023	1,000	1,200	3,000	991	1,495	1,997	1.0014 ± 0.001	1.000		
832	SKC	224-PCX04	001681	10/04/2023	1,000	1,200	3,000	992	1,494	2,001	1.0124 ± 0.001	0.999		
833	SKC	224-PCX04	001750	05/04/2023	1,000	1,200	3,000	992	1,494	1,992	0.9984 ± 0.001	1.000		
834	SKC	224-PCX04	011862	07/04/2023	1,000	1,200	3,000	1,002	1,500	2,003	1.0084 ± 0.001	0.999		
835	SKC	224-PCX04	002060	05/04/2023	1,000	1,200	3,000	991	1,497	1,996	1.0014 ± 0.001	1.000		
836	SKC	224-PCX04	026184	06/04/2023	1,000	1,200	3,000	997	1,493	1,998	1.0004 ± 0.001	0.999		
837	SKC	224-PCX04	026256	05/04/2023	1,000	1,200	3,000	993	1,500	1,996	1.0114 ± 0.001	0.999		
838	SKC	224-PCX04	001617	07/04/2023	1,000	1,200	3,000	998	1,493	1,997	1.0034 ± 0.001	1.000		
839	SKC	224-PCX04	026427	10/04/2023	1,000	1,200	3,000	1,000	1,500	2,003	1.0134 ± 0.001	0.999		
840	SKC	224-PCX04	798349	07/04/2023	1,000	1,200	3,000	994	1,501	1,998	1.0114 ± 0.004	0.999		

Calibrated by :

Approved by :

(Mr. Asst. Engineer)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-II

S/N : 130164

Environmental Conditions
Temperature : 25 ± 3 °C
Pressure : 1010 ± 10 mmHg

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve				
					Setting		Actual (Q cal.)			f		R ²		
					1	2	3	1	2	3		y	x	B ^a
801	SKC	224-PCX04	004569	05/04/2023	1,000	1,000	2,000	1,003	1,498	2,000	1.0114 ± 0.001	0.999		
802	SKC	224-PCX04	004580	05/04/2023	1,000	1,200	3,000	994	1,500	2,001	1.0104 ± 0.001	0.999		
803	SKC	224-PCX04	004473	05/04/2023	1,000	1,000	2,000	992	1,498	1,997	1.0004 ± 0.001	1.000		
804	SKC	224-PCX04	010780	05/04/2023	1,000	1,200	3,000	1,007	1,498	2,001	1.0094 ± 0.001	0.999		
805	SKC	224-PCX04	003822	10/04/2023	1,000	1,200	3,000	995	1,498	1,993	0.9994 ± 0.001	1.000		
806	SKC	224-PCX04	004707	10/04/2023	1,000	1,200	3,000	996	1,500	2,000	1.0014 ± 0.001	1.000		
807	SKC	224-PCX04	011023	05/04/2023	1,000	1,000	3,000	1,011	1,501	2,001	1.0024 ± 0.001	0.997	0.831	
808	SKC	224-PCX04	004524	05/04/2023	1,000	1,200	3,000	999	1,495	1,998	0.9994 ± 0.001	1.000		
809	SKC	224-PCX04	004607	05/04/2023	1,000	1,200	3,000	997	1,497	1,992	0.9984 ± 0.001	1.000		
810	SKC	224-PCX04	004602	05/04/2023	1,000	1,200	3,000	999	1,498	2,000	1.0074 ± 0.001	1.000		
811	SKC	224-PCX04	003886	05/04/2023	1,000	1,200	3,000	999	1,507	1,996	1.0004 ± 0.001	1.000		
812	SKC	224-PCX04	010913	04/04/2023	1,000	1,200	3,000	1,002	1,500	1,995	0.9984 ± 0.001	1.000		
813	SKC	224-PCX04	010981	05/04/2023	1,000	1,200	3,000	1,003	1,498	1,998	0.9974 ± 0.001	1.000		
814	SKC	224-PCX04	004643	10/04/2023	1,000	1,200	3,000	998	1,495	2,000	1.0074 ± 0.001	1.000		
815	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,495	2,000	1.0014 ± 0.001	0.999		
816	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
817	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
818	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
819	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
820	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
821	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
822	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
823	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
824	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
825	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
826	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
827	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
828	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
829	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
830	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
831	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
832	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
833	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
834	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
835	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
836	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
837	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
838	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
839	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
840	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
841	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
842	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
843	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
844	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
845	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
846	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
847	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
848	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
849	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
850	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
851	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
852	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
853	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
854	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
855	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
856	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
857	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
858	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
859	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
860	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
861	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
862	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
863	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
864	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
865	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
866	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
867	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
868	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
869	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
870	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
871	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
872	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
873	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
874	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
875	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
876	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
877	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
878	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
879	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994 ± 0.001	1.000		
880	SKC	224-PCX04	010971	04/04/2023	1,000	1,200	3,000	999	1,494	1,997	0.9994			



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Tel : (662) 939-4379-72 Fax : (662) 513-4221 E-mail : sals@sps.co.th, www.sps.co.th

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 26 ± 3 °C

Pressure : 1010 ± 10 mmHg

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve				
					Setting			Actual (Q std.)		y			R ²	
					1	2	3	1	2	3				
819	SAC	224-PC004	612753	10/04/2023	1,000	1,000	3,000	1,004	1,003	3,004	1.014 ± 0.016	0.999		
841	SAC	224-PC004	626140	07/04/2023	1,000	1,000	3,000	993	1,011	3,002	1.016 ± 0.014	0.999		
842	SAC	224-PC004	616403	10/04/2023	1,000	1,000	3,000	999	1,001	3,001	1.003 ± 0.005	1.000		
843	SAC	224-PC004	626129	10/04/2023	1,000	1,000	3,000	1,000	1,002	3,005	1.000 ± 0.004	0.999		
844	SAC	224-PC004	609753	10/04/2023	1,000	1,000	3,000	1,000	1,001	3,001	1.001 ± 0.003	1.000		
845	SAC	224-PC004	626127	10/04/2023	1,000	1,000	3,000	994	1,005	3,004	1.015 ± 0.011	0.999		

Calibrated by :

Approved by :

(Mr. Anan Jongsakul)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C

Pressure : 1010 ± 10 mmHg

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve				
					Setting			Actual (Q std.)		y			R ²	
					1	2	3	1	2	3				
801	SAC	224-PC004	626120	03/07/2023	1,000	1,000	3,000	992	1,005	3,000	1.001 ± 0.004	1.000		
802	SAC	224-PC004	626154	03/07/2023	1,000	1,000	3,000	1,002	1,004	3,000	1.000 ± 0.003	0.999		
803	SAC	224-PC004	612668	10/07/2023	1,000	1,000	3,000	995	1,003	3,000	1.005 ± 0.008	1.000		
804	SAC	224-PC004	602804	03/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.004	1.000		
805	SAC	224-PC004	612693	03/07/2023	1,000	1,000	3,000	1,002	1,004	3,000	1.011 ± 0.005	0.999		
806	SAC	224-PC004	612688	03/07/2023	1,000	1,000	3,000	998	1,006	3,004	1.011 ± 0.005	1.000		
807	SAC	224-PC004	626202	10/07/2023	1,000	1,000	3,000	997	1,000	3,000	0.999 ± 0.003	1.000		
808	SAC	224-PC004	626100	07/07/2023	1,000	1,000	3,000	1,002	1,005	3,000	1.013 ± 0.007	0.999		
809	SAC	224-PC004	626479	06/07/2023	1,000	1,000	3,000	996	1,001	3,000	1.000 ± 0.003	1.000		
810	SAC	224-PC004	091950	06/07/2023	1,000	1,000	3,000	991	1,001	3,000	1.017 ± 0.004	0.999		
811	SAC	224-PC004	594311	19/07/2023	1,000	1,000	3,000	995	1,000	3,000	1.000 ± 0.003	1.000		
812	SAC	224-PC004	034036	07/07/2023	1,000	1,000	3,000	1,002	1,001	3,000	1.000 ± 0.003	1.000		
813	SAC	224-PC004	602073	06/07/2023	1,000	1,000	3,000	998	1,001	3,000	1.000 ± 0.003	1.000		
814	SAC	224-PC004	626123	07/07/2023	1,000	1,000	3,000	998	1,001	3,000	0.999 ± 0.003	1.000		
815	SAC	224-PC004	626474	07/07/2023	1,000	1,000	3,000	1,000	1,000	3,000	1.000 ± 0.003	0.999		
816	SAC	224-PC004	626477	04/07/2023	1,000	1,000	3,000	993	1,002	3,000	1.014 ± 0.003	0.999		
817	SAC	224-PC004	626880	04/07/2023	1,000	1,000	3,000	995	1,001	3,000	0.999 ± 0.004	1.000		
818	SAC	224-PC004	091486	04/07/2023	1,000	1,000	3,000	1,002	1,001	3,000	1.000 ± 0.003	0.999		
819	SAC	224-PC004	626139	06/07/2023	1,000	1,000	3,000	992	1,001	3,000	1.003 ± 0.003	1.000		
820	SAC	224-PC004	091387	03/07/2023	1,000	1,000	3,000	992	1,002	3,000	1.000 ± 0.003	1.000		
821	SAC	224-PC004	091331	10/07/2023	1,000	1,000	3,000	992	1,001	3,000	1.000 ± 0.003	1.000		
822	SAC	224-PC004	091636	03/07/2023	1,000	1,000	3,000	1,002	1,001	3,000	1.011 ± 0.003	0.999		
823	SAC	224-PC004	798395	10/07/2023	1,000	1,000	3,000	992	1,001	3,000	1.017 ± 0.003	0.999		
824	SAC	224-PC004	626303	03/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.003 ± 0.003	1.000		
825	SAC	224-PC004	798488	10/07/2023	1,000	1,000	3,000	1,000	1,001	3,000	0.999 ± 0.003	1.000		
826	SAC	224-PC004	798476	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	0.999 ± 0.003	1.000		
827	SAC	224-PC004	626173	10/07/2023	1,000	1,000	3,000	993	1,002	3,000	1.015 ± 0.003	0.999		
828	SAC	224-PC004	626170	04/07/2023	1,000	1,000	3,000	1,002	1,001	3,000	1.000 ± 0.003	1.000		
829	SAC	224-PC004	626472	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
830	SAC	224-PC004	626489	04/07/2023	1,000	1,000	3,000	1,002	1,001	3,000	1.000 ± 0.003	1.000		
831	SAC	224-PC004	626139	10/07/2023	1,000	1,000	3,000	991	1,001	3,000	0.999 ± 0.003	1.000		
832	SAC	224-PC004	091567	03/07/2023	1,000	1,000	3,000	990	1,001	3,000	1.011 ± 0.003	1.000		
833	SAC	224-PC004	091756	03/07/2023	1,000	1,000	3,000	992	1,001	3,000	0.999 ± 0.003	1.000		
834	SAC	224-PC004	612682	07/07/2023	1,000	1,000	3,000	1,002	1,001	3,000	1.000 ± 0.003	0.999		
835	SAC	224-PC004	626380	03/07/2023	1,000	1,000	3,000	992	1,001	3,000	1.003 ± 0.003	1.000		
836	SAC	224-PC004	626106	03/07/2023	1,000	1,000	3,000	998	1,001	3,000	1.000 ± 0.003	1.000		
837	SAC	224-PC004	626256	03/07/2023	1,000	1,000	3,000	993	1,001	3,000	1.000 ± 0.003	1.000		
838	SAC	224-PC004	626167	03/07/2023	1,000	1,000	3,000	998	1,001	3,000	1.000 ± 0.003	1.000		
839	SAC	224-PC004	091437	10/07/2023	1,000	1,000	3,000	1,000	1,001	3,000	1.000 ± 0.003	0.999		
840	SAC	224-PC004	798395	04/07/2023	1,000	1,000	3,000	995	1,001	3,000	1.013 ± 0.003	0.999		

