

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

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ		
TSP	High Volume Air Sampler No. R04, R08, R10, R13	Digital Balance
PM ₁₀	High Volume PM ₁₀ Air Sampler No. R10, R11, R13, R15	Digital Balance
SO ₂	SO ₂ Analyzer No. R01, R02, R04, R05	SO ₂ Analyzer No. R01, R02, R04, R05
NO ₂	NO ₂ Analyzer No. R04, R05, R06, R07	NO ₂ Analyzer No. R04, R05, R06, R07
Acetaldehyde	Mass Flow Meter	GC/MS
คุณภาพอากาศจากปล่อง		
TSP	Console No. R05 Pitot Tube No. B24, B38	Digital Balance
NO _x	Vacuum Gauge	Spectrophotometer
SO ₂	Personal Pump SKC No. R13 Rotameter No. H-R01, H-R02	-
Acetaldehyde	Personal Pump SKC No. R13, R33 Rotameter No. L-R02, H-R02	GC/FID
Ethylene Glycol	Personal Pump SKC No. R28, R33 Rotameter No. L-R02, H-R02	GC/FID
ระดับเสียง		-
Leq 24 hr	Acoustic Calibrator	
Lmax	Sound Level Meter No. ACO-R06, R44	
L90		
คุณภาพน้ำ		
pH	-	pH Meter
BOD ₅	-	DO Meter
COD	-	COD Reactor
Total Suspended Solids	-	Digital balances
Total Dissolved Solids	-	Digital balances
Grease and Oil	-	Digital balances
Ethylene Glycol	-	GC/FID
Acetaldehyde	-	GC/MS

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ		
Acetaldehyde	Personal Pump No. R05, R12, R17, R21, R23, R25, R28, R33, R36, R44 Rotameter No. L-R05	GC/FID
Ethylene Glycol	Personal Pump No. R06, R21, R22, R23, R28, R33, R36, R38 Rotameter No. H-R05	GC/FID
Total Dust	Personal Pump No. R01, R02, R30, R31, R36, R40 Rotameter No. H-R05	Digital Balance
Respirable Dust	Personal Pump No. R02, R05, R12, R21, R29, R33, R34 Rotameter No. H-R05	Digital Balance
Phosphoric Acid	Personal Pump No. R03, R05, R15, R17, R36, R40 Rotameter No. L-R05	IC
Sodium Hydroxide	Personal Pump No. R12, R14, R15, R17, R22 R34 Rotameter No. H-R05	-
Sodium Hypochlorite as Sodium	Personal Pump No. R07, R36 Rotameter No. H-R05	ICP
Hydrogen Sulfide	Personal Pump No R08, R17 Rotameter No. L-R05	IC
Acetone	Personal Pump No. R01, R43 Rotameter No. L-R05	GC/FID
Ethanol	Personal Pump No. R01, R43 Rotameter No. L-R05	GC/FID
Chloroform	Personal Pump No. R28, R38 Rotameter No. L-R05	GC/FID
Phenol	Personal Pump No. R15, R36 Rotameter No. L-R05	GC/FID
Isopropyl Alcohol	Personal Pump No. R03, R17 Rotameter No. L-R05	GC/FID
Sulfuric Acid	Personal Pump No. R42 Rotameter No. L-R05	IC
Hydrochloric Acid	Personal Pump No. R40, R43 Rotameter No. H-R05	IC
Acetic Acid	Personal Pump No. R05, R12, R28 Rotameter No. L-R05	GC/FID

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
ระดับความร้อนในสถานประกอบการ WBGT	Heat Stress WBGT Meter No. B31, B32, B33, R04, R05, R06	-
ระดับความเข้มของแสงสว่างในสถาน ประกอบการ Light Intensity	Light Meter No. R07	-
ระดับเสียงในสถานประกอบการ Leq 12 hr Lmax	Acoustic Calibrator No. AC-CR01/63, SV 01/60	-
	Sound Level Meter No. CR-B03, CRB06, CRB10	-
	Noise Dose Meter No. NMD-B06	-
ปริมาณเสียงสะสมติดตัวพนักงาน Noise Dose	Acoustic Calibrator No. SV 01/60	-
	Noise Dosimeter No. NMD-B06, B07, B08, R20, R22, R35	-

เอกสารแนบ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ



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High Volume Air Sampler Calibration Report

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

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B35	B35	02/02/2024	y = 1.188x-3.435	0.996
B36	B36	01/02/2024	y = 1.201x-4.036	0.999
B37	B37	01/02/2024	y = 1.196x-2.671	0.998
B38	B38	02/02/2024	y = 1.232x-6.552	0.997
B39	B39	03/02/2024	y = 1.164x-0.902	0.997
B40	B40	01/02/2024	y = 1.225x-6.117	0.999
B41	B41	02/02/2024	y = 1.265x-6.140	0.999
B42	B42	02/02/2024	y = 1.187x-3.625	0.999
B43	B43	01/02/2024	y = 1.233x-2.707	0.997
B44	B44	01/02/2024	y = 1.202x-3.263	0.996
R01	R01	01/02/2024	y = 1.214x-4.512	0.999
R02	R02	02/02/2024	y = 1.222x-5.522	0.999
R03	R03	03/02/2024	y = 1.204x-5.785	0.999
R04	R04	01/02/2024	y = 1.220x-5.355	0.999
R05	R05	01/02/2024	y = 1.190x-5.262	0.997
R06	R06	02/02/2024	y = 1.223x-6.383	0.998
R07	R07	02/02/2024	y = 1.084x+0.577	0.999
R08	R08	01/02/2024	y = 1.167x-2.531	0.999
R09	R09	01/02/2024	y = 1.194x-3.227	0.998
R10	R10	02/02/2024	y = 1.198x-4.625	0.998
R11	R11	02/02/2024	y = 1.143x-2.176	1.000
R12	R12	02/02/2024	y = 1.165x-4.124	0.998
R13	R13	03/02/2024	y = 1.133x-1.833	0.997
R14	R14	01/02/2024	y = 1.216x-3.559	0.995
R15	R15	01/02/2024	y = 1.183x-5.143	0.999
R16	R16	01/02/2024	y = 1.227x-7.151	0.999
R17	R17	02/02/2024	y = 1.181x-3.964	0.996
R18	R18	02/02/2024	y = 1.195x-3.915	0.997
R19	R19	03/02/2024	y = 1.215x-6.609	1.000
R20	R20	03/02/2024	y = 1.208x-5.309	0.998

Calibrated by :

(Signature)

Approved by :

(Signature)



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High Volume PM-10 Air Sampler Calibration Report

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

Calibration Data

High Volume PM-10 Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
R01	R01	02/02/2024	y = 1.206x-5.952	0.998
R02	R02	02/02/2024	y = 1.219x-3.961	0.997
R03	R03	01/02/2024	y = 1.203x-5.426	0.998
R04	R04	01/02/2024	y = 1.191x-6.027	0.997
R05	R05	01/02/2024	y = 1.199x-5.883	1.000
R06	R06	01/02/2024	y = 1.192x-3.038	0.998
R07	R07	02/02/2024	y = 1.169x-2.670	0.996
R08	R08	02/02/2024	y = 1.186x-4.195	0.997
R09	R09	03/02/2024	y = 1.184x-3.512	1.000
R10	R10	03/02/2024	y = 1.179x-3.695	0.999
R11	R11	03/02/2024	y = 1.202x-2.389	0.997
R12	R12	01/02/2024	y = 1.194x-5.194	0.998
R13	R13	01/02/2024	y = 1.173x-2.754	0.999
R14	R14	01/02/2024	y = 1.176x-2.231	0.997
R15	R15	02/02/2024	y = 1.188x-3.910	0.998
R16	R16	02/02/2024	y = 1.180x-3.568	0.998
R17	R17	02/02/2024	y = 1.195x-3.126	0.996
R18	R18	03/02/2024	y = 1.143x-2.749	1.000
R19	R19	01/02/2024	y = 1.154x-2.002	0.996
R20	R20	01/02/2024	y = 1.161x-4.362	0.998

Calibrated by :

(Signature)

Approved by :

(Signature)



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

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

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

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-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

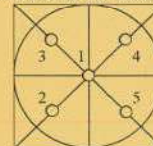
2. TARE FUNCTION : NORMAL

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)
0.00	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 MULTIPLY
COVERAGE FACTOR k=2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 February 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R01	SERIAL NO.	3415		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	08 August 2023		Serial No. :	911	
Reference Standard Gas					
Standard Gas :	Sulphur Dioxide (SO ₂)		Cylinder No. :	A008145K	
Certified Date :	21 June 2021	Expired Date :	21 June 2029	Cylinder Conc. :	49.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°C
% RH	49				
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	1.006
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	658	cc/min	650 ± 10%		
PMT	103.1	mV	-20-150 with Zero Air		
UV LAMP	3017.6	mV	1000-4900		
STR. LGT	61.9	PPB	<100		
DRK PMT	63.4	mV	-50 - 200		
DRK LMP	58.2	mV	-50 - 200		
HVPS	674	V	550-900 constant		
DCPS	2527	mV	2500 ± 200		
RCCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.5	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.006	-	1.0 ± 0.3		
SO ₂ Offset	22.2	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adui Dangkom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 February 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R02	SERIAL NO.	3431		
Calibrator (Dilution System)					
Brand :	API		Model :	700	
Last Cal. Date :	08 August 2023		Serial No. :	911	
Reference Standard Gas					
Standard Gas :	Sulphur Dioxide (SO ₂)		Cylinder No. :	A008145K	
Certified Date :	21 June 2021	Expired Date :	21 June 2029	Cylinder Conc. :	49.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°C
% RH	49				
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	400.1	0.025	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	28.4	in-Hg	25-35		
SAMPLE FLOW	660	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	3038.1	mV	1000-4900		
STR. LGT	61.7	PPB	<100		
DRK PMT	63.1	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	670	V	550-900 constant		
DCPS	2521	mV	2500 ± 200		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.4	°C	5-40		
PMT TEMP	7.5	°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	22.1	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adui Dangkom)

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร 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

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 February 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R04	SERIAL NO.	3489		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	08 August 2023	Serial No. :	911		
Reference Standard Gas					
Standard Gas :	Sulphur Dioxide (SO ₂)	Cylinder No. :	A008145K		
Certified Date :	21 June 2021	Expired Date :	21 June 2029	Cylinder Conc. :	49.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
SO ₂ Span	400.0	400.2	0.050	400.0	1.011
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.7	in-Hg	25-35		
SAMPLE FLOW	654	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3025.4	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	63.2	mV	-50 - 200		
DRK LMP	58.0	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2515	mV	2500 ± 200		
RCCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.2	°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	21.9	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	04 February 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R05	SERIAL NO.	3490		
Calibrator (Dilution System)					
Brand :	API	Model :	700		
Last Cal. Date :	08 August 2023	Serial No. :	911		
Reference Standard Gas					
Standard Gas :	Sulphur Dioxide (SO ₂)	Cylinder No. :	A008145K		
Certified Date :	21 June 2021	Expired Date :	21 June 2029	Cylinder Conc. :	49.8 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°C
% RH	49				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
SO ₂ Span	400.0	399.8	-0.050	400.0	1.008
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.6	in-Hg	25-35		
SAMPLE FLOW	655	cc/min	650 ± 10%		
PMT	103.0	mV	-20-150 with Zero Air		
UV LAMP	3010.2	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	57.7	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2518	mV	2500 ± 200		
RCCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.2	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.008	-	1.0 ± 0.3		
SO ₂ Offset	22.0	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	04 February 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R04	SERIAL NO.	4411		
Calibrator (Dilution System)					
Brand	API		Model	700	
Last Cal. Date	08 August 2023		Serial No.	911	
Reference Standard Gas					
Standard Gas	Nitric Oxide (NO)		Cylinder No.	D636192	
Certified Date	20 April 2022	Expired Date	20 April 2024	Cylinder Conc.	49.1 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.9	-0.025	400.0	1.009
NO _x Span	400	400.2	0.050	400.0	1.013
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	504	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.0	mV	-20 - 150		
AZERO	93.7	mV	-20 - 150		
HVPS	674	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	314.7	°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 _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.009	-	1.0 ± 0.3		
NO ₂ Slope	1.013	-	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 : 
(W.P. Adul Ungkiam)

