

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

เอกสารแนบ 5-1	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ
เอกสารแนบ 5-2	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง
เอกสารแนบ 5-3	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ
เอกสารแนบ 5-4	เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง
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ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ		
TSP	High Volume Air Sampler No. R08, R09, R10, R18	Digital Balance
PM ₁₀	High Volume PM10 Air Sampler No. R14, R16, R17, R18	Digital Balance
SO ₂	SO2 Analyzer No. R01, R04, R06, R10	SO2 Analyzer No. R01, R04, R06, R10
NO ₂	NO Analyzer No. R04, R06, R07, R08	NO Analyzer No. R04, R06, R07, R08
Acetaldehyde	Mass Flow Meter	GC/MS
คุณภาพอากาศจากปล่อง		
TSP	Console No. R02 Pitot Tube No. B38, B45	Digital Balance
PM ₁₀	Console No. R02 Pitot Tube No. B38, B45	Digital Balance
PM _{2.5}	Console No. R02 Pitot Tube No. B38, B45	Digital Balance
NO _x	Vacuum Gauge	Spectrophotometer
SO ₂	Personal Pump SKC No. R17, R36 Rotameter No. H-B08, R03	-
Acetaldehyde	Personal Pump SKC No. R03 Rotameter No. H-R03	GC/FID
Ethylene Glycol	Personal Pump SKC No. R36 Rotameter No. L-R01	GC/FID
ระดับเสียง		-
Leq 24 hr	Acoustic Calibrator	
Lmax	Sound Level Meter No. ACO-R12, R16	
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
Arsenic	-	AAS
Selenium	-	AAS
Mercury	-	AAS
Manganese	-	ICP

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพน้ำ (ต่อ)		
Zinc	-	ICP
Copper	-	ICP
Cadmium	-	ICP
Nickel	-	ICP
Lead	-	ICP
Barium	-	ICP
Trivalent Chromium	-	ICP
Hexavalent Chromium	-	Spectrophotometer
คุณภาพน้ำใต้ดิน		
Acetaldehyde	-	GC/MS
คุณภาพดิน		
Acetaldehyde	-	GC/MS
คุณภาพอากาศในสถานประกอบการ		
Acetaldehyde	Personal Pump No. B77, R06, R07, R14, R21, R24, R25, R30, R35, R42, R43 Rotameter No. L-R01, R05	GC/FID
Ethylene Glycol	Personal Pump No. B77, R07, R14, R15, R24, R25, R30, R32, R33, R35 Rotameter No. H-R01, R05	GC/FID
Total Dust	Personal Pump No. B72, B85, R07, R08, R15, R19, R22, R23, R43 Rotameter No. H-R01, R05	Digital Balance
Respirable Dust	Personal Pump No. B71, R15, R17, R30, R33, R35, R36, R38 Rotameter No. H-R01, R05	Digital Balance
Phosphoric Acid	Personal Pump No. B85, R05, R10, R39, R43 Rotameter No. L-R01, R05	IC
Sodium Hydroxide	Personal Pump No. B72, R06, R10, R21, R26, R43 Rotameter No. H-R01, R05	-
Sodium Hypochlorite as Sodium	Personal Pump No. R32, R33 Rotameter No. H-R01, R05	ICP
Hydrogen Sulfide	Personal Pump No R19, R42 Rotameter No. L-R01, R05	IC
Acetone	Personal Pump No. R14, R44 Rotameter No. L-R01, R05	GC/FID
Ethanol	Personal Pump No. R14, R44 Rotameter No. L-R01, R05	GC/FID
Chloroform	Personal Pump No. R25, R33 Rotameter No. L-R01, R05	GC/FID

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ (ต่อ) Phenol Isopropyl Alcohol Sulfuric Acid Hydrochloric Acid Acetic Acid	Personal Pump No. B85, R10 Rotameter No. L-R01, R05	GC/FID
	Personal Pump No. B65, R21 Rotameter No. L-R01, R05	GC/FID
	Personal Pump No. R39 Rotameter No. L-R01, R05	IC
	Personal Pump No. R12, R35 Rotameter No. L-R01, R05	IC
	Personal Pump No. R07, R08, R10, R21 Rotameter No. L-R01, R05	GC/FID
ระดับเสียงในสถานประกอบการ Leq 12 hr Lmax	Acoustic Calibrator No. AC 03/56	-
	Sound Level Meter No. ACO-B18, B29, R50	-
	Acoustic Calibrator No. AC-CR01/63	-
	Sound Level Meter No. CR-B05, B06, B09, B10	-
ปริมาณเสียงสะสมติดตัวพนักงาน Noise Dose	Acoustic Calibrator No. SV 01/60	-
	Noise Dosimeter No. NMD-B01, B02, B03, B04, R02, R13	-
ระดับความเข้มของแสงสว่างในสถานประกอบการ Light Intensity	Light Meter No. R07	-
ระดับความร้อนในสถานประกอบการ WBGT	Heat Stress WBGT Meter No. R04, R05, R06, R08, R09, R12	-