Calibrated by :

Approved by :

(Mr. Anan Jongsakul)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25 ± 3 °C

Pressure : 1010 ± 10 mmHg

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve				
					Setting			Actual (Q std.)		y			R ²	
					1	2	3	1	2	3				
841	SAC	224-PC004	612668	15/07/2023	1,000	1,000	3,000	998	1,005	3,000	0.999 ± 0.003	1.000		
842	SAC	224-PC004	626041	15/07/2023	1,000	1,000	3,000	1,002	1,004	3,000	0.999 ± 0.003	1.000		
843	SAC	224-PC004	034036	05/07/2023	1,000	1,000	3,000	999	1,001	3,000	0.999 ± 0.003	1.000		
844	SAC	224-PC004	529341	15/07/2023	1,000	1,000	3,000	1,001	1,001	3,000	1.000 ± 0.003	1.000		
845	SAC	224-PC004	529254	04/07/2023	1,000	1,000	3,000	998	1,001	3,000	0.999 ± 0.003	1.000		
846	SAC	224-PC004	566743	04/07/2023	1,000	1,000	3,000	998	1,001	3,000	1.000 ± 0.003	1.000		
847	SAC	224-PC004	566747	04/07/2023	1,000	1,000	3,000	1,001	1,001	3,000	1.001 ± 0.003	0.999		
848	SAC	224-PC004	566753	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
849	SAC	224-PC004	566758	04/07/2023	1,000	1,000	3,000	1,002	1,001	3,000	1.001 ± 0.003	0.999		
850	SAC	224-PC004	566759	04/07/2023	1,000	1,000	3,000	1,000	1,001	3,000	0.999 ± 0.003	1.000		
851	SAC	224-PC004	566760	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
852	SAC	224-PC004	566761	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
853	SAC	224-PC004	566762	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
854	SAC	224-PC004	566763	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
855	SAC	224-PC004	566764	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
856	SAC	224-PC004	566765	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
857	SAC	224-PC004	566766	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
858	SAC	224-PC004	566767	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
859	SAC	224-PC004	566768	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
860	SAC	224-PC004	566769	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
861	SAC	224-PC004	566770	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
862	SAC	224-PC004	566771	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
863	SAC	224-PC004	566772	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
864	SAC	224-PC004	566773	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
865	SAC	224-PC004	566774	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
866	SAC	224-PC004	566775	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
867	SAC	224-PC004	566776	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
868	SAC	224-PC004	566777	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
869	SAC	224-PC004	566778	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
870	SAC	224-PC004	566779	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
871	SAC	224-PC004	566780	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
872	SAC	224-PC004	566781	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
873	SAC	224-PC004	566782	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
874	SAC	224-PC004	566783	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
875	SAC	224-PC004	566784	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
876	SAC	224-PC004	566785	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
877	SAC	224-PC004	566786	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
878	SAC	224-PC004	566787	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
879	SAC	224-PC004	566788	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
880	SAC	224-PC004	566789	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
881	SAC	224-PC004	566790	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
882	SAC	224-PC004	566791	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
883	SAC	224-PC004	566792	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
884	SAC	224-PC004	566793	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
885	SAC	224-PC004	566794	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
886	SAC	224-PC004	566795	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
887	SAC	224-PC004	566796	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
888	SAC	224-PC004	566797	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
889	SAC	224-PC004	566798	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
890	SAC	224-PC004	566799	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
891	SAC	224-PC004	566800	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
892	SAC	224-PC004	566801	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
893	SAC	224-PC004	566802	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
894	SAC	224-PC004	566803	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
895	SAC	224-PC004	566804	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
896	SAC	224-PC004	566805	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
897	SAC	224-PC004	566806	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
898	SAC	224-PC004	566807	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
899	SAC	224-PC004	566808	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		
900	SAC	224-PC004	566809	04/07/2023	1,000	1,000	3,000	999	1,001	3,000	1.000 ± 0.003	1.000		



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Personal Pump Calibration Report												
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 510-H				S/N : 136164				
Environmental Conditions												
Temperature : 25 ± 3 °C Pressure : 1010 ± 15 mmbar												
Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Setting			Actual (Q std.)			Value From Calibration Curve	
					1	2	3	1	2	3	y	x ²
880	SKC	224-PCX03	109349	09/07/2023	1.000	1.500	2.000	1.001	1.497	2.000	1.000x - 0.782	1.000
881	SKC	224-PCX03	109340	07/07/2023	1.000	1.500	2.000	999	1.498	1.998	1.013x - 30.294	0.999
882	SKC	224-PCX03	109673	05/07/2023	1.000	1.500	2.000	995	1.497	1.994	0.999x - 4.301	1.000
883	SKC	224-PCX03	110785	06/07/2023	1.000	1.500	2.000	1.009	1.498	1.999	1.001x - 0.996	0.999
884	SKC	224-PCX03	108133	06/07/2023	1.000	1.500	2.000	996	1.497	1.989	0.992x + 4.363	1.000
885	SKC	224-PCX03	108757	06/07/2023	1.000	1.500	2.000	993	1.500	2.000	1.000x - 16.691	1.000
886	SKC	224-PCX03	1012625	09/07/2023	1.000	1.500	2.000	1.013	1.501	2.002	0.998x + 2.223	0.999
887	SKC	224-PCX03	104324	07/07/2023	1.000	1.500	2.000	997	1.498	1.998	0.992x + 6.303	1.000
888	SKC	224-PCX03	108307	07/07/2023	1.000	1.500	2.000	994	1.497	1.991	0.996x + 0.893	1.000
889	SKC	224-PCX03	108865	07/07/2023	1.000	1.500	2.000	999	1.498	2.000	0.999x - 0.116	0.999
890	SKC	224-PCX03	108366	04/07/2023	1.000	1.500	2.000	992	1.507	1.998	1.000x + 13.854	1.000
891	SKC	224-PCX03	110919	06/07/2023	1.000	1.500	2.000	999	1.497	1.999	0.991x + 7.076	1.000
892	SKC	224-PCX03	110987	06/07/2023	1.000	1.500	2.000	1.001	1.500	1.997	1.002x + 7.536	1.000
893	SKC	224-PCX03	108441	06/07/2023	1.000	1.500	2.000	995	1.495	2.002	1.000x + 7.538	0.999
894	SKC	224-PCX03	1127973	09/07/2023	1.000	1.500	2.000	1.009	1.514	2.005	1.004x + 7.809	0.999
895	SKC	224-PCX03	1127921	09/07/2023	1.000	1.500	2.000	992	1.501	2.000	1.013x - 30.293	0.999
896	SKC	224-PCX03	1127962	09/07/2023	1.000	1.500	2.000	997	1.497	1.994	0.999x + 3.303	1.000
897	SKC	224-PCX03	1127953	09/07/2023	1.000	1.500	2.000	1.000	1.500	2.001	1.010x - 20.281	0.999
898	SKC	224-PCX03	1127938	09/07/2023	1.000	1.500	2.000	995	1.495	1.996	1.002x + 0.403	1.000
Calibrated by :				Approved by :								