Approved by : 



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	04 February 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R05	SERIAL NO.	4413		
Calibrator (Dilution System)					
Brand	API		Model	700	
Last Cal. Date	08 August 2023		Serial No.	911	
Reference Standard Gas					
Standard Gas	Nitric Oxide (NO)		Cylinder No.	D636192	
Certified Date	20 April 2022	Expired Date	20 April 2024	Cylinder Conc.	49.1 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.004
NO _x Span	400	399.9	-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	512	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.1	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	670	V	420 - 900 constant		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	314.9	°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 _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO ₂ Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.1	mV	-20 to +150		
NO ₂ Offset	0.7	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : 
(W.P. Adul Ungkiam)

Approved by : 



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	04 February 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R06	SERIAL NO.	4466		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
			Cylinder Conc.	: 49.1 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	399.7	-0.075	400.0	1.007
NO _x Span	400	400.1	0.025	400.0	1.011
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.2	mV	-20 - 150		
HVPS	673	V	420 - 900 constant		
RCCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	8 - 48		
PMT TEMP	7.2	°C	7 ± 2		
MOLY TEMP	315.4	°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 _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.007	-	1.0 ± 0.3		
NO _x Slope	1.011	-	1.0 ± 0.3		
NO Offset	1.2	mV	-20 to +150		
NO _x Offset	0.8	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Mr. Abdul Dangkom

Approved by :



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	04 February 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R07	SERIAL NO.	4468		
Calibrator (Dilution System)					
Brand	: API		Model	: 700	
Last Cal. Date	: 08 August 2023		Serial No.	: 911	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: D636192	
Certified Date	: 20 April 2022		Expired Date	: 20 April 2024	
			Cylinder Conc.	: 49.1 ppm	
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.4	°C
			% RH	49	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.010
NO _x 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	508	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.9	mV	-20 - 150		
AZERO	93.8	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCCELL PRESS	8.3	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.010	-	1.0 ± 0.3		
NO _x Slope	1.014	-	1.0 ± 0.3		
NO Offset	1.7	mV	-20 to +150		
NO _x Offset	1.0	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Mr. Abdul Dangkom

Approved by :



Certificate of Calibration

Certificate Number : SPR23050422-1 Page : 1 of 3

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

Equipment Name : Mass Flow Meter

Manufacturer : Dwyer

Model : GMF-2101

Serial Number : N/A

ID. Number : MF01/51

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 26 May 2023

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 29 May 2023

Location of Calibration : In-Lab Recommend Due Date : 29 May 2024

Calibration Procedure : SP-CPM-04-13 Date of Issue : 30 May 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 to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

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

Calibrated by : Mr. Jirasak Pumbut

Calibration Officer

Approved by

(Mr. Prayoon Topart)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR23050422-1 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Mass Flow Calibrator	AFC-COMplete-10	12532	AD2207-177-0001	17 Jul 2023
Standard Flow Meter	520-H	200353	MW-0071-22	25 Aug 2023

Traceability

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

MesaLabs - Mesa Laboratories, Inc. NVLEP Lab Code 200661-0 (ISO17025)

SP-FM-04-15 rev.0



Result of Calibration

Certificate No. : SPR23050422-1

Page : 3 of 3

Function : Air Flow Measurement

Unit : mL/min

Calibration Point	UUC Reading	Standard Reading	UUC Error	K Factor Value	Uncertainty (±)
0.0	0.00	0.00	0.00	1.00000	0.12
3.3	3.42	3.59	-0.17	1.04971	0.26
7.3	7.52	7.78	-0.26	1.03457	0.26
13.5	13.83	14.34	-0.51	1.03688	0.26
17.0	17.12	17.65	-0.53	1.03096	0.26

Note:

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

Measurement Uncertainty

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

- End of Certificate -

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

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)

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_CN10925102Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

Name: 7890

Setpoint Status: Pass

Base Signal: 89800 Ab

ASTM Noise counts	Drift counts/Hr
285.31	96.04
<= 768.00	<= 19200.00

Agilent Recommended: Pass

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

Tested Combination2	Back	SSL	/ External	SQ
Name:	5975C			
Setpoint Status:	Pass			
Amu:	1050	m/z	Drift After Five Minutes:	1 mV
Agilent Recommended:	>= -100	and	<= 1100	<= 1100 mV
RFPA Voltage:	479 mV			

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

Source:

EI - Inert

Filament:

2

Setpoint Status:

Pass

Signal to Noise:

566

Agilent Recommended:

>= 160

Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose
This section describes the as found system configuration.

Details	
System	
System ID	GC_MS_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

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

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

Electronic Signature

Purpose

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

Details

Full Name of Signer: 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-CQ39KOMV
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 9:12:26 AM	Audit	SessionCreated	Session	None
March 31, 2023 9:12:29 AM	Start	Configuration	Session	None
March 31, 2023 9:12:26 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/Go/Configurations/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 [GoMs] - File path: [ProtocolPacks/GoMs/Configurations/02.50/GoMs.02.50.eqp], EQP File Name: [GoMs.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 - 7690: - Qualitative Test - No setpoints associated	None
March 31, 2023 9:21:33 AM	End	Execution	System Inspection and Basic Safety and Operation - 7690: - Qualitative Test - No setpoints associated	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 9:21:35 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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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 9:22:46 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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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-CQ39KOMV

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 9:26:42 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
March 31, 2023 9:27:39 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	
March 31, 2023 9:55:59 AM	Start	Execution	RFPA - 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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User Name: saenguthai.tarak
Hostname: LAPTOP-CQ39KOMV

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 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 10:46:28 AM	Audit	Data	GC Scouting Run - Manual Injection, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : F:\Data\SC_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\IND_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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Date: March 31, 2023 1:21:52 PM
System ID: GC_MS_03_52_CN10925102

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User Name: saunguthai.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 11:15:13 AM	Audit	AcqRestarted	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	AcqClosed	Session	None
March 31, 2023 11:21:04 AM	Audit	AcqRestarted	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: - Detector FID - L: >= 300000	Data files 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	
March 31, 2023 11:24:31 AM	End	Execution	Log Amp - 5975C SQ: - Source: Run Count : 1 EI - Inert	

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User Name: saunguthai.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 11:24:33 AM	Start	Execution	RFPA - 5975C SQ: - Source: EI None - Inert	
March 31, 2023 11:27:22 AM	End	Execution	RFPA - 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 11:28:06 AM	Start	Execution	Tune EI - 5975C SQ: - Source: - None EI - Inert Filament 2 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:26 AM	End	Execution	Tune EI - 5975C SQ: - Source: - Run Count : 1 EI - Inert Filament 2 (Qualitative - No setpoints associated)	
March 31, 2023 11:28:26 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\DATA5IM.S
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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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_CN10925120 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\DATASIM.MS
March 31, 2023 1:02:09 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

เอกสารแนบ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง



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

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	DH _g (mmH ₂ O)
B01	1563	01/12/2023	0.998	50.05
B02	8002514	02/12/2023	1.006	49.58
B03	1503016	01/12/2023	1.003	50.16
B04	00006659	04/12/2023	0.998	49.71
B05	00007428	04/12/2023	0.999	49.24
R01	1561	02/12/2023	1.005	49.98
R02	8002513	03/12/2023	1.003	49.90
R03	1570	04/12/2023	0.996	49.68
R04	8002519	01/12/2023	1.002	49.43
R05	1503015	01/12/2023	0.997	50.24

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

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

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	01/02/2024	0.84	0.83
B04	S	0.99	02/02/2024	0.85	0.84
B05	S	0.99	02/02/2024	0.84	0.84
B07	S	0.99	01/02/2024	0.84	0.85
B08	S	0.99	01/02/2024	0.83	0.84
B09	S	0.99	03/02/2024	0.84	0.85
B11	S	0.99	03/02/2024	0.84	0.84
B16	S	0.99	01/02/2024	0.83	0.84
B18	S	0.99	02/02/2024	0.84	0.84
B19	S	0.99	02/02/2024	0.84	0.83
B21	S	0.99	01/02/2024	0.84	0.85
B24	S	0.99	02/02/2024	0.85	0.84
B27	S	0.99	01/02/2024	0.84	0.84
B30	S	0.99	02/02/2024	0.84	0.83
B31	S	0.99	02/02/2024	0.84	0.85
B33	S	0.99	01/02/2024	0.84	0.84
B35	S	0.99	01/02/2024	0.85	0.84

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

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



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

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B36	S	0.99	02/02/2024	0.84	0.83
B37	S	0.99	02/02/2024	0.84	0.84
B38	S	0.99	01/02/2024	0.84	0.84
B39	S	0.99	02/02/2024	0.85	0.84
B40	S	0.99	02/02/2024	0.84	0.83
B41	S	0.99	01/02/2024	0.84	0.85
B44	S	0.99	01/02/2024	0.85	0.84
B45	S	0.99	02/02/2024	0.83	0.84
B46	S	0.99	01/02/2024	0.84	0.85
B47	S	0.99	03/02/2024	0.84	0.84
B48	S	0.99	03/02/2024	0.84	0.85
B49	S	0.99	01/02/2024	0.83	0.84
B54	S	0.99	01/02/2024	0.84	0.85
B56	S	0.99	02/02/2024	0.84	0.84
B57	S	0.99	01/02/2024	0.83	0.84
B58	S	0.99	02/02/2024	0.84	0.85

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

Calibrated by :

(Mr. Adul Dangklom)

Approved by :



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

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

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

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

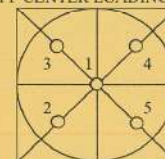
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
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 : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
31 July 2023



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

Certificate No. Q23081570

F3-011-04/01-12

page 1 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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



REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. MP-0035-23, Due Date 02 February 2024.