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
B01	B01	01/08/2024	$y = 1.171x - 2.911$	0.998
B02	B02	02/08/2024	$y = 1.163x + 0.020$	0.999
B03	B03	05/08/2024	$y = 1.195x - 3.992$	0.998
B04	B04	02/08/2024	$y = 1.212x - 3.522$	0.999
B05	B05	02/08/2024	$y = 1.222x - 5.699$	0.997
B06	B06	05/08/2024	$y = 1.192x - 3.521$	0.999
B07	B07	08/08/2024	$y = 1.173x - 2.945$	0.998
B08	B08	02/08/2024	$y = 1.181x - 2.549$	0.999
B09	B09	02/08/2024	$y = 1.202x - 4.007$	0.999
B10	B10	05/08/2024	$y = 1.187x - 0.531$	0.998
B11	B11	05/08/2024	$y = 1.092x + 1.351$	1.000
B12	B12	07/08/2024	$y = 1.186x - 4.168$	0.998
B13	B13	05/08/2024	$y = 1.182x - 3.641$	0.996
B14	B14	05/08/2024	$y = 1.226x - 5.106$	0.999
B15	B15	05/08/2024	$y = 1.218x - 3.602$	1.000
B16	B16	02/08/2024	$y = 1.174x - 1.318$	0.997
B17	B17	05/08/2024	$y = 1.188x - 1.593$	1.000
B18	B18	02/08/2024	$y = 1.218x - 5.796$	0.999
B19	B19	02/08/2024	$y = 1.225x - 6.976$	0.998
B20	B20	02/08/2024	$y = 1.197x - 2.746$	0.999
B21	B21	05/08/2024	$y = 1.214x - 5.212$	0.997
B22	B22	05/08/2024	$y = 1.205x - 5.711$	0.999
B23	B23	02/08/2024	$y = 1.221x - 4.197$	0.998
B24	B24	02/08/2024	$y = 1.164x - 1.349$	0.999
B25	B25	07/08/2024	$y = 1.125x - 0.794$	1.000
B26	B26	07/08/2024	$y = 1.181x - 2.418$	0.998
B27	B27	07/08/2024	$y = 1.109x - 1.204$	0.998
B28	B28	07/08/2024	$y = 1.183x - 5.519$	1.000
B29	B29	02/08/2024	$y = 1.227x - 3.979$	0.996
B30	B30	05/08/2024	$y = 1.174x - 2.401$	0.999
B31	B31	05/08/2024	$y = 1.190x - 4.450$	1.000
B32	B32	05/08/2024	$y = 1.203x - 1.091$	0.999
B33	B33	05/08/2024	$y = 1.218x - 3.935$	1.000
B34	B34	05/08/2024	$y = 1.224x - 5.708$	0.996

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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	05/08/2024	$y = 1.186x - 3.084$	0.999
B36	B36	05/08/2024	$y = 1.210x - 3.778$	0.997
B37	B37	06/08/2024	$y = 1.196x - 3.291$	0.998
B38	B38	06/08/2024	$y = 1.176x - 3.769$	1.000
B39	B39	05/08/2024	$y = 1.200x - 1.884$	0.999
B40	B40	05/08/2024	$y = 1.192x - 3.238$	0.999
B41	B41	05/08/2024	$y = 1.170x - 2.205$	0.996
B42	B42	05/08/2024	$y = 1.141x - 0.385$	1.000
B43	B43	02/08/2024	$y = 1.175x - 1.695$	0.996
B44	B44	02/08/2024	$y = 1.167x - 1.577$	0.998
R01	R01	02/08/2024	$y = 1.177x - 4.285$	0.999
R02	R02	02/08/2024	$y = 1.216x - 5.757$	0.997
R03	R03	02/08/2024	$y = 1.198x - 6.621$	0.999
R04	R04	08/08/2024	$y = 1.170x - 2.838$	0.997
R05	R05	08/08/2024	$y = 1.184x - 4.669$	1.000
R06	R06	01/08/2024	$y = 1.205x - 5.684$	0.998
R07	R07	01/08/2024	$y = 1.114x + 0.237$	1.000
R08	R08	01/08/2024	$y = 1.073x + 1.881$	0.997
R09	R09	01/08/2024	$y = 1.186x - 1.865$	0.999
R10	R10	02/08/2024	$y = 1.171x - 3.610$	0.996
R11	R11	02/08/2024	$y = 1.201x - 4.470$	1.000
R12	R12	02/08/2024	$y = 1.167x - 3.984$	0.998
R13	R13	06/08/2024	$y = 1.171x - 3.661$	0.997
R14	R14	06/08/2024	$y = 1.194x - 2.635$	0.998
R15	R15	02/08/2024	$y = 1.207x - 6.878$	0.999
R16	R16	02/08/2024	$y = 1.212x - 6.360$	1.000
R17	R17	05/08/2024	$y = 1.194x - 4.223$	0.999
R18	R18	05/08/2024	$y = 1.151x - 2.849$	0.999
R19	R19	05/08/2024	$y = 1.172x - 3.442$	0.998
R20	R20	05/08/2024	$y = 1.184x - 3.473$	0.999