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Personal Pump Calibration Report												
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 510-H				S/N : 136164				
Environmental Conditions												
Temperature : 25 ± 3 °C Pressure : 1010 ± 15 mmbar												
Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Setting			Actual (Q std.)			Value From Calibration Curve	
					1	2	3	1	2	3	y	x ²
901	SKC	224-PCX03	1023407	09/07/2023	1.000	1.500	2.000	991	1.506	2.002	1.007x - 14.479	1.000
902	SKC	224-PCX03	1024430	09/07/2023	1.000	1.500	2.000	997	1.497	1.998	0.998x + 12.236	1.000
903	SKC	224-PCX03	1091562	09/07/2023	1.000	1.500	2.000	1.002	1.498	2.002	1.003x + 3.881	1.000
904	SKC	224-PCX03	1091572	09/07/2023	1.000	1.500	2.000	995	1.491	1.994	0.997x + 2.717	1.000
905	SKC	224-PCX03	1094470	09/07/2023	1.000	1.500	2.000	992	1.505	1.997	1.001x - 0.536	1.000
906	SKC	224-PCX03	1094564	09/07/2023	1.000	1.500	2.000	994	1.497	1.993	0.996x + 0.976	1.000
907	SKC	224-PCX03	1094489	09/07/2023	1.000	1.500	2.000	993	1.490	1.997	1.007x - 16.277	1.000
908	SKC	224-PCX03	1083215	04/07/2023	1.000	1.500	2.000	1.010	1.499	2.003	0.998x + 11.330	0.999
909	SKC	224-PCX03	1094629	09/07/2023	1.000	1.500	2.000	990	1.503	2.000	1.011x + 24.548	1.000
910	SKC	224-PCX03	1091760	07/07/2023	1.000	1.500	2.000	996	1.509	1.992	0.999x + 0.299	1.000
911	SKC	224-PCX03	1091765	07/07/2023	1.000	1.500	2.000	999	1.497	1.995	1.000x + 0.834	0.999
912	SKC	224-PCX03	1091568	07/07/2023	1.000	1.500	2.000	993	1.499	1.996	1.001x - 0.776	1.000
913	SKC	224-PCX03	1091838	07/07/2023	1.000	1.500	2.000	1.001	1.510	1.989	0.998x + 16.559	1.000
914	SKC	224-PCX03	1091764	07/07/2023	1.000	1.500	2.000	993	1.501	1.997	1.013x - 30.120	0.999
915	SKC	224-PCX03	1091837	07/07/2023	1.000	1.500	2.000	1.000	1.499	2.000	0.998x + 3.442	0.999
916	SKC	224-PCX03	1091843	05/07/2023	1.000	1.500	2.000	997	1.498	1.993	0.992x + 2.530	1.000
917	SKC	224-PCX03	1091845	05/07/2023	1.000	1.500	2.000	998	1.507	1.998	1.004x - 15.440	0.999
918	SKC	224-PCX03	1091758	05/07/2023	1.000	1.500	2.000	990	1.496	1.996	1.000x + 0.973	1.000
919	SKC	224-PCX03	1091802	05/07/2023	1.000	1.500	2.000	1.001	1.497	1.998	1.003x + 14.352	0.999
920	SKC	224-PCX03	1091809	05/07/2023	1.000	1.500	2.000	990	1.499	2.001	1.016x - 39.919	0.999
921	SKC	224-PCX03	1091728	09/07/2023	1.000	1.500	2.000	997	1.493	1.997	0.999x + 3.765	1.000
922	SKC	224-PCX03	1091844	05/07/2023	1.000	1.500	2.000	1.002	1.511	2.001	1.003x + 2.666	0.999
923	SKC	224-PCX03	1091847	05/07/2023	1.000	1.500	2.000	1.011	1.475	1.989	0.980x + 20.506	0.999
924	SKC	224-PCX03	1091893	06/07/2023	1.000	1.500	2.000	993	1.507	1.995	1.007x + 16.615	0.999
925	SKC	224-PCX03	1091852	04/07/2023	1.000	1.500	2.000	1.009	1.494	1.993	0.999x + 11.169	1.000
926	SKC	224-PCX03	1091954	06/07/2023	1.000	1.500	2.000	1.011	1.499	2.004	1.001x - 3.374	0.999
927	SKC	224-PCX03	1091938	06/07/2023	1.000	1.500	2.000	999	1.499	1.999	1.009x - 19.890	1.000
928	SKC	224-PCX03	1091981	06/07/2023	1.000	1.500	2.000	1.005	1.499	2.000	1.002x + 11.856	0.998
929	SKC	224-PCX03	1091402	04/07/2023	1.000	1.500	2.000	1.000	1.492	1.987	0.995x + 16.145	1.000
930	SKC	224-PCX03	1091811	07/07/2023	1.000	1.500	2.000	999	1.492	1.991	0.994x + 5.391	1.000
931	SKC	224-PCX03	1091823	04/07/2023	1.000	1.500	2.000	1.000	1.499	1.999	0.995x + 5.391	0.999
932	SKC	224-PCX03	1091950	04/07/2023	1.000	1.500	2.000	997	1.499	1.991	0.995x + 0.498	1.000
933	SKC	224-PCX03	1091854	04/07/2023	1.000	1.500	2.000	993	1.501	1.988	1.014x - 32.194	0.999
934	SKC	224-PCX03	1091831	06/07/2023	1.000	1.500	2.000	1.001	1.498	2.002	1.004x - 12.314	1.000
935	SKC	224-PCX03	1091480	23/07/2023	1.000	1.500	2.000	998	1.496	1.993	0.993x + 5.393	1.000
936	SKC	224-PCX03	1091844	07/07/2023	1.000	1.500	2.000	1.005	1.497	1.997	1.006x - 18.614	0.999
937	SKC	224-PCX03	1091432	07/07/2023	1.000	1.500	2.000	993	1.497	1.988	0.995x + 5.942	1.000
938	SKC	224-PCX03	1091349	07/07/2023	1.000	1.500	2.000	996	1.498	1.990	1.002x + 7.642	1.000
939	SKC	224-PCX03	1091893	04/07/2023	1.000	1.500	2.000	1.000	1.514	1.992	0.995x + 18.820	0.999
Calibrated by :				Approved by :								



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Personal Pump Calibration Report												
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 510-H				S/N : 136164				
Environmental Conditions												
Temperature : 25 ± 3 °C Pressure : 1010 ± 15 mmbar												
Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Setting			Actual (Q std.)			Value From Calibration Curve	
					1	2	3	1	2	3	y	x ²
889	SKC	224-PCX03	109753	07/07/2023	1.000	1.500	2.000	1.000	1.500	2.001	1.000x - 13.778	1.000
891	SKC	224-PCX03	1091548	09/07/2023	1.000	1.500	2.000	991	1.508	2.006	1.021x - 39.143	0.999
892	SKC	224-PCX03	1094003	09/07/2023	1.000	1.500	2.000	997	1.492	1.991	1.000x + 2.482	1.000
893	SKC	224-PCX03	1091229	05/07/2023	1.000	1.500	2.000	1.002	1.500	2.003	1.011x - 20.859	0.999
894	SKC	224-PCX03	109753	09/07/2023	1.000	1.500	2.000	1.001	1.494	1.991	0.994x + 2.525	1.000
895	SKC	224-PCX03	1091337	05/07/2023	1.000	1.500	2.000	991	1.504	2.000	1.016x - 32.201	0.998
Calibrated by :				Approved by :								



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Personal Pump Calibration Report													
Calibration Method : Dry Cal Primary Flowmeter					Model : Defender 510-H			S/N : 136164					
Environmental Conditions													
Temperature		25		± 3		°C							
Pressure		1010		± 15		mmbar							
Personal Pump Data					Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve			
					Setting			Actual (Q set.)					
					1	2	3	1	2	3	y	x	
801	SAC	224-PC004	262135	02/10/2023	1,000	1,200	2,000	997	1,494	1,995	0.996	1.186	1.000
802	SAC	224-PC004	626166	03/10/2023	1,000	1,200	2,000	995	1,491	1,997	0.999	1.029	1.000
803	SAC	224-PC004	612968	02/10/2023	1,000	1,200	2,000	994	1,488	1,996	1.000	1.211	0.991
804	SAC	224-PC004	620808	03/10/2023	1,000	1,200	2,000	1,001	1,502	1,997	0.999	1.061	1.000
805	SAC	224-PC004	612893	03/10/2023	1,000	1,200	2,000	1,000	1,500	1,999	1.000	1.194	0.996
806	SAC	224-PC004	262188	04/10/2023	1,000	1,200	2,000	998	1,497	1,999	1.000	1.047	1.000
807	SAC	224-PC004	626062	04/10/2023	1,000	1,200	2,000	997	1,492	1,999	0.999	1.033	1.000
808	SAC	224-PC004	624100	03/10/2023	1,000	1,200	2,000	998	1,496	1,994	0.999	1.104	1.000
809	SAC	224-PC004	624879	04/10/2023	1,000	1,200	2,000	1,012	1,500	2,000	0.998	1.004	0.999
810	SAC	224-PC004	619192	03/10/2023	1,000	1,200	2,000	992	1,486	1,984	1.000	1.182	1.000
811	SAC	224-PC008	564315	05/10/2023	1,000	1,500	2,000	993	1,501	1,994	1.000	1.263	0.999
812	SAC	224-PC008	634656	05/10/2023	1,000	1,500	2,000	1,000	1,496	1,998	1.001	1.272	1.000
813	SAC	224-PC008	630773	04/10/2023	1,000	1,500	2,000	1,000	1,488	1,987	0.999	1.338	1.000
814	SAC	224-PC004	626313	04/10/2023	1,000	1,200	2,000	990	1,493	1,989	0.999	1.301	1.000
815	SAC	224-PC004	626874	06/10/2023	1,000	1,200	2,000	1,000	1,494	1,984	1.000	1.075	0.999
816	SAC	224-PC004	626077	06/10/2023	1,000	1,200	2,000	1,001	1,498	1,996	1.000	1.047	0.999
817	SAC	224-PC004	626860	06/10/2023	1,000	1,200	2,000	1,000	1,492	1,988	0.999	1.074	1.000
818	SAC	224-PC004	631484	03/10/2023	1,000	1,200	2,000	999	1,494	1,992	1.000	1.043	0.999
819	SAC	224-PC004	619199	02/10/2023	1,000	1,200	2,000	991	1,481	1,988	0.999	1.035	0.999
820	SAC	224-PC004	619167	02/10/2023	1,000	1,200	2,000	1,001	1,494	1,999	1.000	1.232	0.999
821	SAC	224-PC004	619161	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.201	1.000
822	SAC	224-PC004	619164	03/10/2023	1,000	1,200	2,000	991	1,492	1,994	1.000	1.060	1.000
823	SAC	224-PC004	619163	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
824	SAC	224-PC004	619162	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
825	SAC	224-PC004	619165	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
826	SAC	224-PC004	619166	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
827	SAC	224-PC004	619167	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
828	SAC	224-PC004	619168	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
829	SAC	224-PC004	619169	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
830	SAC	224-PC004	619170	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
831	SAC	224-PC004	619171	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
832	SAC	224-PC004	619172	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
833	SAC	224-PC004	619173	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
834	SAC	224-PC004	619174	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
835	SAC	224-PC004	619175	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
836	SAC	224-PC004	619176	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
837	SAC	224-PC004	619177	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
838	SAC	224-PC004	619178	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
839	SAC	224-PC004	619179	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
840	SAC	224-PC004	619180	03/10/2023	1,000	1,200	2,000	991	1,491	1,997	1.000	1.043	0.999
Calibrated by :					Approved by :								
(Rt. Adv. Duplication)													