UNCERTAINTY :

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

Certificate No. Q23081570

F3-011-04/01-12

page 2 of 3



@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (kPa)		Conversion to inHg		Correction (inHg)	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-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



SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

Calibration Certificate

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

SITHIPORN
associates

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

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

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

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

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

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
R01	SKC	224-PCXR4	602467	03/01/2024	1,000	1,500	2,000	992	1,508	2,005	1.008x - 15.012	1.000
R02	SKC	224-PCXR4	626450	04/01/2024	1,000	2,000	3,000	998	1,499	1,990	0.989x + 12.189	1.000
R03	SKC	224-PCXR4	691592	03/01/2024	1,000	1,500	2,000	1,004	1,500	2,004	1.012x - 22.718	0.999
R04	SKC	224-PCXR4	691672	04/01/2024	1,000	1,500	2,000	996	1,493	1,996	0.998x - 2.002	1.000
R05	SKC	224-PCXR4	798470	03/01/2024	1,000	1,500	2,000	993	1,507	1,999	1.013x - 29.199	0.999
R06	SKC	224-PCXR4	798456	04/01/2024	1,000	1,500	2,000	997	1,498	1,996	1.002x - 6.760	1.000
R07	SKC	224-PCXR4	798480	05/01/2024	1,000	1,500	2,000	994	1,492	1,999	1.008x - 16.153	1.000
R08	SKC	224-PCXR4	883215	05/01/2024	1,000	1,500	2,000	1,012	1,500	2,005	0.999x + 3.725	1.000
R09	SKC	224-PCXR4	034650	05/01/2024	1,000	1,500	2,000	991	1,504	2,001	1.018x - 36.179	0.999
R10	SKC	224-PCXR4	091765	03/01/2024	1,000	1,500	2,000	997	1,511	1,994	1.000x + 0.499	1.000
R11	SKC	224-PCXR4	091763	04/01/2024	1,000	1,500	2,000	1,000	1,499	2,002	1.012x - 24.042	0.999
R12	SKC	224-PCXR4	091568	03/01/2024	1,000	1,500	2,000	996	1,500	2,000	1.003x - 7.698	1.000
R13	SKC	224-PCXR4	091638	04/01/2024	1,000	1,500	2,000	1,002	1,501	1,991	0.989x + 14.781	1.000
R14	SKC	224-PCXR4	091764	03/01/2024	1,000	1,500	2,000	994	1,503	1,999	1.014x - 30.292	0.999
R15	SKC	224-PCXR8	529457	03/01/2024	1,000	1,500	2,000	1,001	1,500	2,004	1.006x - 11.543	1.000
R16	SKC	224-PCXR8	529643	05/01/2024	1,000	1,500	2,000	998	1,495	1,994	0.999x - 3.450	1.000
R17	SKC	224-PCXR8	529645	04/01/2024	1,000	1,500	2,000	995	1,509	2,001	1.015x - 30.890	0.999
R18	SKC	224-PCXR8	566756	04/01/2024	1,000	1,500	2,000	991	1,498	1,998	1.001x - 6.800	1.000
R19	SKC	224-PCXR8	566802	04/01/2024	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.772	0.999
R20	SKC	224-PCXR8	529089	05/01/2024	1,000	1,500	2,000	991	1,500	2,003	1.020x - 39.390	0.999
R21	SKC	224-PCXR8	665728	03/01/2024	1,000	1,500	2,000	998	1,495	1,999	1.000x - 3.937	1.000
R22	SKC	224-PCXR8	707444	03/01/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.005x - 8.595	1.000
R23	SKC	224-PCXR8	761067	03/01/2024	1,000	1,500	2,000	998	1,491	1,991	0.993x + 3.358	1.000
R24	SKC	224-PCXR8	707893	04/01/2024	1,000	1,500	2,000	996	1,508	2,000	1.008x - 16.660	0.999
R25	SKC	224-PCXR8	761052	04/01/2024	1,000	1,500	2,000	1,010	1,496	1,995	0.985x + 21.199	1.000
R26	SKC	224-PCXR8	707956	04/01/2024	1,000	1,500	2,000	1,002	1,500	2,005	1.010x - 16.732	1.000
R27	SKC	224-PCXR8	707398	03/01/2024	1,000	1,500	2,000	996	1,500	2,002	1.007x - 16.201	1.000
R28	SKC	224-PCXR8	707481	05/01/2024	1,000	1,500	2,000	1,004	1,501	2,002	1.010x - 19.878	0.999
R29	SKC	224-PCXR8	707402	05/01/2024	1,000	1,500	2,000	1,003	1,494	1,989	0.986x + 16.137	1.000
R30	SKC	224-PCXR8	093811	05/01/2024	1,000	1,500	2,000	1,000	1,493	1,993	0.995x + 4.371	1.000
R31	SKC	224-PCXR8	093183	05/01/2024	1,000	1,500	2,000	1,001	1,501	2,000	1.002x - 2.800	1.000
R32	SKC	224-PCXR8	671950	05/01/2024	1,000	1,500	2,000	998	1,501	1,993	0.996x + 4.136	1.000
R33	SKC	224-PCXR4	626254	03/01/2024	1,000	1,500	2,000	994	1,502	2,000	1.015x - 32.298	0.999
R34	SKC	224-PCXR4	626131	03/01/2024	1,000	1,500	2,000	1,002	1,499	2,004	1.007x - 12.157	1.000
R35	SKC	224-PCXR8	707460	04/01/2024	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.098	1.000
R36	SKC	224-PCXR8	707446	04/01/2024	1,000	1,500	2,000	1,004	1,498	2,001	1.009x - 18.630	0.999
R37	SKC	224-PCXR8	707432	04/01/2024	1,000	1,500	2,000	996	1,499	2,000	1.000x - 1.827	1.000
R38	SKC	224-PCXR8	707349	03/01/2024	1,000	1,500	2,000	997	1,500	2,002	1.003x - 7.889	1.000
R39	SKC	224-PCXR8	761095	03/01/2024	1,000	1,500	2,000	1,001	1,497	1,994	0.998x + 1.193	1.000

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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.7	994.0	1980.7	1.000x - 3.859	0.999
H-R02	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	500.8	999.1	1988.7	1.001x - 2.909	1.000
H-R03	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.7	990.3	1997.7	0.993x + 3.830	1.000
H-R04	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	496.8	992.2	2016.5	1.007x - 11.486	1.000
H-R05	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	499.6	992.9	1990.7	1.002x - 4.797	1.000
H-R06	Dwyer	VFB-65	05/01/2024	500	1,000	2,000	505.2	995.4	1982.6	0.999x - 1.343	0.999

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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	03/01/2024	50	100	200	50.8	101.0	204.3	$0.982x + 3.092$	0.999
L-R02	Dwyer	VFA-21	04/01/2026	50	100	200	50.1	102.0	201.4	$1.006x - 0.301$	0.999
L-R03	Dwyer	VFA-21	03/01/2024	50	100	200	50.1	100.2	202.3	$1.013x - 0.675$	1.000
L-R04	Dwyer	VFA-21	03/01/2024	50	100	200	50.2	100.9	201.2	$1.007x - 0.709$	0.999
L-R05	Dwyer	VFA-21	04/01/2024	50	100	200	50.2	101.0	201.4	$0.993x + 1.253$	1.000
L-R06	Dwyer	VFA-21	05/01/2024	50	100	200	51.0	100.2	202.3	$1.001x + 0.832$	1.000

Calibrated by :

(Mr.Adul Dangklom)

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. : 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.



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

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

APPROVED

Signature

Engineer : Suwarot Trikanut

Date : 09/08/2023



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



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., 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	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



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

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	09/08/2023	



Comments			
Reviewed by		Date	09/08/2023



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

Sample ID: **fid std**

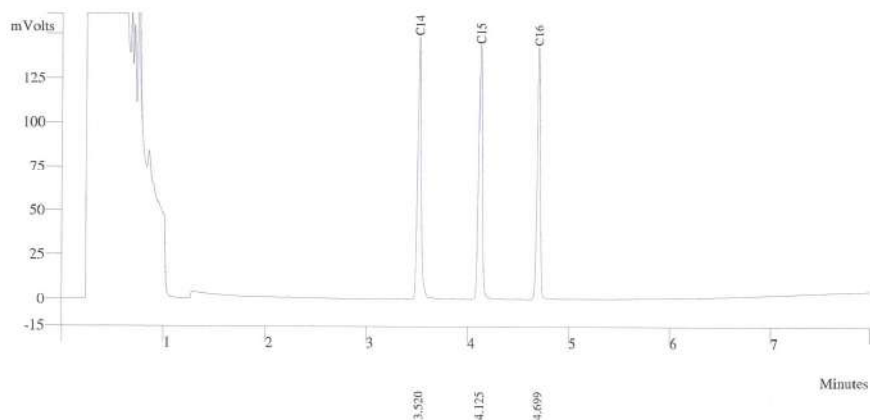
Operator (Ini): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		

Sample ID: **fid std**

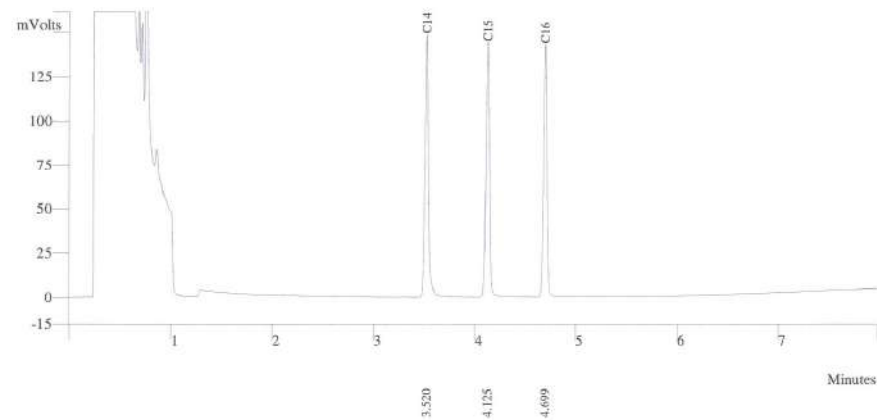
Operator (Ini): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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**

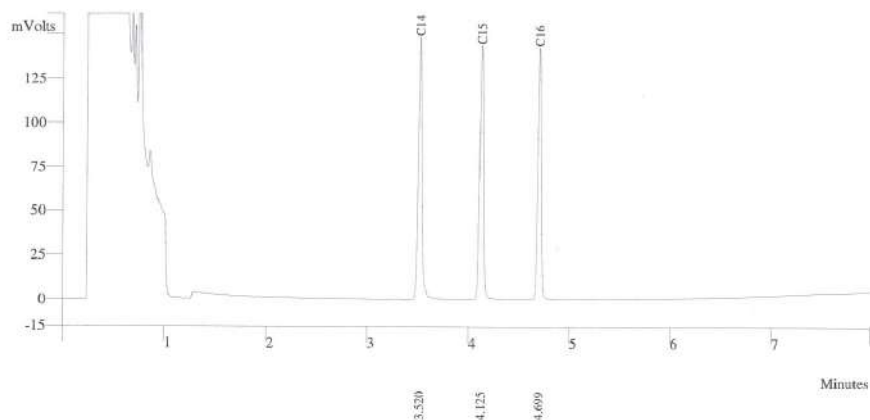
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		

Sample ID: **fid std**

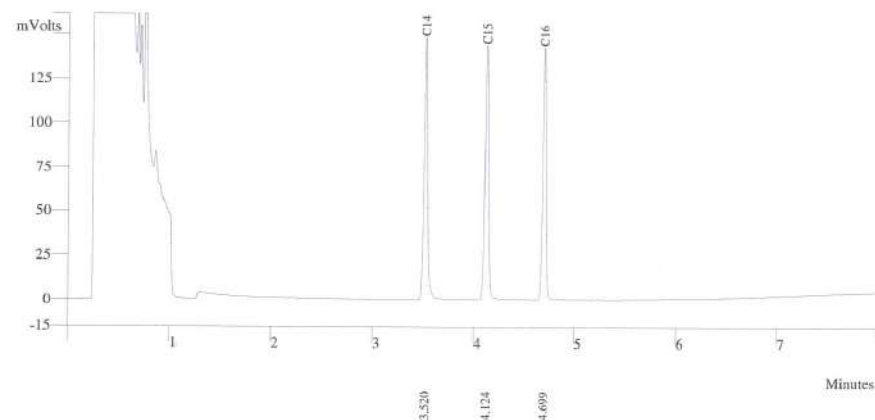
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		