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
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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
B01	B01	02/08/2024	$y = 1.192x - 3.010$	0.997
B02	B02	05/08/2024	$y = 1.166x - 1.422$	0.998
B03	B03	07/08/2024	$y = 1.198x - 2.675$	0.997
B04	B04	02/08/2024	$y = 1.195x - 4.855$	0.999
B05	B05	05/08/2024	$y = 1.215x - 6.792$	0.999
B06	B06	02/08/2024	$y = 1.184x - 3.554$	0.997
B07	B07	01/05/2024	$y = 1.132x - 0.786$	1.000
B08	B08	02/08/2024	$y = 1.203x - 1.746$	0.997
B09	B09	05/08/2024	$y = 1.198x - 3.274$	0.999
B10	B10	02/08/2024	$y = 1.175x - 1.634$	0.996
B11	B11	02/08/2024	$y = 1.188x - 1.290$	0.999
B12	B12	07/08/2024	$y = 1.200x - 4.619$	0.997
B13	B13	05/08/2024	$y = 1.140x - 2.044$	0.997
B14	B14	06/08/2024	$y = 1.137x + 0.196$	0.996
B15	B15	05/08/2024	$y = 1.156x - 0.963$	1.000
B16	B16	06/08/2024	$y = 1.178x + 0.511$	0.999
B17	B17	02/08/2024	$y = 1.167x - 2.529$	0.998
B18	B18	01/08/2024	$y = 1.193x - 2.801$	0.997
B19	B19	05/08/2024	$y = 1.174x - 2.984$	0.998
B20	B20	01/08/2024	$y = 1.197x - 4.582$	0.999
B21	B21	05/08/2024	$y = 1.195x - 3.263$	0.998
B22	B22	02/08/2024	$y = 1.137x - 0.996$	0.998
B23	B23	05/08/2024	$y = 1.191x - 2.392$	0.998
B24	B24	01/08/2024	$y = 1.185x - 3.393$	0.997
B25	B25	02/08/2024	$y = 1.202x - 3.881$	0.997
B26	B26	02/08/2024	$y = 1.193x - 3.733$	0.997
B27	B27	02/08/2024	$y = 1.165x - 4.778$	0.999
B28	B28	02/08/2024	$y = 1.182x - 4.730$	0.999
B29	B29	05/08/2024	$y = 1.177x - 4.217$	0.999
B30	B30	05/08/2024	$y = 1.188x - 3.046$	0.998
B31	B31	01/08/2024	$y = 1.173x - 1.247$	1.000
B32	B32	01/08/2024	$y = 1.157x - 3.072$	1.000
B33	B33	05/08/2024	$y = 1.153x - 0.882$	0.997
B34	B34	05/08/2024	$y = 1.193x - 1.943$	0.996