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Personal Pump Calibration Report												
Calibration Method : Dry Cal Primary Flowmeter					Model : Defender 510-H			S/N : 136164				
Environmental Conditions												
Temperature					25		± 3		°C			
Pressure					1010		± 15		mmbar			
Personal Pump Data					Calibration Data							
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve		
					Setting			Actual (0 std.)			y	x ²
					1	2	3	1	2			
801	SAC	224-PC004	615669	10/10/2023	1,000	1,200	2,000	999	1,481	1,993	0.994 x - 3.883	1,000
802	SAC	224-PC004	626061	03/10/2023	1,000	1,200	2,000	994	1,486	1,989	0.995 x - 1.759	1,000
803	SAC	224-PC004	619436	03/10/2023	1,000	1,200	2,000	995	1,488	1,989	0.994 x - 2.866	1,000
804	SAC	224-PC008	629241	03/10/2023	1,000	1,500	2,000	992	1,501	1,990	1.000 x - 29.951	0.999
805	SAC	224-PC008	629394	03/10/2023	1,000	1,500	2,000	1,000	1,495	1,989	0.999 x - 10.994	1,000
806	SAC	224-PC008	566763	03/10/2023	1,000	1,500	2,000	1,000	1,495	1,989	1.000 x - 14.984	0.999
807	SAC	224-PC008	566764	03/10/2023	1,000	1,500	2,000	994	1,502	1,996	1.014 x - 27.737	0.999
808	SAC	224-PC008	566765	03/10/2023	1,000	1,500	2,000	1,000	1,495	1,989	1.000 x - 13.977	1,000
809	SAC	224-PC008	566766	03/10/2023	1,000	1,500	2,000	998	1,496	1,990	1.010 x - 19.983	0.999
810	SAC	224-PC008	566767	03/10/2023	1,000	1,500	2,000	999	1,495	1,989	1.010 x - 15.980	1,000
811	SAC	224-PC008	566768	03/10/2023	1,000	1,500	2,000	999	1,494	1,989	1.009 x - 24.981	0.999
812	SAC	224-PC008	566769	03/10/2023	1,000	1,500	2,000	999	1,493	1,988	0.998 x - 2.979	1,000
813	SAC	224-PC008	566770	03/10/2023	1,000	1,500	2,000	999	1,492	1,987	0.998 x - 2.979	1,000
814	SAC	224-PC008	566771	03/10/2023	1,000	1,500	2,000	999	1,491	1,987	1.014 x - 33.978	0.999
815	SAC	224-PC008	566772	03/10/2023	1,000	1,500	2,000	999	1,490	1,987	1.014 x - 30.979	0.999
816	SAC	224-PC008	566773	03/10/2023	1,000	1,500	2,000	994	1,493	1,986	0.999 x - 9.981	1,000
817	SAC	224-PC008	566774	03/10/2023	1,000	1,500	2,000	992	1,487	1,989	1.000 x - 14.979	1,000
818	SAC	224-PC008	566775	03/10/2023	1,000	1,500	2,000	989	1,493	1,994	1.010 x - 9.973	1,000
819	SAC	224-PC008	566776	03/10/2023	1,000	1,500	2,000	1,000	1,497	1,997	1.000 x - 21.972	0.999
820	SAC	224-PC008	566777	03/10/2023	1,000	1,500	2,000	993	1,495	1,988	0.998 x - 2.973	1,000
821	SAC	224-PC010	512633	03/10/2023	1,000	1,200	2,000	992	1,494	1,997	1.010 x - 31.976	0.999
822	SAC	224-PC010	529513	03/10/2023	1,000	1,500	2,000	1,000	1,500	1,987	1.000 x - 20.965	0.999
823	SAC	224-PC010	529573	03/10/2023	1,000	1,500	2,000	999	1,495	1,991	0.990 x - 6.791	1,000
824	SAC	224-PC010	511103	03/10/2023	1,000	1,200	2,000	993	1,490	1,993	1.010 x - 8.970	1,000
825	SAC	224-PC010	536302	03/10/2023	1,000	1,200	2,000	991	1,484	1,988	0.996 x - 5.962	1,000
826	SAC	224-PC010	536311	03/10/2023	1,000	1,200	2,000	995	1,492	1,991	0.990 x - 4.984	1,000
827	SAC	224-PC010	536309	03/10/2023	1,000	1,200	2,000	994	1,493	1,993	0.990 x - 2.973	1,000
828	SAC	224-PC009	506825	03/10/2023	1,000	1,500	2,000	1,000	1,498	1,998	1.000 x - 17.974	0.999
829	SAC	224-PC009	506827	03/10/2023	1,000	1,500	2,000	994	1,494	1,987	0.999 x - 3.976	1,000
830	SAC	224-PC009	506879	03/10/2023	1,000	1,500	2,000	993	1,495	1,996	1.000 x - 19.978	0.999
831	SAC	224-PC009	506887	03/10/2023	1,000	1,500	2,000	992	1,496	1,995	1.000 x - 17.972	1,000
832	SAC	224-PC009	506897	03/10/2023	1,000	1,500	2,000	999	1,497	1,996	1.000 x - 21.966	0.999
833	SAC	224-PC009	506977	03/10/2023	1,000	1,500	2,000	993	1,490	1,995	0.990 x - 4.975	1,000
834	SAC	224-PC009	512606	03/10/2023	1,000	1,200	2,000	995	1,495	1,998	0.990 x - 12.974	1,000
835	SAC	224-PC009	512683	03/10/2023	1,000	1,200	2,000	997	1,496	1,998	0.987 x - 12.962	1,000
836	SAC	224-PC009	536060	03/10/2023	1,000	1,200	2,000	990	1,490	1,990	1.000 x - 5.973	1,000
837	SAC	224-PC009	536111	03/10/2023	1,000	1,200	2,000	1,000	1,487	1,999	1.010 x - 21.963	0.999
838	SAC	224-PC009	536031	03/10/2023	1,000	1,200	2,000	996	1,491	1,998	1.010 x - 30.973	0.999
839	SAC	224-PC009	510477	03/10/2023	1,000	1,200	2,000	1,000	1,490	1,997	1.007 x - 10.969	0.999
840	SAC	2204-PC009	510920	03/10/2023	1,000	1,200	2,000	996	1,489	1,997	0.986 x - 4.994	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 Pressure				25 ± 1016		± 15 mmbar						
Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)			Value From Calibration Curve				
					Setting		Actual (Q std.)	y		x		
					1	2	3	1	2	3		
880	SLC	224-PC050	504069	05/10/2023	1.000	1.500	2.000	1.020	1.487	2.000	1.027x - 13.252	0.999
881	SLC	224-PC050	504080	05/10/2023	1.000	1.500	2.000	994	1.436	1.996	1.008x - 17.526	1.000
882	SLC	224-PC050	504173	05/10/2023	1.000	1.500	2.000	992	1.485	1.992	1.020x - 11.742	1.000
883	SLC	224-PC050	510785	05/10/2023	1.000	1.500	2.000	994	1.407	1.998	1.008x - 15.177	1.000
884	SLC	224-PC050	508333	04/10/2023	1.000	1.500	2.000	1.000	1.508	1.999	1.005x - 16.042	0.999
885	SLC	224-PC050	516371	04/10/2023	1.000	1.500	2.000	899	1.458	1.999	1.010x - 23.175	0.999
886	SLC	224-PC050	512835	02/10/2023	1.000	1.500	2.000	1.000	1.492	1.989	0.994x + 1.336	1.000
887	SLC	224-PC050	504284	08/10/2023	1.000	1.500	2.000	1.001	1.500	1.996	1.006x - 16.009	0.999
888	SLC	224-PC050	508307	09/10/2023	1.000	1.500	2.000	1.000	1.494	1.995	0.990x + 6.617	1.000
889	SLC	224-PC050	518860	05/10/2023	1.000	1.500	2.000	999	1.488	1.998	0.997x + 3.214	0.999
890	SLC	224-PC050	508366	03/10/2023	1.000	1.500	2.000	993	1.495	1.992	0.999x - 3.005	1.000
891	SLC	224-PC050	516810	10/10/2023	1.000	1.500	2.000	998	1.496	1.993	0.999x - 1.867	1.000
892	SLC	224-PC050	516987	04/10/2023	1.000	1.500	2.000	1.001	1.496	1.997	1.009x - 22.028	0.999
893	SLC	224-PC050	508485	06/10/2023	1.000	1.500	2.000	997	1.491	1.990	0.992x + 2.516	1.000
894	SLC	224-PC050	512071	04/10/2023	1.000	1.500	2.000	998	1.486	1.993	1.005x - 16.076	0.999
895	SLC	224-PC048	512782	09/10/2023	1.000	1.500	2.000	998	1.490	1.990	1.012x - 25.793	0.999
896	SLC	224-PC048	512782	09/10/2023	1.000	1.500	2.000	999	1.495	1.989	0.991x + 5.720	1.000
897	SLC	224-PC018	512765	09/10/2023	1.000	1.500	2.000	994	1.496	1.996	2.011x - 26.512	0.999
898	SLC	224-PC018	512766	10/10/2023	1.000	1.500	2.000	995	1.489	1.987	0.996x + 1.218	1.000
Calibrated by : 					Approved by : 							
See Note (signature)												

Personal Pump Calibration Report												
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender S10-H			S/N : 126164					
Environmental Conditions												
Temperature : 25 ± 3 °C												
Pressure : 1010 ± 15 mmbar												
Personal Pump Data												
No.	Brand	Model	Serial No.	Date	Calibration Data							
					Flow Rate (ml/min)			Value From Calibration Curve				
					Setting	1	2	3	1	2	3	γ
R02	SAC	204-PC084	612753	07/10/2023	1,000	1,200	2,000	999	1,095	1,916	1,010x - 21.287	0.999
R01	SAC	204-PC084	621140	09/10/2023	1,000	1,200	2,000	999	1,099	1,916	1,013x - 31.991	0.999
R42	SAC	204-PC084	624652	07/10/2023	1,000	1,200	2,000	999	1,095	1,914	0.990x - 4.088	1.000
R43	SAC	204-PC084	624128	07/10/2023	1,000	1,200	2,000	1,001	1,098	1,919	1,010x - 21.073	0.999
R44	SAC	204-PC084	620753	07/10/2023	1,000	1,200	2,000	994	1,092	1,910	0.997x - 8.275	1.000
R45	SAC	204-PC084	626337	06/10/2023	1,000	1,200	2,000	990	1,087	1,905	1,000x - 18.994	1.000
Calibrated by : 					Approved by : 							
(Sig. John Lim khum)												

Rotameter Calibration Report (For Personal Pump High Flow Adjust)													
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender S10-H				S/N : 126164					
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	γ	R^2		
H-001	Dwyer	VFB-65	01/04/2023	100	1,000	2,000	500.1	993.6	1992.1	1,000x - 1.647	0.999		
H-002	Dwyer	VFB-65	16/04/2023	100	1,000	2,000	500.4	993.7	1992.7	1,001x - 3.427	1.000		
H-003	Dwyer	VFB-65	07/04/2023	100	1,000	2,000	500.1	993.3	1991.7	0.999x - 4.025	1.000		
H-004	Dwyer	VFB-65	16/04/2023	100	1,000	2,000	497.2	993.2	1991.9	1,001x - 11.202	1.000		
H-005	Dwyer	VFB-65	06/04/2023	100	1,000	2,000	499.2	993.3	1990.7	1,001x - 7.116	1.000		
H-006	Dwyer	VFB-65	16/04/2023	100	1,000	2,000	504.8	994.6	1992.8	0.999x - 1.961	0.999		
Calibrated by : 				Approved by : 									
(Sig. John Lim khum)													