Sample ID: **fid std**

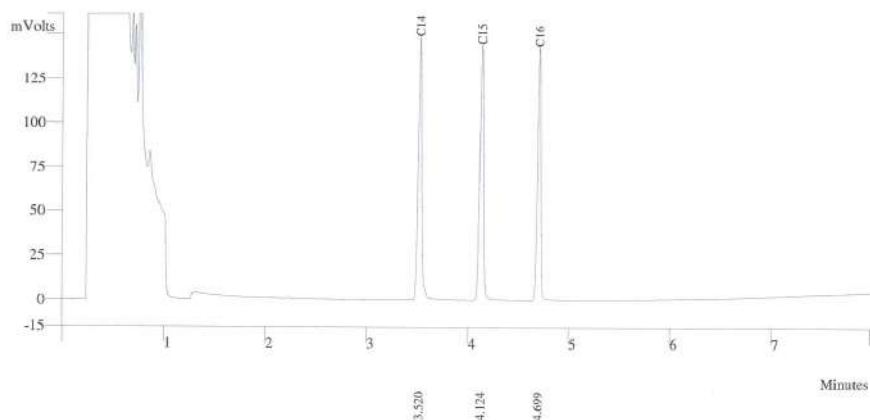
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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



Agilent Technologies

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 %

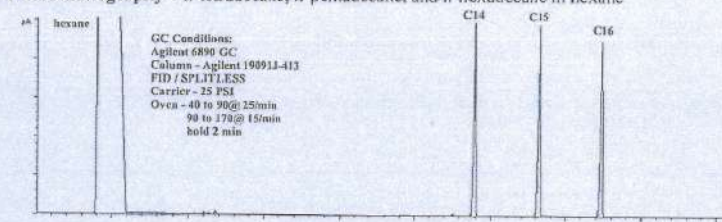
Solvent: hexane

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/NCSL 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 Trikainut

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 :

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 : 27 Mar. 2023

Date of Calibration : 29 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.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 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	93.94	-0.06	± 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	1.80	± 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.Weerachai Deechaiyap)

Approved by :

(Mr.Prawate Klunaypa)

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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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, Chatchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Noise R_081/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R06	ACO	6236	00152005	04 February 2024	94.0	94.0
ACO-R44	ACO	6236	00192056	04 February 2024	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.94 ± 0.10 dB	

Calibrated by :

(Mr.Adul Dangklom)

Approved by :

เอกสารแนบ 5-4

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง

**QUALITY CALIBRATION CO.,LTD.**

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



CERTIFICATE No : 23E8494
REFERENCE No : 70413-1

PAGE : 1 OF 3

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 06-Sep-23

APPROVED BY : 

ISSUED DATE : 06-Sep-23

RECEIVED DATE : 31-Aug-23

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

F-G010 REV 03

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkae, 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 ELECTRODE WAS CALIBRATED BY USING STANDARD pH BUFFER
2. REFERENCE STANDARD INSTRUMENTS :-

<u>INSTRUMENT</u>	<u>MODEL</u>	<u>SERIAL No/ LOT No</u>	<u>CERTIFICATE No</u>	<u>DUE DATE</u>
1) pH STANDARD SOLUTION	00651-06	CC767907	4880-13836406	29-Dec-24
2) pH STANDARD SOLUTION	00651-08	CC765602	4881-13757019	18-Nov-24
3) pH STANDARD SOLUTION	00651-10	CC767180	4882-13813369	14-Dec-24
4) PROCESS CALIBRATOR	CA150	91S6079	23E1312	19-Apr-24
5) BATH	260014	1247 48074	22T9870	13-Sep-23
6) THERMOMETER WITH PROBE	421504	55000379	22T9904	13-Sep-23

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

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

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3

**QUALITY CALIBRATION CO.,LTD.**

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

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

CERTIFICATE No : 23E8494

PAGE : 3 OF 3

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

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

3. DISPLAY UNIT WITH TEMPERATURE

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

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



CERT.No.: HS-U017D

Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 24, Pracharatbamphen,
Samsaennok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com

Certificate of Calibration

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

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

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.

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

(Natenapha Pisatkhon)



CERT.No.: HS-V015C

Harikul Science Co.,Ltd.
694 Soi Ratchadanivet 24, Pracharatbamphen,
Samsaennok, Huaikhwang, Bangkok 10310
Tel: 0-2274-2456 Fax: 0-2274-2443
Email: info@harikul.com www.harikul.com

Certificate of Calibration

Calibration Date : 20 Mar 24

Submitted by : ASIA LAB @ CONSULTANT CO.,LTD

184 Soi Phutthamonthon Sai 2 Soi 12,
Bangphai, Bangkae, Bangkok 10160

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 15B100751

Probe : YSI 5010

S/N : 22D100097

ID NO. : -

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : S/N. 11430

Technician : Kittipong M.

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

(Supreecha Sumaritam)

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.com

CERTIFICATE No : 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-23APPROVED BY : ISSUED DATE : 07-Feb-23RECEIVED 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, Bangkae, 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	22T7511	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
	2	149.5
	3	149.4
	4	149.4
	5	149.7
	6	149.4
	7	149.6
	8	149.3
	9	149.6
	10	149.7
	11	149.5
	12	149.4
	13	149.3
	14	149.4
	15	149.6
Uncertainty of Measurement(± °C)		0.86

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

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

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

END OF CALIBRATION REPORT

F-G

**QUALITY CALIBRATION CO.,LTD.**

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

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

www.qcalibration.comCERTIFICATE No : 24T0774
REFERENCE No : 71986-2

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

MODEL : DRB 200

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 : 5-Feb-24

APPROVED BY : 

ISSUED DATE : 5-Feb-24

RECEIVED DATE : 5-Feb-24

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

P-G010 REV : 02

**QUALITY CALIBRATION CO.,LTD.**

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

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

CERTIFICATE No : 24T0774

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

ID NUMBER : CRB 05/59

RECEIVED DATE : 5-Feb-24

AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200

SERIAL NUMBER : 15110C0235

CALIBRATION DATE : 5-Feb-24

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	23T6640	14-Jul-24

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	150.2
	2	150.2
	3	150.2
	4	149.9
	5	150.1
	6	150.7
	7	149.9
	8	149.9
	9	150.8
	10	149.5
	11	150.2
	12	150.0
	13	149.5
	14	149.5
	15	149.6
Uncertainty of Measurement(± °C)		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 MUL
COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

F-G0



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



CERTIFICATE No : 23M2442

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW

MANUFACTURER : SARTORIUS S/N : 36591843

ID No : BA 09/61 RECEIVED DATE : 10-Mar-23

AIR PRESSURE : 1010mbar \pm 1mbar CALIBRATION DATE : 10-Mar-23

AMBIENT TEMPERATURE : 23° C \pm 1° C RELATIVE HUMIDITY : 49 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-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

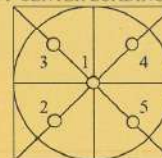
2. TARE FUNCTION : NORMAL

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	0.000058
0.1	0.1000	0.0000	0.000059
0.2	0.2000	0.0000	0.000059
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 MULTI
COVERAGE FACTOR $k=2$, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT



CERTIFICATE No : 24M2229
REFERENCE No : 72448-3

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY :

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2229

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

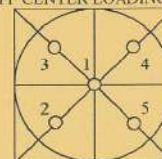
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



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. : 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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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



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



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., 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	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



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

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	09/08/2023	



Comments			
Reviewed by		Date	09/08/2023



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

Sample ID: **fid std**

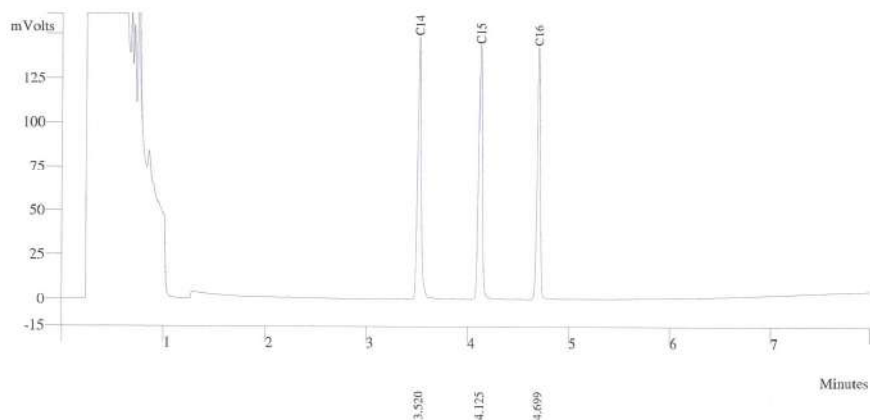
Operator (Ini): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		

Sample ID: **fid std**

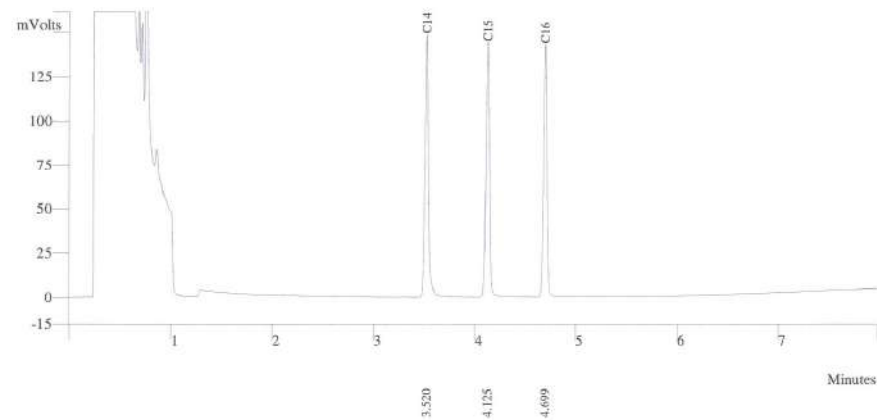
Operator (Ini): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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**

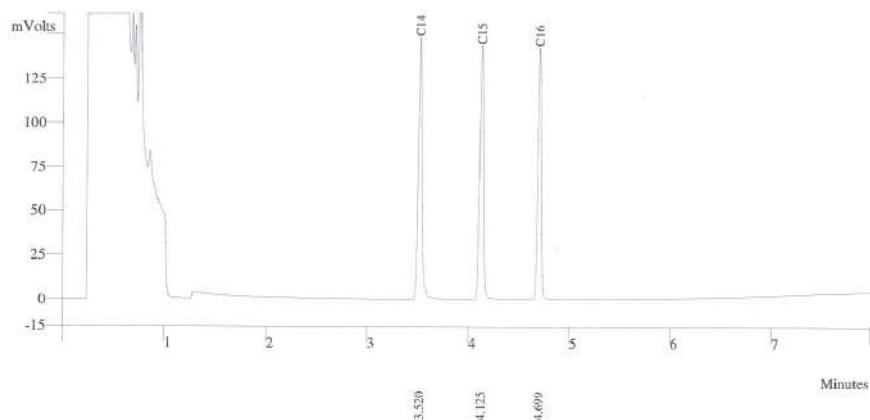
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		

Sample ID: **fid std**

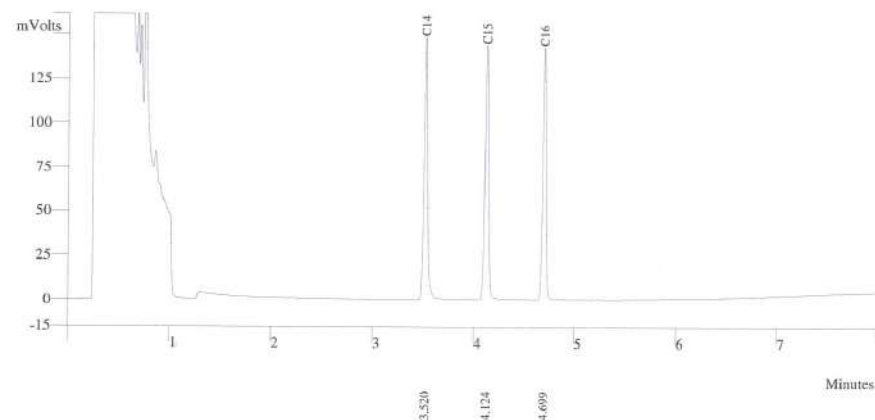
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		



Sample ID: **fid std**

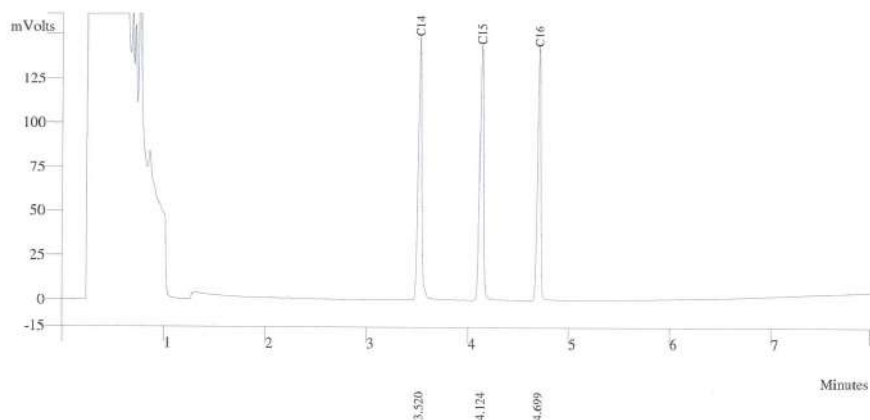
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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



Agilent Technologies

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 %

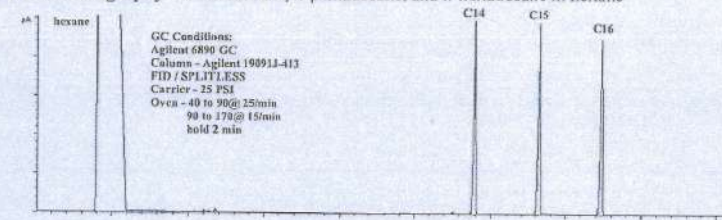
Solvent: hexane

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/NCSL 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 Trikainut

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. Pontongkam

Service Manager

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

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

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 µL

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

Name: 7890

Setpoint Status: Pass

Base Signal: 89800 Ab

	ASTM Noise counts	Drift counts/Hr
Agilent Recommended:	285.31	96.04
Status:	<= 768.00 Pass	<= 19200.00 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

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 and <= 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: >= 160

Overall Signal to Noise EI Test Status

Pass

Instrument Details

Purpose
This section describes the as found system configuration.

Details

System	
System ID	GC_MS_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

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

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

Electronic Signature

Purpose

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

Details

Full Name of Signer: 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-CQ39KOMV
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 9:12:26 AM Audit		SessionCreated	Session	None
March 31, 2023 9:12:28 AM Start		Configuration	Session	None
March 31, 2023 9:12:26 AM Audit		Entitlement	Licensing	User is Nonpaying and does not require an unlock code
March 31, 2023 9:20:14 AM Audit		EcpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/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 [GoMs] - File path: [ProtocolPacks/GoMs/Configurations/02.50/GoMs.02.50.eqp], EQP File Name: [GoMs.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

User Name: saenguthai.tarak
Hostname: LAPTOP-CQ3S8KOMV

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

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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-CQ3S8KOMV

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 9:26:00 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-CQ38KOMV

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 9:26:42 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.3°C	None
March 31, 2023 9:27:39 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: EI - Inert	None
March 31, 2023 9:55:59 AM	Start	Execution	RFPA - 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: - 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-CQ38KOMV

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 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 files Path : F:\Data\SC_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\ND_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-CQ38KOMV

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 11:15:13 AM	Audit	AceRestarted	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	AceClosed	Session	None
March 31, 2023 11:21:04 AM	Audit	AceRestarted	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: - Detector FID - L: >= 300000	Data files 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: EI - Inert	None
March 31, 2023 11:24:31 AM	End	Execution	Log Amp - 5975C SQ: - Source: 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-CQ38KOMV

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 11:24:33 AM	Start	Execution	RFPA - 5975C SQ: - Source: EI - Inert	None
March 31, 2023 11:27:22 AM	End	Execution	RFPA - 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 files Path : F:\SN_F1_01.D\DATA9IM.MS
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.tarak
Hostname: LAPTOP-GQ3SKOMV


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\DATASIM.MS
March 31, 2023 1:02:09 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

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

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

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

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

General Instructions:

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

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Component List

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

Parts lists

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

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

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

Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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

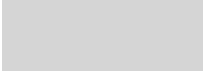

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

Calibration Certificate

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

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

SITHIPORN
associates

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

Continuation of Calibration Certificate

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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

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

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

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 4, 2024</u>
Address : <u>7 Soi Phaholyothin 24</u>	Recommendation Recertification
<u>Paholyothin Road</u>	Period <u>6</u> Months
Jompoi Chatuchak, Bangkok 1090	Recertification Due: <u>July 4, 2024</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>July 6, 2023</u>
Phone: <u>083-9269252</u>	Visit Number: <u>2 of 2</u>
Fax: <u>02-513-4221</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
	PerkinElmer Fax: <u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>February 28, 2024</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

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

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 DATE TESTED : January 4, 2024

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 4, 2024

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:

(Mr. Wiphan Promlumda)

Service Engineer



PinAAcle 900T Preventive Maintenance Report

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

Instrument Location: AAS Room

Instrument Serial No.: PTCS14111103

Date: 04-Jan-2024

PinAAcle 900T Preventive Maintenance (PM)

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

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

Scope

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

The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Configuration Notes

Parts Lists

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

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

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

Additional Tools Required for PM			
Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	MG0-252
N1013002	1.0A Neutral density filter	1	MG2-358
B3100652 Or N9307029	Electronic Flow Meter	1	N/A
B0505495	Test Jig	1	N/A
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	092216-010130
N3050109	Ba Lumina HCL	1	1-2416--040160
N3050139	K Lumina HCL	1	110716-010060
N3050152	Ni Lumina HCL	1	100516-030190
N3050119	Cr Lumina HCL	1	091911-020150

Procedure Checklist

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

1. General:

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

2. PC Instrument Software:

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

3. Mechanical:

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

3.1 Flame Technique

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

3.2 THGA Technique

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

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

4. Electrical:

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

5. Optics:

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

6. Gasses:

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

7. Flame Interlock Check:

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

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests [Flame]:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.		0.1789	Passed
0.2 A ND Filter	± 5% from Cert.		1.0186	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

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

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

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

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

8.4 D₂ Background Compensation with Copper

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

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

8.5 AA-BG Baseline Noise with Copper

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

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

8.6 AA-BG Baseline Noise with Arsenic

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

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

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

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

9. After PM Performance tests [THGA]:

9.1 Furnace Gas Flows

Description: Ensures the flow rates are within specification.

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

9.2 Chromium Baseline Noise

Description: Signal to noise check.

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

9.3 Chromium Characteristic Mass and Precision

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

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

9.4 Copper Characteristic Mass and Zeeman Ratio

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

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

10. Review:

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

Additional Comments

Additional Comments Regarding the PM

Zeeman Ratio

Atomic Signal (Peak area)

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

0.1602

0.2940

0.544

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900T have been completed.

This PinAAcle 900T

Passes

Fails

 the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative

Date:

04-Jan-2024

(DD-MMM-YYYY)

Authorized Customer Representative:

Date:

04-Jan-2024

(DD-MMM-YYYY)

เอกสารแนบ 5-5

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในสถานประกอบการ



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)					
					1	2	3	1	2	3	y	R ²	
R01	SKC	224-PCXR4	602467	03/01/2024	1,000	1,500	2,000	992	1,508	2,005	1.008x - 15.012	1.000	
R02	SKC	224-PCXR4	626450	04/01/2024	1,000	1,500	2,000	998	1,499	1,990	0.989x + 12.189	1.000	
R03	SKC	224-PCXR4	691592	03/01/2024	1,000	1,500	2,000	1,004	1,500	2,004	1.012x - 22.718	0.999	
R04	SKC	224-PCXR4	691672	04/01/2024	1,000	1,500	2,000	996	1,493	1,996	0.998x - 2.002	1.000	
R05	SKC	224-PCXR4	798470	03/01/2024	1,000	1,500	2,000	993	1,507	1,999	1.013x - 29.199	0.999	
R06	SKC	224-PCXR4	798456	04/01/2024	1,000	1,500	2,000	997	1,498	1,996	1.002x - 6.760	1.000	
R07	SKC	224-PCXR4	798480	05/01/2024	1,000	1,500	2,000	994	1,492	1,999	1.008x - 16.153	1.000	
R08	SKC	224-PCXR4	883215	05/01/2024	1,000	1,500	2,000	1,012	1,500	2,005	0.999x + 3.725	1.000	
R09	SKC	224-PCXR4	034650	05/01/2024	1,000	1,500	2,000	991	1,504	2,001	1.018x - 36.179	0.999	
R10	SKC	224-PCXR4	091765	03/01/2024	1,000	1,500	2,000	997	1,511	1,994	1.000x + 0.499	1.000	
R11	SKC	224-PCXR4	091763	04/01/2024	1,000	1,500	2,000	1,000	1,499	2,002	1.012x - 24.042	0.999	
R12	SKC	224-PCXR4	091568	03/01/2024	1,000	1,500	2,000	996	1,500	2,000	1.003x - 7.698	1.000	
R13	SKC	224-PCXR4	091638	04/01/2024	1,000	1,500	2,000	1,002	1,501	1,991	0.989x + 14.781	1.000	
R14	SKC	224-PCXR4	091764	03/01/2024	1,000	1,500	2,000	994	1,503	1,999	1.014x - 30.292	0.999	
R15	SKC	224-PCXR8	529457	03/01/2024	1,000	1,500	2,000	1,001	1,500	2,004	1.006x - 11.543	1.000	
R16	SKC	224-PCXR8	529643	05/01/2024	1,000	1,500	2,000	998	1,495	1,994	0.999x - 3.450	1.000	
R17	SKC	224-PCXR8	529645	04/01/2024	1,000	1,500	2,000	995	1,509	2,001	1.015x - 30.890	0.999	
R18	SKC	224-PCXR8	566756	04/01/2024	1,000	1,500	2,000	991	1,498	1,998	1.001x - 6.800	1.000	
R19	SKC	224-PCXR8	566802	04/01/2024	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.772	0.999	
R20	SKC	224-PCXR8	529089	05/01/2024	1,000	1,500	2,000	991	1,500	2,003	1.020x - 39.390	0.999	
R21	SKC	224-PCXR8	665728	03/01/2024	1,000	1,500	2,000	998	1,495	1,999	1.000x - 3.937	1.000	
R22	SKC	224-PCXR8	707444	03/01/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.005x - 8.595	1.000	
R23	SKC	224-PCXR8	761067	03/01/2024	1,000	1,500	2,000	998	1,491	1,991	0.993x + 3.358	1.000	
R24	SKC	224-PCXR8	707893	04/01/2024	1,000	1,500	2,000	996	1,508	2,000	1.008x - 16.660	0.999	
R25	SKC	224-PCXR8	761052	04/01/2024	1,000	1,500	2,000	1,010	1,496	1,995	0.985x + 21.199	1.000	
R26	SKC	224-PCXR8	707956	04/01/2024	1,000	1,500	2,000	1,002	1,500	2,005	1.010x - 16.732	1.000	
R27	SKC	224-PCXR8	707398	03/01/2024	1,000	1,500	2,000	996	1,500	2,002	1.007x - 16.201	1.000	
R28	SKC	224-PCXR8	707481	05/01/2024	1,000	1,500	2,000	1,004	1,501	2,002	1.010x - 19.878	0.999	
R29	SKC	224-PCXR8	707402	05/01/2024	1,000	1,500	2,000	1,003	1,494	1,989	0.986x + 16.137	1.000	
R30	SKC	224-PCXR8	093811	05/01/2024	1,000	1,500	2,000	1,000	1,493	1,993	0.995x + 4.371	1.000	
R31	SKC	224-PCXR8	093183	05/01/2024	1,000	1,500	2,000	1,001	1,501	2,000	1.002x - 2.800	1.000	
R32	SKC	224-PCXR8	671950	05/01/2024	1,000	1,500	2,000	998	1,501	1,993	0.996x + 4.136	1.000	
R33	SKC	224-PCXR4	626254	03/01/2024	1,000	1,500	2,000	994	1,502	2,000	1.015x - 32.298	0.999	
R34	SKC	224-PCXR4	626131	03/01/2024	1,000	1,500	2,000	1,002	1,499	2,004	1.007x - 12.157	1.000	
R35	SKC	224-PCXR8	707460	04/01/2024	1,000	1,500	2,000	999	1,498	1,995	0.994x + 6.098	1.000	
R36	SKC	224-PCXR8	707446	04/01/2024	1,000	1,500	2,000	1,004	1,498	2,001	1.009x - 18.630	0.999	
R37	SKC	224-PCXR8	707432	04/01/2024	1,000	1,500	2,000	996	1,499	2,000	1.000x - 1.827	1.000	
R38	SKC	224-PCXR8	707349	03/01/2024	1,000	1,500	2,000	997	1,500	2,002	1.003x - 7.889	1.000	
R39	SKC	224-PCXR8	761095	03/01/2024	1,000	1,500	2,000	1,001	1,497	1,994	0.998x + 1.193	1.000	