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)													
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender S10-H				S/N : 126164					
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	γ	R^2		
L-001	Dwyer	VFA-S1	05/04/2023	50	100	200	50.2	101.0	201.2	0.991x - 1.016	0.999		
L-002	Dwyer	VFA-S1	16/04/2023	50	100	200	50.1	102.0	201.0	1.001x - 0.106	0.999		
L-003	Dwyer	VFA-S1	07/04/2023	50	100	200	50.1	100.2	202.7	1.015x - 0.510	1.000		
L-004	Dwyer	VFA-S1	10/04/2023	50	100	200	50.3	100.9	200.6	1.003x - 0.713	0.999		
L-005	Dwyer	VFA-S1	06/04/2023	50	100	200	50.2	101.0	202.6	0.994x - 1.450	1.000		
L-006	Dwyer	VFA-S1	10/04/2023	50	100	200	50.6	100.3	200.3	1.001x - 6.717	1.000		
Calibrated by : 				Approved by : 									



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)											
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 510-H				S/N : 136164			
Calibration Data											
Rotameter Data			Calibration Data						Value From Calibration Curve		
No.	Brand	Model	Date	Flow Rate (mL/min)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
H-801	Dwyer	VFA-45	05/07/2023	500	1,000	2,000	501.2	993.0	1978.7	0.9994 ± 3.853	0.999
H-802	Dwyer	VFA-45	05/07/2023	500	1,000	2,000	501.1	998.1	1986.7	1.0004 ± 2.024	1.000
H-803	Dwyer	VFA-45	06/07/2023	500	1,000	2,000	501.2	999.1	1995.7	0.9926 ± 3.817	1.000
H-804	Dwyer	VFA-45	18/07/2023	500	1,000	2,000	496.1	991.2	2014.5	1.0054 ± 10.883	1.000
H-805	Dwyer	VFA-45	05/07/2023	500	1,000	2,000	499.1	987.0	1988.7	1.0024 ± 6.676	1.000
H-806	Dwyer	VFA-45	06/07/2023	500	1,000	2,000	504.7	994.0	1980.6	0.9984 ± 1.539	0.999
Calibrated by :				Approved by :							



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)											
Calibration Method : Dry Cal Primary Flowmeter				Model : Defender 510-H				S/N : 136164			
Calibration Data											
Rotameter Data			Calibration Data						Value From Calibration Curve		
No.	Brand	Model	Date	Flow Rate (mL/min)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
L-1001	Dwyer	VFA-21	05/07/2023	50	100	200	50.6	100.9	200.1	0.9854 ± 2.912	1.000
L-1002	Dwyer	VFA-21	05/07/2023	50	100	200	50.4	101.4	200.8	1.0034 ± 0.894	0.999
L-1003	Dwyer	VFA-21	06/07/2023	50	100	200	50.1	100.1	202.1	1.0064 ± 0.170	1.000
L-1004	Dwyer	VFA-21	18/07/2023	50	100	200	50.3	100.8	203.3	1.0024 ± 0.562	1.000
L-1005	Dwyer	VFA-21	05/07/2023	50	100	200	50.1	101.1	202.8	0.9994 ± 0.445	0.999
L-1006	Dwyer	VFA-21	06/07/2023	50	100	200	50.7	101.3	202.5	0.9954 ± 1.435	1.000
Calibrated by :				Approved by :							



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24, ทุ่งพญาไท กรุงเทพฯ 10900
Tel : (662) 639-4370-71, Fax : (662) 513-4321, E-mail : info@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						Value From Calibration Curve		
No.	Brand	Model	Date	Flow Rate (mL/min)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
H-801	Dwyer	VFA-45	02/06/2023	500	1,000	2,000	502.9	994.3	1977.4	1.0034 ± 7.746	0.999
H-802	Dwyer	VFA-45	09/10/2023	500	1,000	2,000	495.9	995.6	2008.4	0.9959 ± 3.124	1.000
H-803	Dwyer	VFA-45	09/10/2023	500	1,000	2,000	504.5	990.0	1999.9	0.9874 ± 9.890	1.000
H-804	Dwyer	VFA-45	08/10/2023	500	1,000	2,000	496.9	986.1	2006.2	1.0044 ± 15.756	0.999
H-805	Dwyer	VFA-45	09/10/2023	500	1,000	2,000	503.1	991.3	2014.3	1.0004 ± 1.636	1.000
H-806	Dwyer	VFA-45	05/10/2023	500	1,000	2,000	499.2	997.2	1974.6	0.9984 ± 3.462	0.999
Calibrated by :				Approved by :							



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Tel : (662) 639-4370-71, Fax : (662) 513-4321, E-mail : info@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						Value From Calibration Curve		
No.	Brand	Model	Date	Flow Rate (mL/min)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
L-1001	Dwyer	VFA-21	02/10/2023	50	100	200	50.4	99.3	200.4	0.9854 ± 0.553	1.000
L-1002	Dwyer	VFA-21	06/10/2023	50	100	200	49.3	100.6	199.3	1.0024 ± 1.123	0.999
L-1003	Dwyer	VFA-21	04/10/2023	50	100	200	50.1	99.3	203.7	1.0014 ± 0.261	1.000
L-1004	Dwyer	VFA-21	09/10/2023	50	100	200	50.1	100.7	200.6	1.0064 ± 1.050	0.999
L-1005	Dwyer	VFA-21	03/10/2023	50	100	200	49.8	101.4	200.7	0.9954 ± 1.282	1.000
L-1006	Dwyer	VFA-21	05/10/2023	50	100	200	50.3	101.1	199.7	1.0064 ± 0.716	0.999
Calibrated by :				Approved by :							



บริษัท ไทยยูนิค จำกัด

THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0822/20530

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

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

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladao Chatuchak Bangkok 10900

Date : 10/08/2022

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column: Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 118,103 Counts.



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80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.94	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	4,000	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (°C)	80	80	± 5
Injector (°C)	220	220	± 5
Detector (°C)	300	300	± 5
Incubator (°C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.68	≤ 5
Retention Time C15 (%)	0.01	≤ 0.5

APPROVAL

Signature:

Engineer : Suwarot Trikanut

Date : 10/08/2022



VARIAN

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SERVICE DEPARTMENT
FR-SV-029 Rev. 04

VARIAN

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SERVICE DEPARTMENT
FR-SV-029 Rev. 04

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THAI UNIQUE CO., LTD.

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80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	117,172
C15 Area 2	119,182
C15 Area 3	117,982
C15 Area 4	118,589
C15 Area 5	117,592
C15 Area Average	118,103
* % RSD (< 5 %)	1.68


* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

% RSD = (std.dev / avg) * 100

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/08/2022	



Comments	-		
Reviewed by		Date	10/08/2022



VARIAN

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80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200

Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.048
C15 RT 2	4.048
C15 RT 3	4.048
C15 RT 4	4.048
C15 RT 5	4.048
C15 RT Average	4.000
* % RSD (< 0.5 %)	0.01


* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

% RSD = (std.dev / avg) * 100

Compliance	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Performance by		
Date	10/08/2022	



Comments			
Reviewed by	 P.	Date	10/08/2022



VARIAN

1/1

SERVICE DEPARTMENT

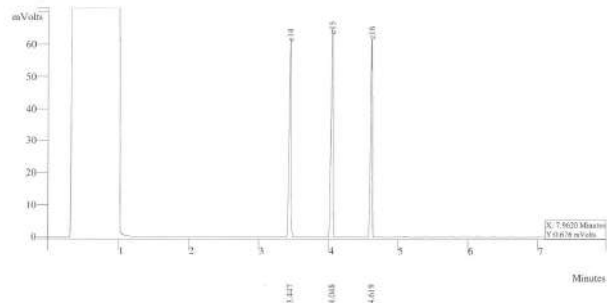
Sample ID: fid std

Operator (Inj): suwarot
 Injection Date: 16/08/2022
 Calc Date: 16/08/2022
 Run Time (min): 7.993
 Workstation:
 Instrument (Inj): Varian Star #1



c:\star\data\tu\cal2022\fid2022001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.477	112355	VP	1.7
2	c15	33.6834	4.048	117172	VV	1.5
3	c16	34.0178	4.619	118335	VP	1.5
Totals		100.0000		347862		



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1 Of 1

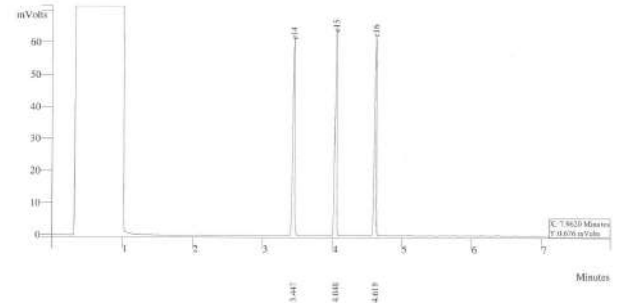
Sample ID: fid std

Operator (Inj): suwarot
 Injection Date: 16/08/2022
 Calc Date: 16/08/2022
 Run Time (min): 7.993
 Workstation:
 Instrument (Inj): Varian Star #1



c:\star\data\tu\cal2022\fid2022002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.477	112755	VP	1.7
2	c15	33.6834	4.048	119182	VV	1.5
3	c16	34.0178	4.619	118265	VP	1.5
Totals		100.0000		348205		



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1 Of 1

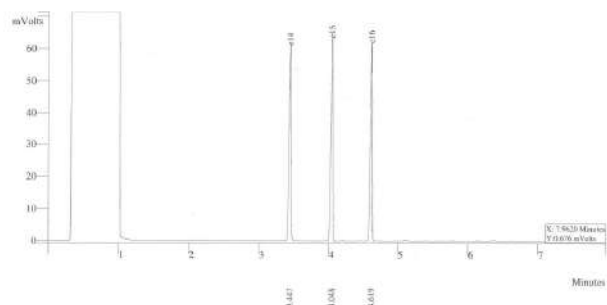
Sample ID: fid std

Operator (Inj): suwarot
 Injection Date: 16/08/2022
 Calc Date: 16/08/2022
 Run Time (min): 7.993
 Workstation:
 Instrument (Inj): Varian Star #1



c:\star\data\tu\cal2022\fid2022003.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.477	112755	VP	1.7
2	c15	33.6834	4.048	117982	VV	1.5
3	c16	34.0178	4.619	118265	VP	1.5
Totals		100.0000		348205		