Calibrated by :

(Mr. Adul Dangkom)

Approved by :



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve		
					Setting			Actual (Q std.)					
					1	2	3	1	2	3	y	R ²	
R40	SKC	224-PCXR4	612753	05/01/2024	1,000	1,500	2,000	1,001	1,502	2,003	1.013x - 23.923	0.999	
R41	SKC	224-PCXR4	626140	05/01/2024	1,000	1,500	2,000	992	1,509	2,001	1.016x - 31.995	0.999	
R42	SKC	224-PCXR4	626463	03/01/2024	1,000	1,500	2,000	998	1,494	1,999	1.000x - 2.397	1.000	
R43	SKC	224-PCXR4	626129	03/01/2024	1,000	1,500	2,000	1,003	1,501	2,005	1.012x - 20.899	0.999	
R44	SKC	224-PCXR4	602753	05/01/2024	1,000	1,500	2,000	1,002	1,496	1,993	0.995x + 3.007	1.000	
R45	SKC	224-PCXR4	626137	03/01/2024	1,000	1,500	2,000	992	1,505	2,002	1.019x - 37.144	0.999	

Calibrated by :

Approved by :



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)						
					1	2	3	1	2	3	y		R ²	
R01	SKC	224-PCXR4	602467	04/04/2024	1,000	1,500	2,000	994	1,506	2,006	1.009x - 15.012	1.000		
R02	SKC	224-PCXR4	626450	04/04/2024	1,000	1,500	2,000	999	1,497	1,989	0.988x + 13.944	1.000		
R03	SKC	224-PCXR4	691592	09/04/2024	1,000	1,500	2,000	1,006	1,498	2,005	1.011x - 20.963	0.999		
R04	SKC	224-PCXR4	691672	02/04/2024	1,000	1,500	2,000	998	1,491	1,995	0.996x + 0.630	1.000		
R05	SKC	224-PCXR4	798470	04/04/2024	1,000	1,500	2,000	995	1,508	1,998	1.010x - 23.496	0.999		
R06	SKC	224-PCXR4	798456	05/04/2024	1,000	1,500	2,000	998	1,500	1,997	1.001x - 5.085	1.000		
R07	SKC	224-PCXR4	798480	02/04/2024	1,000	1,500	2,000	996	1,491	2,002	1.009x - 17.430	1.000		
R08	SKC	224-PCXR4	883215	04/04/2024	1,000	1,500	2,000	1,010	1,502	2,007	1.001x + 0.255	1.000		
R09	SKC	224-PCXR4	034650	05/04/2024	1,000	1,500	2,000	994	1,503	2,003	1.017x - 34.105	0.999		
R10	SKC	224-PCXR4	091765	05/04/2024	1,000	1,500	2,000	998	1,497	1,996	1.001x - 3.929	1.000		
R11	SKC	224-PCXR4	091763	05/04/2024	1,000	1,500	2,000	1,001	1,501	2,001	1.010x - 21.251	0.999		
R12	SKC	224-PCXR4	091568	04/04/2024	1,000	1,500	2,000	997	1,500	2,002	1.004x - 9.014	1.000		
R13	SKC	224-PCXR4	091638	06/04/2024	1,000	1,500	2,000	1,003	1,503	1,993	0.990x + 13.944	1.000		
R14	SKC	224-PCXR4	091764	09/04/2024	1,000	1,500	2,000	995	1,501	1,998	1.013x - 27.899	0.999		
R15	SKC	224-PCXR8	529457	04/04/2024	1,000	1,500	2,000	1,002	1,501	2,003	1.005x - 8.870	1.000		
R16	SKC	224-PCXR8	529643	06/04/2024	1,000	1,500	2,000	999	1,497	1,995	1.000x - 4.367	1.000		
R17	SKC	224-PCXR8	529645	04/04/2024	1,000	1,500	2,000	997	1,507	2,003	1.012x - 23.233	0.999		
R18	SKC	224-PCXR8	566756	06/04/2024	1,000	1,500	2,000	992	1,499	1,999	1.002x - 7.159	1.000		
R19	SKC	224-PCXR8	566802	04/04/2024	1,000	1,500	2,000	1,002	1,497	2,002	1.011x - 21.211	0.999		
R20	SKC	224-PCXR8	529089	06/04/2024	1,000	1,500	2,000	994	1,501	2,004	1.013x - 24.274	1.000		
R21	SKC	224-PCXR8	665728	04/04/2024	1,000	1,500	2,000	1,000	1,496	1,998	0.999x - 1.264	1.000		
R22	SKC	224-PCXR8	707444	04/04/2024	1,000	1,500	2,000	1,001	1,501	2,004	1.006x - 10.948	1.000		
R23	SKC	224-PCXR8	761067	04/04/2024	1,000	1,500	2,000	997	1,493	1,992	0.994x + 2.840	1.000		
R24	SKC	224-PCXR8	707893	02/04/2024	1,000	1,500	2,000	997	1,507	1,998	1.006x - 14.466	0.999		
R25	SKC	224-PCXR8	761052	09/04/2024	1,000	1,500	2,000	1,009	1,494	1,996	0.987x + 17.592	1.000		
R26	SKC	224-PCXR8	707956	06/04/2024	1,000	1,500	2,000	1,003	1,500	2,004	1.009x - 15.934	0.999		
R27	SKC	224-PCXR8	707398	09/04/2024	1,000	1,500	2,000	995	1,502	2,003	1.008x - 17.956	1.000		
R28	SKC	224-PCXR8	707481	09/04/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.012x - 22.471	0.999		
R29	SKC	224-PCXR8	707402	06/04/2024	1,000	1,500	2,000	1,005	1,495	1,992	0.987x + 16.057	1.000		
R30	SKC	224-PCXR8	093611	09/04/2024	1,000	1,500	2,000	999	1,494	1,995	0.997x + 0.921	1.000		
R31	SKC	224-PCXR8	093183	04/04/2024	1,000	1,500	2,000	1,002	1,504	2,001	1.001x - 1.723	1.000		
R32	SKC	224-PCXR8	671950	09/04/2024	1,000	1,500	2,000	999	1,502	1,996	0.997x + 3.818	1.000		
R33	SKC	224-PCXR4	626254	04/04/2024	1,000	1,500	2,000	996	1,499	2,001	1.010x - 22.367	0.999		
R34	SKC	224-PCXR4	626131	04/04/2024	1,000	1,500	2,000	1,000	1,501	2,005	1.008x - 14.071	1.000		
R35	SKC	224-PCXR8	707460	06/04/2024	1,000	1,500	2,000	996	1,496	1,996	0.997x + 1.671	1.000		
R36	SKC	224-PCXR8	707446	02/04/2024	1,000	1,500	2,000	1,002	1,499	2,000	1.010x - 20.385	0.999		
R37	SKC	224-PCXR8	707432	04/04/2024	1,000	1,500	2,000	998	1,497	1,999	0.997x + 1.683	1.000		
R38	SKC	224-PCXR8	707349	04/04/2024	1,000	1,500	2,000	999	1,499	2,000	1.000x - 3.701	1.000		
R39	SKC	224-PCXR8	761095	09/04/2024	1,000	1,500	2,000	1,002	1,496	1,993	0.996x + 2.987	1.000		

Calibrated by :

(Mr. Adul Dansakorn)

Approved by :



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (mL/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)						
					1	2	3	1	2	3	y		R ²	
R40	SKC	224-PCXR4	612753	06/04/2024	1,000	1,500	2,000	998	1,499	1,997	1.011x - 23.404	0.999		
R41	SKC	224-PCXR4	626140	05/04/2024	1,000	1,500	2,000	993	1,507	1,999	1.013x - 27.249	0.999		
R42	SKC	224-PCXR4	626463	02/04/2024	1,000	1,500	2,000	1,000	1,495	1,998	0.998x + 1.113	1.000		
R43	SKC	224-PCXR4	626129	09/04/2024	1,000	1,500	2,000	1,004	1,503	2,004	1.010x - 18.786	0.999		
R44	SKC	224-PCXR4	602753	05/04/2024	1,000	1,500	2,000	1,003	1,494	1,992	0.993x + 5.576	1.000		
R45	SKC	224-PCXR4	626137	09/04/2024	1,000	1,500	2,000	994	1,507	2,004	1.011x - 21.270	1.000		
R47	SKC	224-PCXR4	A129234	06/04/2024	1,000	1,500	2,000	993	1,509	2,001	1.014x - 28.446	0.999		
R48	SKC	224-PCXR4	A129253	08/04/2024	1,000	1,500	2,000	1,000	1,494	1,999	0.999x - 0.164	1.000		
R49	SKC	224-PCXR4	A129168	08/04/2024	1,000	1,500	2,000	1,003	1,501	2,005	1.012x - 21.059	0.999		
R50	SKC	224-PCXR4	A129282	08/04/2024	1,000	1,500	2,000	1,002	1,496	1,993	0.995x + 2.808	1.000		
R51	SKC	224-PCXR4	A129284	08/04/2024	1,000	1,500	2,000	995	1,505	2,002	1.005x - 10.182	1.000		

Calibrated by :

(Mr. Adul Dansakorn)

Approved by :



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.7	994.0	1980.7	1.000x - 3.859	0.999
H-R02	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	500.8	999.1	1988.7	1.001x - 2.909	1.000
H-R03	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	501.7	990.3	1997.7	0.993x + 3.830	1.000
H-R04	Dwyer	VFB-65	03/01/2024	500	1,000	2,000	496.8	992.2	2016.5	1.007x - 11.486	1.000
H-R05	Dwyer	VFB-65	04/01/2024	500	1,000	2,000	499.6	992.9	1990.7	1.002x - 4.797	1.000
H-R06	Dwyer	VFB-65	05/01/2024	500	1,000	2,000	505.2	995.4	1982.6	0.999x - 1.343	0.999

Calibrated by :

(Mr. Adui Ungkuom)

Approved by :



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-R01	Dwyer	VFB-65	02/04/2024	500	1,000	2,000	502.7	995.4	1981.1	0.999x - 2.801	0.999
H-R02	Dwyer	VFB-65	04/04/2024	500	1,000	2,000	501.2	1000.7	1990.7	1.000x - 1.869	1.000
H-R03	Dwyer	VFB-65	09/04/2024	500	1,000	2,000	502.1	993.7	1998.1	0.992x + 5.811	1.000
H-R04	Dwyer	VFB-65	08/04/2024	500	1,000	2,000	497.2	993.8	2015.1	1.006x - 10.146	1.000
H-R05	Dwyer	VFB-65	05/04/2024	500	1,000	2,000	500.1	995.3	1991.1	1.001x - 3.418	1.000
H-R06	Dwyer	VFB-65	05/04/2024	500	1,000	2,000	503.6	996.6	1984.2	1.000x - 2.517	0.999

Calibrated by :

(Mr. Adui Ungkuom)

Approved by :



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	03/01/2024	50	100	200	50.8	101.0	204.3	0.982x + 3.092	0.999
L-R02	Dwyer	VFA-21	04/01/2024	50	100	200	50.1	102.0	201.4	1.006x - 0.301	0.999
L-R03	Dwyer	VFA-21	03/01/2024	50	100	200	50.1	100.2	202.3	1.013x - 0.675	1.000
L-R04	Dwyer	VFA-21	03/01/2024	50	100	200	50.2	100.9	201.2	1.007x - 0.709	0.999
L-R05	Dwyer	VFA-21	04/01/2024	50	100	200	50.2	101.0	201.4	0.993x + 1.253	1.000
L-R06	Dwyer	VFA-21	05/01/2024	50	100	200	51.0	100.2	202.3	1.001x + 0.832	1.000

Calibrated by :

(Mr.Adul Dangklom)

Approved by :



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	02/04/2024	50	100	200	50.3	101.4	203.9	0.983x + 2.931	1.000
L-R02	Dwyer	VFA-21	04/04/2024	50	100	200	50.4	101.6	201.0	1.005x - 0.238	0.999
L-R03	Dwyer	VFA-21	09/04/2024	50	100	200	49.7	100.6	202.7	1.014x - 0.648	1.000
L-R04	Dwyer	VFA-21	08/04/2024	50	100	200	50.6	101.3	200.8	1.005x - 0.238	0.999
L-R05	Dwyer	VFA-21	08/04/2024	50	100	200	50.9	101.5	201.8	0.992x + 1.933	1.000
L-R06	Dwyer	VFA-21	05/04/2024	50	100	200	50.6	99.8	201.9	1.002x + 0.409	1.000

Calibrated by :

(Mr.Adul Dangklom)

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. : 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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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)	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



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



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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



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

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	09/08/2023	



Comments			
Reviewed by		Date	09/08/2023



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

Sample ID: **fid std**

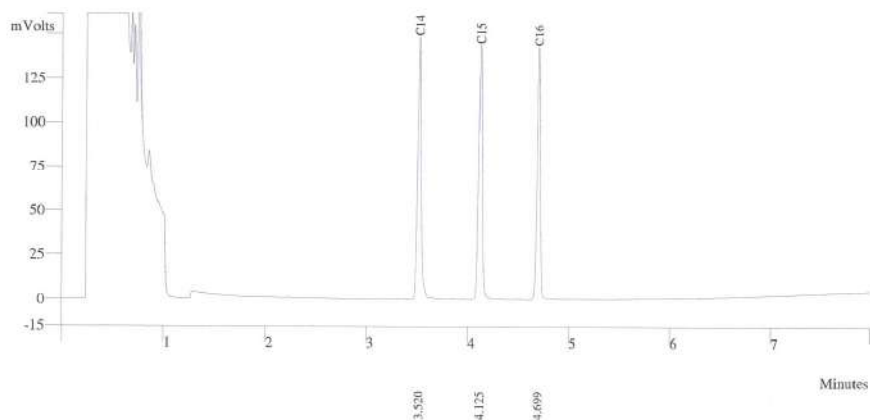
Operator (Ini): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		

Sample ID: **fid std**

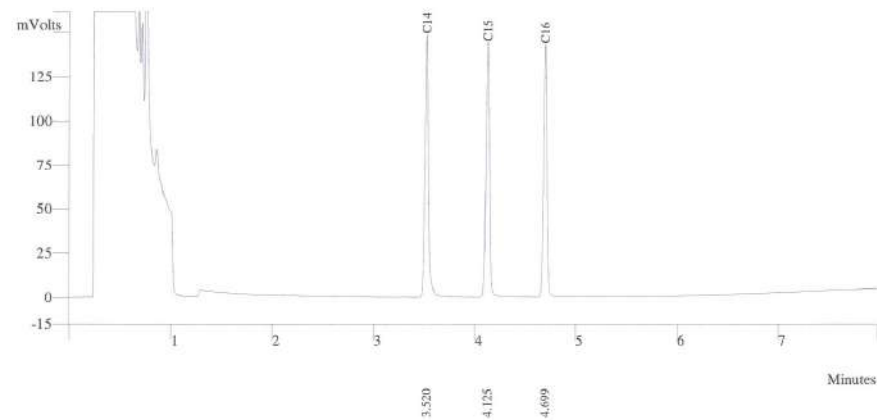
Operator (Ini): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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**

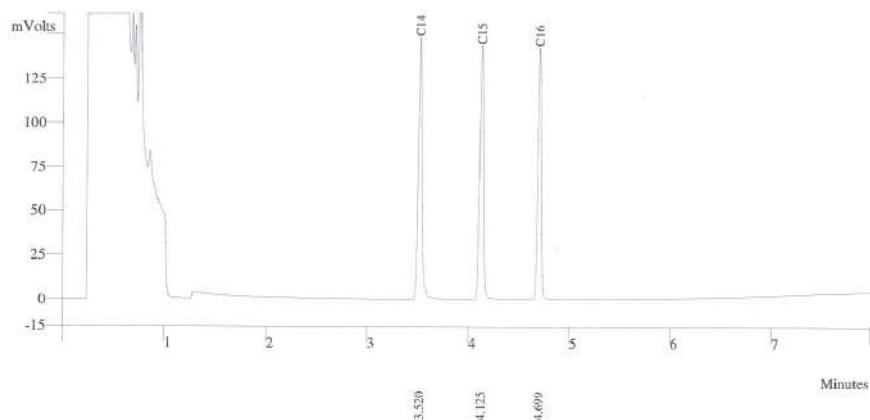
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		

Sample ID: **fid std**

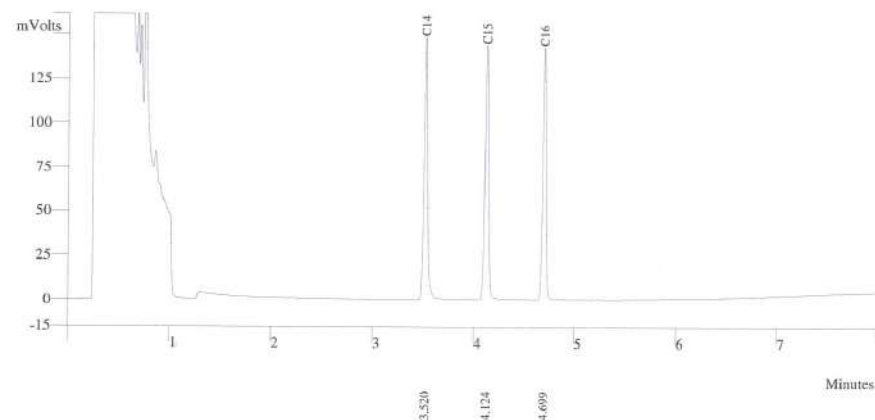
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Ini):



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		



Sample ID: **fid std**

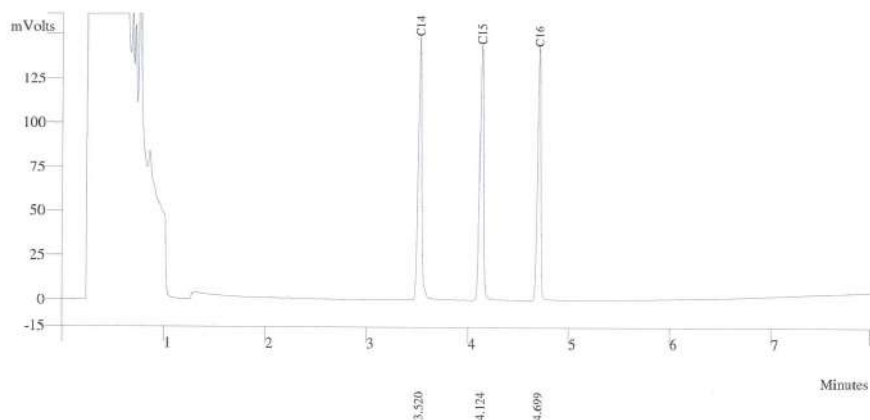
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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

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

A = FID 10 V RESULTS

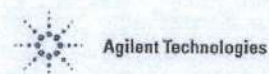


Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
	Totals	99.9552		1087210		



THAI UNIQUE CO.,LTD.

1 OF 1



Certificate 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 %

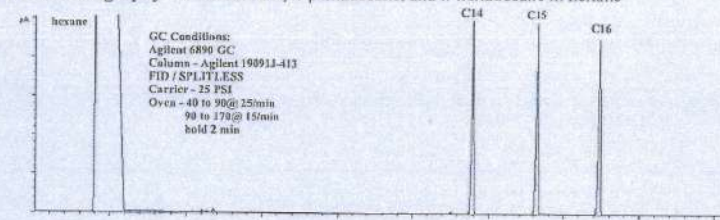
Solvent: hexane

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/NCSL 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 Trikainut

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. Pontongkam

Service Manager



CERTIFICATE No : 23M2441
REFERENCE No : 68471-1

PAGE : 1 OF 2

Certificate of Calibration

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

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

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



CERTIFICATE No : 23M2441

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

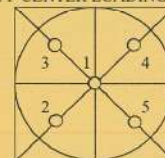
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

ID No : BA05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : 

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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

CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU

MANUFACTURER : METTLER TOLEDO S/N : 1126422905

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

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

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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

ARCHEMICA LAB
บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD.