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1 Of 1

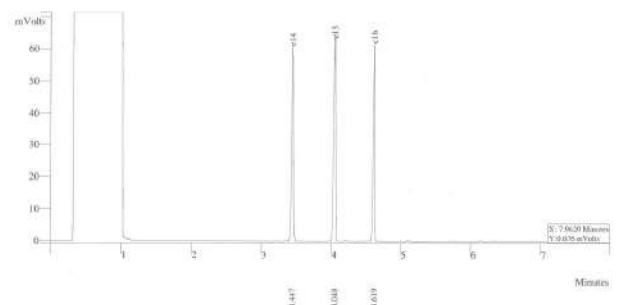
Sample ID: fid std

Operator (Inj): suwarot
 Injection Date: 16/08/2022
 Calc Date: 16/08/2022
 Run Time (min): 7.993
 Workstation:
 Instrument (Inj): Varian Star #1



c:\star\data\tu\cal2022\fid2022004.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.377	113755	VP	1.7
2	c15	33.6834	4.048	118589	VV	1.5
3	c16	34.3178	4.619	128265	VP	1.5
Totals		100.0000		360292		



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1 Of 1

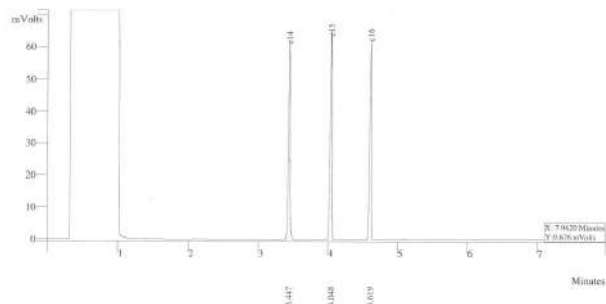
Sample ID: fid std

Operator (Inj): suwarot
 Injection Date: 16/08/2022
 Calc Date: 16/08/2022
 Run Time (min): 7.993
 Workstation:
 Instrument (Inj): Varian Star #1



c:\star\data\cal\2022\fid\2022005.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	c14	32.2988	3.377	115755	VP	1.7
2	c15	33.6834	4.048	117592	VV	1.5
3	c16	34.3178	4.619	138265	VP	1.5
Totals		100.0000		369202		

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1 of 1

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 80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
 80-82 Prachathipatai Rd., Bangkokphrom, Pranakorn, Bangkok 10200
 Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawat@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0823/21044

Instrument Type : GC

Model : CP-3800

Serial Number : 00734

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

Address : 7 Phahonyothin Soi 24 Phahonyothin Rd. Ladyao Chatuchak Bangkok 10900

Date : 09/08/2023

ELECTRONIC TEST

CPU	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
LCD TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
VENT TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
KEY ECHO TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL
DESTRUCTION RAM TEST	<input checked="" type="checkbox"/> PASS	<input type="checkbox"/> FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

Column	80 °C hold 1 min., rate 20 °C/min. to 200 °C hold 1min.
Injector	220 °C
Detector	300 °C
Column flow	5 mL/min
Makeup flow	25 mL/min
Air flow	300 mL/min
Hydrogen flow	30 mL/min

Column:Capillary Column CP sil 5 CB 0.25 ID x 15 M

Sample: 1 µL Injection FID Test Sample 0.218 g/L C14,C15,C16 in hexane

SENSITIVITY TEST: C15. (Area count) = 362,972 Counts.

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 80-82 Prachathipatai Rd., Bangkokphrom, Pranakorn, Bangkok 10200
 Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawat@thaiunique.com, Website : www.thaiunique.com

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	1.47	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	19,600	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (°C)	80	80	± 5
Injector (°C)	220	220	± 5
Detector (°C)	300	300	± 5
Incubator (°C)	60	N/A	± 5

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.52	≤ 5
Retention Time C15(%)	0.01	≤ 0.5

APPROVAL :

Signature:

Engineer : Suwarot Trikanut

Date : 09/08/2023





Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	357,863
C15 Area 2	357,824
C15 Area 3	367,724
C15 Area 4	361,724
C15 Area 5	369,724
C15 Area Average	362,972
* % RSD (< 5 %)	1.52

* The precision specification should be less than 2.0 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 5 % for Manual injections. To calculate the %RSD, select the C15 peak area for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Performance by	
Date	09/08/2023



Comments			
Reviewed by		Date	09/08/2023



Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.125
C15 RT 2	4.125
C15 RT 3	4.125
C15 RT 4	4.124
C15 RT 5	4.124
C15 RT Average	4.122
* % RSD (< 0.5 %)	0.01

* The precision specification should be less than 0.5 % RSD ** (Relative Standard Deviation) for an Auto sampler injection and less than 0.5 % for Manual injections. To calculate the %RSD, select the RT C15 peak for each of the five (5) samples.

** (Relative Standard Deviation is determined by dividing the standard deviation by the average and multiplying by 100.)

$$\% \text{ RSD} = (\text{std.dev} / \text{avg}) * 100$$

Compliance	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Performance by	
Date	09/09/2023



Comments			
Reviewed by		Date	09/09/2023



1/1

SERVICE DEPARTMENT



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SERVICE DEPARTMENT

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

Sample ID: fid std

Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):

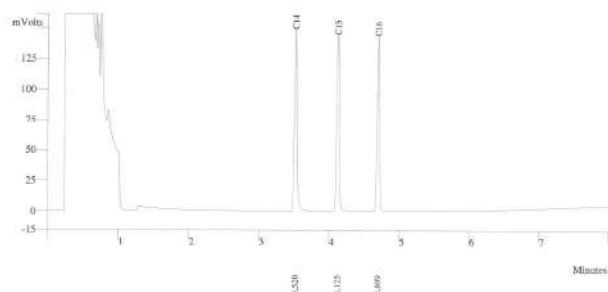


VARIAN

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	359491	BB	2.2
2	C15	33.4804	4.125	357863	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9312		1062305		

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

Sample ID: fid std

Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):

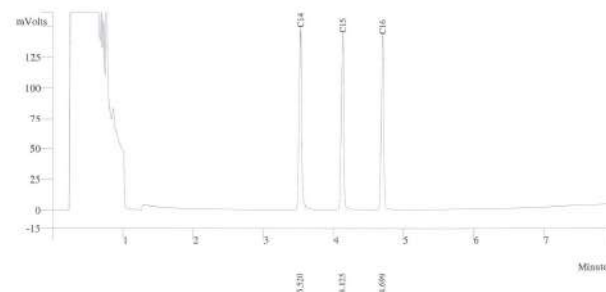


VARIAN

Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4804	4.125	357824	BB	2.3
3	C16	32.6143	4.699	344951	BB	2.2
Totals		99.9332		1065270		



Sample ID: fid std

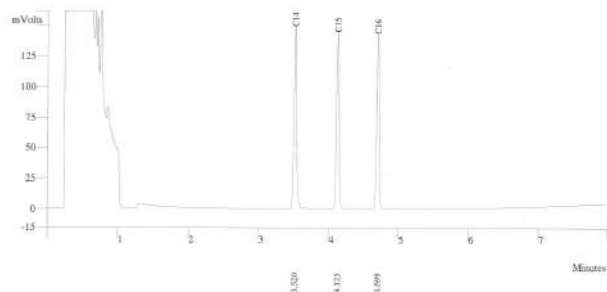
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.125	367724	BB	2.3
3	C16	32.6143	4.699	354951	BB	2.2
Totals		99.9352		1085170		



THAI UNIQUE CO.,LTD.

1 Of 1

Sample ID: fid std

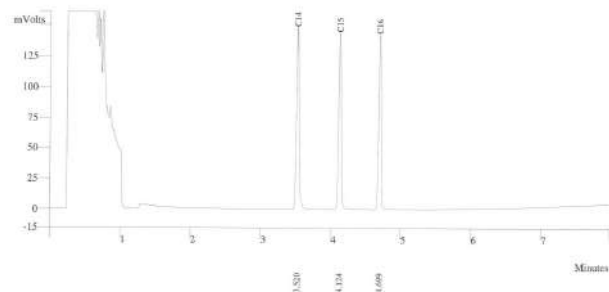
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	361724	BB	2.3
3	C16	32.6143	4.699	354991	BB	2.2
Totals		99.9352		1079210		



THAI UNIQUE CO.,LTD.

1 Of 1

Sample ID: fid std

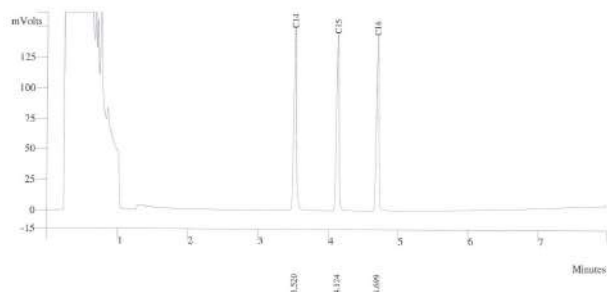
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



Run Mode: Analysis
Peak Measurement: Peak Area
Calculation Type: External Std.

c:\star\data\tu\cal2023\fid\calfid2023002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
Totals		99.9552		1087210		



THAI UNIQUE CO.,LTD.

1 Of 1



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
MODEL : XS105DU
SERIAL No : 1126422905
ID No : BA 05/50
CONDITION AS RECEIVED : USED ITEM
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 10-Mar-23
APPROVED BY :
ISSUED DATE : 16-Mar-23
RECEIVED DATE : 10-Mar-23

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

F-0010 REV 02



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

- 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.
- REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	M23020135	02-Feb-25
2) STANDARD WEIGHT	E2	15843	M23020148	02-Feb-25
- THIS RESULT WAS FOUND ACCURATE AS SHOWN ON DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- 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

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR

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

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

END OF CALIBRATION REPORT



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059
AS-DV S/N : 190915235

for

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

Operator Signature : Date : Jan 4, 2023

(Mr. Channarong Khiao-Un)

Test Engineer



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059
AS-DV S/N : 190915235

for

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

Operator Signature : Date : Jul 3, 2023

(Mr. Nutdanai Laekhwan)

Applications Chemist



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

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

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



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

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



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

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



MAINTENANCE AND TEST CERTIFICATE MODEL OPTIMA 5300DV

SERIAL NUMBER <u>077C7042401</u>	DATE TESTED <u>January 11, 2023</u>
Remarks :	
Commissioning follow as commissioning performance sheets.	