Operator Signature : _____

Date : Jul 3, 2023

(Mr.Nutdanai Laekhwan)

Applications Chemist



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>January 4, 2024</u>
Address : <u>7 Soi Phaholyothin 24</u>	Recommendation Recertification
<u>Paholyothin Road</u>	Period <u>6</u> Months
Jompoi Chatuchak, Bangkok 1090	Recertification Due: <u>July 4, 2024</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>July 6, 2023</u>
Phone: <u>083-9269252</u>	Visit Number: <u>2 of 2</u>
Fax: <u>02-513-4221</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
	PerkinElmer Fax: <u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<u>OPTIMA 5300DV</u>	<u>077C7042401</u>	
TESTED EQUIPMENT	CALIBRATION NUMBER	EXPIRATION
<u>IPV Methods</u>		
TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>December 30, 2024</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>March 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>February 28, 2024</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

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

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : <u>077C7042401</u>		DATE TESTED : <u>January 4, 2024</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00529
	Ni 231.604 nm	≤ 0.008	0.00672
	Ni 341.476 nm	≤ 0.012	0.00793
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01588
	Ba 455.403 nm	≤ 0.025	0.02280
Precision	As 193.656 nm	% RSD < 1.0	0.92 %
	Zn 213.856 nm	% RSD < 1.0	0.95 %
	Mn 257.610 nm	% RSD < 1.0	0.75 %
	La 379.478 nm	% RSD < 1.0	0.44 %
	Ba 455.403 nm	% RSD < 1.0	0.46 %
	Ba 493.408 nm	% RSD < 1.0	0.37 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	19.99 ppb
	As 193.696 nm	3(sd)	26.66 ppb
	Pb 220.353 nm	3(sd)	1.81 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	38.21 ppb
	Zn 213.856 nm	3(sd)	2.48 ppb
	Mn 257.610 nm	3(sd)	0.59 ppb
	La 379.478 nm	3(sd)	5.52 ppb
	Ba 455.403 nm	3(sd)	0.13 ppb
	Ba 493.408 nm	3(sd)	1.08 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	141.47
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	29.04



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 DATE TESTED January 4, 2024

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:

(Mr. Wiphan Promlumda)

Service Engineer

เอกสารแนบ 5-6

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : Cirrus

Model : CR:515

Serial No. : 92002

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level 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 Feb. 2024

Date of Calibration : 5 Mar. 2024

1/2

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

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FM.BL.MTC.002 Rev.4

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

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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

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

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

Acoustic Output in dB re 20 μ Pa, 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	94.04	0.04	± 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	1000.3	0.3	± 1.5	$\pm 1.0\%$

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.70	± 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 Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 5 Mar. 2024

Date of Issue : 6 Mar. 2024

Ref : 2011267022200795002

End of Certificate

2 / 2

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0639

MTC No. EEL. BP. 39/0866

CALIBRATION CERTIFICATE

Submitted by : S.P.S Consulting Services 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 : SVANTEK

Model : SV34

Serial No. : 33137

Ambient Environment

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

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

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

- Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
 7. Condenser Microphone Bruel&Kjaer 4180 S/N 2633526.

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 : 11 Aug. 2023

Date of Calibration : 22 Aug. 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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Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0639

MTC No. EEL. BP. 39/0866

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

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ 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 2
1/2 inch Bruel&Kjaer 4180	113.53	-0.47	± 0.10	$\pm 0.75 \text{ dB}$

2. Frequency

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

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	0.39	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

...
(Mr.Weerachai Deechaiyae)

Approved by :

...
(Mr.Prawate Khaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Aug. 2023

Date of Issue : 24 Aug. 2023

Ref : 2011266081103146002

End of Certificate

2 / 2

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FM.BL.MTC.002 Rev.4

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7 ซอยพหลโยธิน 24 แขวงพหลโยธิน เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 539-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Noise R_210-1/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	CIRRUS	Number	AC-CR01/63
Model	CR515	Serial No.	92002
Calibration Range	94 dB, 1000 Hz	Last Calibration	05 March 2024
		Due Date	05 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
CR-B03	Cirrus	CR161B	G301155	08 April 2024	94.0	94.0
CR-B06	Cirrus	CR161B	G301151	08 April 2024	94.1	94.0
CR-B10	Cirrus	CR161B	G301407	08 April 2024	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					94.04 ± 0.10 dB	

Calibrated by :

(Mr. Abdul Dangklom)

Approved by :



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Tel : (662) 539-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Noise Dose R_210-2/24

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-B06	SVANTEK	SV-1041S	80816	08 April 2024	113.5	113.5
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.53 ± 0.10 dB	

Calibrated by :

(Mr. Abdul Dangklom)

Approved by :

เอกสารแนบ 5-7

เอกสารสอบเทียบเครื่องมือการตรวจวัดปริมาณเสียงสะสมติดตัวพนักงาน



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0639

MTC No. EEL. BP. 39/0866

CALIBRATION CERTIFICATE

Submitted by : S.P.S Consulting Services 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 : SVANTEK

Model : SV34

Serial No. : 33137

Ambient Environment

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

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

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

- Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
 7. Condenser Microphone Bruel&Kjaer 4180 S/N 2633526.

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 : 11 Aug. 2023

Date of Calibration : 22 Aug. 2023

1 / 2

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0639

MTC No. EEL. BP. 39/0866

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

Nominal Output of Unit Under Test = 114 dB re 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ 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 2
1/2 inch Bruel&Kjaer 4180	113.53	-0.47	± 0.10	$\pm 0.75 \text{ dB}$

2. Frequency

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

3. Total distortion

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	0.39	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

...
(Mr.Weerachai Deechaiyae)

Approved by :

...
(Mr.Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Aug. 2023

Date of Issue : 24 Aug. 2023

Ref : 2011266081103146002

End of Certificate

2 / 2

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FM.BL.MTC.002 Rev.4

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Noise Dose R_210/24

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-B06	SVANTEK	SV-104IS	80816	08 April 2024	113.5	113.5
NMD-B07	SVANTEK	SV-104IS	80817	08 April 2024	113.5	113.5
NMD-B08	SVANTEK	SV-104IS	80818	08 April 2024	113.5	113.5
NMD-R20	SVANTEK	SV-104IS	70035	08 April 2024	113.5	113.5
NMD-R22	SVANTEK	SV-104IS	80801	08 April 2024	113.5	113.5
NMD-R35	SVANTEK	SV-104IS	80873	08 April 2024	113.5	113.5
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.53± 0.10 dB	

Calibrated by :

(Mr. Adul Dangklom)

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



CALIBRATION LABORATORY Co.,LTD.

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



CONDITION OF CALIBRATION ITEM : 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



@clccalibration

เอกสารแนบ 5-9

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับความร้อนในสถานประกอบการ



Certificate of Calibration

Certificate Number : SPR23110050-4 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 32
Serial Number : TPH050047
ID. Number : B31

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 03 Nov 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 03 Nov 2023
Location of Calibration : In-Lab Recommend Due Date : 03 Nov 2024
Calibration Procedure : SP-CPT-04-13 Date of Issue : 04 Nov 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 to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

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

Calibrated by : Mr.Pitak Srisutam

Calibration Officer

Approved by :

(Mr.

Authorized Signatory



Calibration Report

Certificate Number : SPR23110050-4

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	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



Result of Calibration

Certificate No. : SPR23110050-4

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.017	40.1	0.083	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.017	40.1	0.083	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.2	0.186	0.20
35.0	35.012	35.2	0.188	0.20
40.0	40.017	40.2	0.183	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 -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24030285-2

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 32

Serial Number : TPH050015

ID. Number : B32

Environmental Conditions

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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 19 Mar 2024

Calibration Date : 20 Mar 2024

Recommend Due Date : 20 Mar 2025

Date of Issue : 21 Mar 2024

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs. The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by : Mr.Navaporn Uengseng

Calibration Officer

Approved by :

(Ms.Bussakorn Chaikaew)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24030285-2

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	5020A	A47046	QR24-0167	26 Jan 2025

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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24030285-2

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	30.0	-0.012	0.20
35.0	35.010	35.0	-0.010	0.20
40.0	40.015	40.1	0.085	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	30.0	-0.012	0.20
35.0	35.010	35.0	-0.010	0.20
40.0	40.015	40.1	0.085	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	30.0	-0.012	0.20
35.0	35.010	35.0	-0.010	0.20
40.0	40.015	40.1	0.085	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 -



Certificate of Calibration

Certificate Number : SPR23110050-5 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 : Quest Technologies
Model : QUESTemp 32
Serial Number : TPK120034
ID. Number : B33
Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 03 Nov 2023
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 03 Nov 2023
Location of Calibration : In-Lab Recommend Due Date : 03 Nov 2024
Calibration Procedure : SP-CPT-04-13 Date of Issue : 04 Nov 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 to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

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

Calibrated by : Mr.Pitak Srisutam

Calibration Officer

Approved by :

(Mr.Prayoon Topan)

Authorized Signatory



Calibration Report

Certificate Number : SPR23110050-5 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 :

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Quality Reborn Co., Ltd



Result of Calibration

Certificate No. : SPR23110050-5

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.2	0.186	0.20
35.0	35.012	35.2	0.188	0.20
40.0	40.017	40.2	0.183	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.0	-0.014	0.20
35.0	35.012	35.0	-0.012	0.20
40.0	40.017	40.0	-0.017	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	30.1	0.086	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.017	40.1	0.083	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 -



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 to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

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



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	QR23-0176	26 Jan 2024

Traceability

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

Certificate No. : SPR23090267-4

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
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 : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
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 : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
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 -



Certificate of Calibration

Certificate Number : SPR24030285-6

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 : 19 Mar 2024

Relative Humidity : 50 % \pm 15 %

Calibration Date : 20 Mar 2024

Location of Calibration : In-Lab

Recommend Due Date : 20 Mar 2025

Calibration Procedure : SP-CPT-04-13

Date of Issue : 21 Mar 2024

Method of Calibration

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

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

Calibrated by : Mr.Navaporn Uengseng

Calibration Officer

Approved by :

(Ms.Bussakorn Chaikaew)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR24030285-6

Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	5020A	A47046	QR24-0167	26 Jan 2025

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



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24030285-6

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.7	-0.312	0.20
35.0	35.010	34.7	-0.310	0.20
40.0	40.015	39.8	-0.215	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.8	-0.212	0.20
35.0	35.010	34.8	-0.210	0.20
40.0	40.015	39.8	-0.215	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.6	-0.412	0.20
35.0	35.010	34.7	-0.310	0.20
40.0	40.015	39.7	-0.315	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 -



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

Heat R023_1

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B31	Verification Date :	08 April 2024
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp ^o 32	Barometric Pressure :	1011 mmbar
Serial No. :	TPH050047	Relative Humidity :	49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : 
(Mr.Adul Dangklom)

Approved by : 



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
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Heat R023_2

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B32	Verification Date :	08 April 2024
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp ^o 32	Barometric Pressure :	1011 mmbar
Serial No. :	TPH050015	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	12.5	0.0	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : 
(Mr.Adul Dangklom)

Approved by : 



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

Heat R023_3

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	B33	Verification Date :	08 April 2024
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp ^o 32	Barometric Pressure :	1011 mmbar
Serial No. :	TPK120034	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	47.2	-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 Dangklom)

Approved by : 



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

Heat R023_4

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	R04	Verification Date :	08 April 2024
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp ^o 34	Barometric Pressure :	1011 mmbar
Serial No. :	TEN040005	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	12.5	0.0	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : 
(Mr.Adul Dangklom)

Approved by : 



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Heat R023_5

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	R05	Verification Date :	08 April 2024
Brand :	METROSONICS	Ambient Temp. :	24.5 °C
Model :	hs-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	12.5	0.0	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.3	0.0	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : 
(Mr.Adul Dangklom)

Approved by : 



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

Heat R023_6

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	R06	Verification Date :	08 April 2024
Brand :	METROSONICS	Ambient Temp. :	24.5 °C
Model :	hs-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)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : 
(Mr.Adul Dangklom)

Approved by : 