This is to certify that the above tests have been performed and the configuration tested	
<input checked="" type="checkbox"/>	meets
<input type="checkbox"/>	does not meet
the PerkinElmer Specifications listed on this certificate.	
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.	
Authorized Represent	<div style="border: 1px solid black; height: 40px; width: 100%;"></div> <div style="text-align: center;">(Mr. Wiphan Promlunda)</div> <div style="text-align: center;">Service Engineer</div>



WO-01981290/2023

WO-01981290/2023

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

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

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

Page 1 of 4

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Bangkok, Huay Kwang, Bangkok 10310

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

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

Page 2 of 4

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Bangkok, Huay Kwang, Bangkok 10310

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

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

Page 3 of 4

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Bangkok, Huay Kwang, Bangkok 10310

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

SERIAL NUMBER	077C7042401	DATE TESTED	July 6, 2023
Remarks :			
Commissioning follow as commissioning performance sheets.			
This is to certify that the above tests have been performed and the configuration tested			
<input checked="" type="checkbox"/> meets			
<input type="checkbox"/> does not meet			
the PerkinElmer Specifications listed on this certificate.			
This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms.			
Authorized Representative			
Service Engineer			

Page 4 of 4

PerkinElmer Ltd. 290 Soi 17, Rama 9 Road, Bangkok, Huay Kwang, Bangkok 10310

เอกสารแนบ 5-6

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

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

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

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

Date of Receipt : 22 Apr. 2022

Date of Calibration : 28 Apr. 2022

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

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

FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-65/0455

MTC No. EEL. BP. 41/0465

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr.Nuttapong Niljrusvanit)

(Mr.Fawikiat Iamsamran)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 28 Apr. 2022

Date of Issue : 28 Apr. 2022

Ref : 2011265042601787001

2 / 2

End of Certificate

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

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

FM.BLMTC.002 Rev.4

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

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_412/23

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R40	ACO	6236	00192052	09 August 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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_509/23

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R40	ACO	6236	00192052	04 October 2023	94.0	94.0
ACO-R41	ACO	6236	00192053	04 October 2023	94.1	94.0
ACO-R50	ACO	6236	00192062	04 October 2023	94.0	94.0
ACO-R51	ACO	6236	00192063	04 October 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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_592/23

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R04	ACO	6236	00142005	30 October 2023	94.0	94.0
ACO-R05	ACO	6236	00142020	30 October 2023	94.0	94.0
ACO-R06	ACO	6236	00152005	30 October 2023	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr. Abdul Dangklom)

Approved by :

เอกสารแนบ 5-7

เอกสารสอบเทียบเครื่องมือการตรวจวัดปริมาณเสียงสะสมติดตัวพนักงาน



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0359

MTC No. EEL. BP. 23/0366

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Ambient Environment

Description : Noise Dosimeter

Temperature : (23 ± 3) °C

Manufacturer : Svantek

Relative Humidity : (50 ± 15) %

Model : SV-104IS

Ambient Pressure : (101.325 ± 1.5) kPa

Serial No. : 80840

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 3 Mar. 2023

Date of Calibration : 10 Mar. 2023

1 / 2

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

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

FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0359

MTC No. EEL. BP. 23/0366

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.1	0.1	0.25	2.0
1 000	0.0	-0.1	0.25	1.4
4 000	-0.1	-0.1	0.25	3.6

Note : 1) There was no adjustment.

2) The calibration was performed at a sound pressure level of 114 dB.

3) The measured values did not include the correction of microphone of UUT.

4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

(Mr. Sanaey Grajang)

Approved by :

(Mr. Prawate Klaiyapa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 20112660300092001

Date of Calibration : 10 Mar. 2023

Date of Issue : 13 Mar. 2023

2 / 2

End of Certificate

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

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0399

MTC No. EEL. BP. 90/0366

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Ambient Environment

Description : Noise Dosimeter

Temperature : (23 ± 3) °C

Manufacturer : Svantek

Relative Humidity : (50 ± 15) %

Model : SV-104IS

Ambient Pressure : (101.325 ± 1.5) kPa

Serial No. : 106120

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 20 Mar. 2023

Date of Calibration : 31 Mar. 2023

1 / 2

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

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0399

MTC No. EEL. BP. 90/0366

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.3	-0.3	0.25	2.0
1 000	0.0	-0.1	0.25	1.4
4 000	-0.1	-0.1	0.25	3.6

Note : 1) There was no adjustment.

2) The calibration was performed at a sound pressure level of 114 dB.

3) The measured values did not include the correction of microphone of UUT.

4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

(Mr. Sanaey Grajang)

Approved by :

(Mr. Prawate Klaiyapa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011266032001153001

Date of Calibration : 31 Mar. 2023

Date of Issue : 31 Mar. 2023

2 / 2

End of Certificate

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. 21-66/0414

MTC No. EEL. BP. 110/0366

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106122

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 27 Mar. 2023

Date of Calibration : 3 Apr. 2023

1 / 2

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0414

MTC No. EEL. BP. 111/0366

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., 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 : Noise Dosimeter

Manufacturer : Svantek

Model : SV-104IS

Serial No. : 106123

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustical signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 27 Mar. 2023

Date of Calibration : 3 Apr. 2023

1 / 2

The results relate only to the items tested/calibrated or value assigned.
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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0414

MTC No. EEL. BP. 110/0366

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.3	0.5	0.25	2.0
1 000	0.1	-0.1	0.25	1.4
4 000	0.4	0.2	0.25	3.6

Note : 1) There was no adjustment.

2) The calibration was performed at a sound pressure level of 114 dB.

3) The measured values did not include the correction of microphone of UUT.

4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

(Mr. Sanay Grajang)

Approved by :

(Mr. Prawate Klunypa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011266032701229001

Date of Calibration : 3 Apr. 2023

Date of Issue : 4 Apr. 2023

2 / 2

End of Certificate

The results relate only to the items tested/calibrated or value assigned.
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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0414

MTC No. EEL. BP. 111/0366

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	-0.2	-0.3	0.25	2.0
1 000	0.6	-0.3	0.25	1.4
4 000	-0.4	-0.4	0.25	3.6

Note : 1) There was no adjustment.

2) The calibration was performed at a sound pressure level of 114 dB.

3) The measured values did not include the correction of microphone of UUT.

4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

(Mr. Sanay Grajang)

Approved by :

(Mr. Prawate Klunypa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011266032701229002

Date of Calibration : 3 Apr. 2023

Date of Issue : 4 Apr. 2023

2 / 2

End of Certificate

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FM.BLMTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0399

MTC No. EEL. BP. 91/0366

CALIBRATION CERTIFICATE

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

Address : 7 Soi Phaholyothin 24, Phaholyothin Rd., Jompo, 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 : Noise Dosimeter

Manufacturer : Svanitek

Model : SV-104IS

Serial No. : 106124

Standards used :

Multifunction Acoustic Calibrator Brüel&Kjær 4226 S/N 2810358 with Coupler UA0915 S/N 2810358.

Calibration Procedure :

This instrument was calibrated by using calibration procedure no CP-102-01, which was based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2006). This calibration procedure was related to the acoustic signal test of frequency weightings using a multifunction acoustic calibrator.

This instrument has been calibrated against standards maintained at the 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.

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%.

Date of Receipt : 20 Mar, 2023

Date of Calibration : 31 Mar, 2023

1 / 2

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0399

MTC No. EEL. BP. 91/0366

Acoustic signal test of frequency weightings

Frequency (Hz)	Deviation from response curve		Uncertainty (±dB)	Tolerance Limits Class 2 (±dB)
	A-weighting (dB)	C-weighting (dB)		
125	0.6	0.2	0.25	2.0
1 000	0.0	-0.1	0.25	1.4
4 000	-0.6	-0.4	0.25	3.6

Note : 1) There was no adjustment.

2) The calibration was performed at a sound pressure level of 114 dB.

3) The measured values did not include the correction of microphone of UUT.

4) The deviation was produced from the absolute difference between the measured values and the responding sound pressure levels in IEC 61672-1 (2002).

Calibrated by :

(Mr. Sanaey Grajang)

Approved by :

(Mr. Prawate Kiatyapa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Ref : 2011266032001153002

Date of Calibration : 31 Mar, 2023

Date of Issue : 31 Mar, 2023

2 / 2

End of Certificate

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

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

FM.BLMTC.002 Rev.4

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Noise Dose R_413/23

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	19 September 2022
		Due Date	19 September 2023
Calibration Data			
Sound Level Meter Data		Calibration Data	
SIM No.	Brand	Model	Serial No.
NMD-B01	SVANTEK	SV-104IS	80840
Date		09 August 2023	
Actual Reading [dB]		Before Adjustment	
		113.6	
		After Adjustment	
		113.6	
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)			
113.63 ± 0.10 dB			

Calibrated by :

(Mr. Anan Longsom)

Approved by :

Noise Doc R_510/23

Noise Dose Meter Calibration Report

Acoustic Calibrator Data											
Brand	SVANTEK	Number	SV 01/60								
Model	SV34	Serial No.	33137								
Calibration Range	114 dB, 1000 Hz	Last Calibration	22 August 2023								
		Due Date	22 August 2024								
Calibration Data											
Sound Level Meter Data				Calibration Data							
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]						
					Before Adjustment	After Adjustment					
					NMD-B16	SVANTEK	SV-1041S	106120	04 October 2023	113.5	113.5
					NMD-B17	SVANTEK	SV-1041S	106122	04 October 2023	113.6	113.5
					NMD-B18	SVANTEK	SV-1041S	106123	04 October 2023	113.5	113.5
NMD-B19	SVANTEK	SV-1041S	106124	04 October 2023	113.5	113.5					
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.53± 0.10 dB						

Calibrated by :

(Mr. Anon Longsom)

Approved by :

เอกสารแนบ 5-8

เอกสารสอบเทียบเครื่องมือการตรวจวัดแสงสว่างในสถานประกอบการ



CALIBRATION LABORATORY Co.,LTD.

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



CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : LUX METER
MANUFACTURER : EXTECH INSTRUMENTS
MODEL / TYPE : 407026
SERIAL NO. : A.052323/A.052323 [LUX-R07]
CLID. NO. : 252201553
JOB CONTROL NO. : 230725081564

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

DATE OF RECEIVED : 25 July 2023

DATE OF ISSUED : 31 July 2023

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

Calibrated By : Suwit Phuanbusabong

Calibration Engineer



Approved By : Mongkol Yotsoontorn

Authorized Signatory

31 July 2023



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

Certificate No. Q23081564

F3-011-04/01-12

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

NOMENCLATURE : LUX METER
MANUFACTURER : EXTECH INSTRUMENTS
MODEL / TYPE : 407026
SERIAL NO. : A.052323/A.052323 [LUX-R07]
DATE OF CALIBRATION : 26 July 2023
DUE DATE OF CALIBRATION : 26 July 2024

ENVIRONMENT CONDITIONS :

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

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-18 by comparison with Photometer/Radiometer & Illuminance

Sensor which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

Photometer/Radiometer & Illuminance Sensor, Bentham Model ORM400/DH400VL S/N. 27710,27585/3.

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through Optical Test and Calibration Ltd.

Certificate No. 144408/ABU, Due Date 03 April 2024.

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:2022)"

Certificate No. Q23081564

F3-011-04/01-12

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

LUX METER

STD Applied (lux)	DUC Reading (lux)	Correction (lux)	Uncertainty \pm (% of rdg.)
100	102	-2	2.6
200	204	-4	2.6
300	304	-4	2.6
1000	1000	0	2.6
2000	1951	+49	2.6
3000	2950	+50	3.6

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 46 of 54

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

End of Certificate

Certificate No. Q23081564

F3-011-04/01-12

page 3 of 3



เอกสารแนบ 5-9

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับความร้อนในสถานประกอบการ



Certificate of Calibration

Certificate Number : SPR23090267-4 Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,
Bangkok 10900

Equipment Name : Area Heat Stress Monitor
Manufacturer : Quest Technologies
Model : QUESTemp 36
Serial Number : TEN040005
ID. Number : R04

Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 18 Sep 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 18 Sep 2023
Location of Calibration : In-Lab Recommend Due Date : 18 Sep 2024
Calibration Procedure : SP-CPT-04-13 Date of Issue : 19 Sep 2023

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 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. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr. Lapon Naimpoung
Calibration Officer

Approved by : 
(Mr. Nirut Loha)
Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23090267-4 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QRZ3-D176	26 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.
Quality Reborn Co., Ltd

SP-FM-04-15 rev.0



Result of Calibration

Certificate No. : SPR23090267-4 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET) Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

Temperature Accuracy in the Measurement. (DRY) Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

Temperature Accuracy in the Measurement. (GLOBE) Unit : $^{\circ}\text{C}$

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

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 -

SP-FM-04-15 REV.0



Certificate of Calibration

Certificate Number : SPR23030505-5 Page : 1 of 3
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road, Jompol, Chatuchak,
Bangkok 10900

Equipment Name : Area Heat Stress Monitor
Manufacturer : Metrosonics
Model : hs-32
Serial Number : MCD070035
ID. Number : R05
Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 30 Mar 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 31 Mar 2023
Location of Calibration : In-Lab Recommend Due Date : 31 Mar 2024
Calibration Procedure : SP-CPT-04-13 Date of Issue : 01 Apr 2023

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 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) Co., Ltd.

Calibrated by : Mr. Sarawut Khitmai
Calibration Officer

Approved by :
(Mr. Nirut Loha)
Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23030505-5 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QR23-0176	26 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co., Ltd.
Quality Reborn Co., Ltd

SP-FM-04-15 rev.0



Result of Calibration

Certificate No. : SPR23030505-5 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET) Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.013	29.9	-0.113	0.50
35.0	35.010	34.9	-0.110	0.50
40.0	40.015	39.9	-0.115	0.50

Temperature Accuracy in the Measurement. (DRY) Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.013	29.9	-0.113	0.50
35.0	35.010	34.9	-0.110	0.50
40.0	40.015	39.9	-0.115	0.50

Temperature Accuracy in the Measurement. (GLOBE) Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.013	29.8	-0.213	0.50
35.0	35.010	34.8	-0.210	0.50
40.0	40.015	39.8	-0.215	0.50

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 -

SP-FM-04-15 REV.0



Certificate of Calibration

Certificate Number : SPR23090267-2 Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phatolyuthin 24 Phatolyuthin Road, Jompol, Chulabhai,
Bangkok 10900

Equipment Name : Area Heat Stress Monitor
Manufacturer : Metrosonics
Model : hs-32
Serial Number : MCD070028
ID. Number : R06

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 18 Sep 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 18 Sep 2023
Location of Calibration : In-Lab Recommend Due Date : 18 Sep 2024
Calibration Procedure : SP-CPT-04-13 Date of Issue : 19 Sep 2023

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 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. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Lapon. Naimpoung

Calibration Officer

Approved by :

(Mr.Nirut Loha)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23090267-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QR23-0176	26 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.
Quality Reborn Co., Ltd

SP-FM-04-15 rev.0



Result of Calibration

Certificate No. : SPR23090267-2

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : $^{\circ}\text{C}$

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.013	40.1	0.087	0.20

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 -

SP-FM-04-15 REV.0



Certificate of Calibration

Certificate Number : SPR23030505-8 Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phatthayuthin 24 Phatthayuthin Road, Jungsri, Chatuchak,
Bangkok 10900Equipment Name : Area Heat Stress Monitor
Manufacturer : Quest Technologies
Model : QUESTemp 32
Serial Number : TPE070001
ID. Number : R12Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 30 Mar 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 31 Mar 2023
Location of Calibration : In-Lab Recommend Due Date : 31 Mar 2024
Calibration Procedure : SP-CPT-04-13 Date of Issue : 01 Apr 2023

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 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) Co., Ltd.

Calibrated by : Mr. Sarawut Khitmai
Calibration OfficerApproved by :
(Mr. Nirut Loha)
Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23030505-8 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due Date
Humidity Chamber	TH-80S	N/A	SPR23010480-5	22 Feb 2024
THERMO-HYGROMETER	5020A	A47046	QR23-0176	26 Jan 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
SP Metrology - SP Metrology system (Thailand) Co.Ltd.
Quality Reborn Co., Ltd

SP-FM-04-15 rev.0



Result of Calibration

Certificate No. : SPR23030505-8 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.013	30.0	-0.013	0.50
35.0	35.010	35.0	-0.010	0.50
40.0	40.015	40.0	-0.015	0.50

Temperature Accuracy in the Measurement. (DRY)

Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.013	30.0	-0.013	0.50
35.0	35.010	35.0	-0.010	0.50
40.0	40.015	40.0	-0.015	0.50

Temperature Accuracy in the Measurement. (GLOBE)

Unit : $^{\circ}\text{C}$

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (\pm)
30.0	30.013	30.1	0.087	0.50
35.0	35.010	35.1	0.090	0.50
40.0	40.015	40.1	0.085	0.50

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 -

SP-FM-04-15 REV.0

Heat Stress WBGT Meter Verification Report

Verification Data			
Heat Stress WBGT Meter No.	: R04	Verification Date	: 04 October 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TENO40005	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)	12.5	UUC* Reading (°C)	12.4
		Correction (°C)	0.1
			Tolerance Limit (°C)
			±0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	47.1	UUC* Reading (°C)	47.0
		Correction (°C)	0.1
			Tolerance Limit (°C)
			±0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	69.3	UUC* Reading (°C)	69.3
		Correction (°C)	0.0
			Tolerance Limit (°C)
			±0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :

(Mr. Adul Dangklom)

Approved by :

Heat Stress WBGT Meter Verification Report

Verification Data			
Heat Stress WBGT Meter No.	: R12	Verification Date	: 9 August 2023
Brand	: 3M	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPE070001	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)	12.5	UUC* Reading (°C)	12.4
		Correction (°C)	0.1
			Tolerance Limit (°C)
			± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	47.1	UUC* Reading (°C)	47.0
		Correction (°C)	0.1
			Tolerance Limit (°C)
			± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	69.3	UUC* Reading (°C)	69.3
		Correction (°C)	0.0
			Tolerance Limit (°C)
			± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by :

(Mr. Adul Dangklom)

Approved by :

Heat Stress WBGT Meter Verification Report

Verification Data					
Heat Stress WBGT Meter No.	: R06	Verification Date	: 04 October 2023		
Brand	: METROSONICS	Ambient Temp.	: 24.5 °C		
Model	: bs-32	Barometric Pressure	: 1011 mmbar		
Serial No.	: MCD070028	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)	12.5	UUC* Reading (°C)	12.6	Correction (°C)	-0.1
					Tolerance Limit (°C)
					±0.5
Dry Probe Temperature Measurement					
Verification Module Reading (°C)	47.1	UUC* Reading (°C)	47.0	Correction (°C)	0.1
					Tolerance Limit (°C)
					±0.5
Globe Probe Temperature Measurement					
Verification Module Reading (°C)	69.3	UUC* Reading (°C)	69.2	Correction (°C)	0.1
					Tolerance Limit (°C)
					±0.5
UUC* = UNIT UNDER CALIBRATION					

Verified by :

(Mr. Adul Dangklom)

Approved by :

Heat Stress WBGT Meter Verification Report

Verification Data					
Heat Stress WBGT Meter No.	: R05	Verification Date	: 04 October 2023		
Brand	: METROSONICS	Ambient Temp.	: 24.5 °C		
Model	: hr-32	Barometric Pressure	: 1011 mmbar		
Serial No.	: MCD070035	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)	12.5	UUC* Reading (°C)	12.5	Correction (°C)	0.0
					Tolerance Limit (°C)
					±0.5
Dry Probe Temperature Measurement					
Verification Module Reading (°C)	47.1	UUC* Reading (°C)	47.0	Correction (°C)	0.1
					Tolerance Limit (°C)
					±0.5
Globe Probe Temperature Measurement					
Verification Module Reading (°C)	69.3	UUC* Reading (°C)	69.3	Correction (°C)	0.0
					Tolerance Limit (°C)
					±0.5
UUC* = UNIT UNDER CALIBRATION					

Verified by :

(Mr. Adul Dangklom)

Approved by :

Heat R104

Heat Stress WBGT Meter Verification Report					
Verification Data					
Heat Stress WBGT Meter No.	: R05	Verification Date	: 29 October 2023		
Brand	: METROSONICS	Ambient Temp.	: 24.5	°C	
Model	: hr-32	Barometric Pressure	: 1011	mmbar	
Serial No.	: MCD070035	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	69.3	0.0	± 0.5		
UUC* = UNIT UNDER CALIBRATION					

Verified by : _____
(Mr.Adul Dangklorn)

Approved by : _____