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905

ID No : BA05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU

MANUFACTURER : METTLER TOLEDO S/N : 1126422905

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

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

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



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

CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	18 August 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R01	SERIAL NO.	3415		
Calibrator (Dilution System)					
Brand : Teledyne			Model : 700E		
Last Cal. Date : 30 October 2023			Serial No. : 201-S		
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.	24.6	°C
			% RH	48	
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	28.5	in-Hg	25-35		
SAMPLE FLOW	659	cc/min	650 ± 10%		
PMT	103.2	mV	-20-150 with Zero Air		
UV LAMP	3024.3	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	62.9	mV	-50 - 200		
DRK LMP	57.6	mV	-50 - 200		
HVPS	675	V	550-900 constant		
DCPS	2518	mV	2500 ± 200		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.2	°C	5-40		
PMT TEMP	7.4	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.011	-	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 : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Mr. Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	18 August 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R04	SERIAL NO.	3489		
Calibrator (Dilution System)					
Brand : Teledyne			Model : 700E		
Last Cal. Date : 30 October 2023			Serial No. : 201-S		
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.	24.6	°C
			% RH	48	
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	399.7	-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	28.6	in-Hg	25-35		
SAMPLE FLOW	655	cc/min	650 ± 10%		
PMT	103.3	mV	-20-150 with Zero Air		
UV LAMP	3028.1	mV	1000-4900		
STR. LGT	61.9	PPB	<100		
DRK PMT	63.5	mV	-50 - 200		
DRK LMP	58.2	mV	-50 - 200		
HVPS	673	V	550-900 constant		
DCPS	2525	mV	2500 ± 200		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	5-40		
PMT TEMP	7.2	°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	22.1	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 : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Mr. Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	18 August 2024	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R06	SERIAL NO.	066		
Calibrator (Dilution System)					
Brand : Teledyne			Model : 700E		
Last Cal. Date : 30 October 2023			Serial No. : 201-S		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO ₂)			Cylinder No. : A00814SK		
Certified Date : 21 June 2021			Expired Date : 21 June 2029		
Cylinder Conc. : 49.8 ppm					
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH			48		
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	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	654	cc/min	650 ± 10%		
PMT	103.0	mV	-20-150 with Zero Air		
UV LAMP	3016.4	mV	1000-4900		
STR. LGT	61.6	PPB	<100		
DRK PMT	63.1	mV	-50 - 200		
DRK LMP	57.8	mV	-50 - 200		
HVPS	671	V	550-900 constant		
DCPS	2517	mV	2500 ± 200		
RCCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.4	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.009	-	1.0 ± 0.3		
SO ₂ Offset	21.8	mV	<250		
Stability at Zero	0.1	PPB	<0.2		
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	18 August 2024	BRAND :	TELEDYNE	MODEL :	100E
NO.	SO ₂ -R10	SERIAL NO.	TR51065		
Calibrator (Dilution System)					
Brand : Teledyne			Model : 700E		
Last Cal. Date : 30 October 2023			Serial No. : 201-S		
Reference Standard Gas					
Standard Gas : Sulphur Dioxide (SO ₂)			Cylinder No. : A00814SK		
Certified Date : 21 June 2021			Expired Date : 21 June 2029		
Cylinder Conc. : 49.8 ppm					
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH			48		
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%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	28.7	in-Hg	25-35		
SAMPLE FLOW	660	cc/min	650 ± 10%		
PMT	103.1	mV	-20-150 with Zero Air		
UV LAMP	3019.7	mV	1000-4900		
STR. LGT	61.5	PPB	<100		
DRK PMT	63.0	mV	-50 - 200		
DRK LMP	57.9	mV	-50 - 200		
HVPS	672	V	550-900 constant		
DCPS	2526	mV	2500 ± 200		
RCCELL TEMP	50.1	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.008	-	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 : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	18 August 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R04	SERIAL NO.	4411		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	48				
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	400.4	0.100	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	504	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.1	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HVPS	674	V	420 - 900 constant		
RCCELL TEMP	50.5	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.8	°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	1.010	-	1.0 ± 0.3		
NO _x Slope	1.014	-	1.0 ± 0.3		
NO Offset	1.8	mV	-20 to +150		
NO _x Offset	1.1	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	18 August 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R06	SERIAL NO.	4466		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	48				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.003
NO _x Span	400	399.8	-0.050	400.0	1.007
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	512	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.2	mV	-20 - 150		
AZERO	94.1	mV	-20 - 150		
HVPS	669	V	420 - 900 constant		
RCCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	28.8	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.4	°C	315 ± 5		
RCCELL PRESS	8.4	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.003	-	1.0 ± 0.3		
NO _x Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO _x Offset	0.6	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	18 August 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R07	SERIAL NO.	4468		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	48				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.009
NO _x Span	400	400.3	0.075	400.0	1.012
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	506	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	102.9	mV	-20 - 150		
AZERO	93.6	mV	-20 - 150		
HVPS	672	V	420 - 900 constant		
RCELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	29.4	°C	8 - 48		
PMT TEMP	7.3	°C	7 ± 2		
MOLY TEMP	315.2	°C	315 ± 5		
RCELL 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	1.009	-	1.0 ± 0.3		
NO _x Slope	1.012	-	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 :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



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

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	18 August 2024	BRAND :	API	MODEL :	200E
NO.	NOX-R08	SERIAL NO.	243		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700E	
Last Cal. Date	: 30 October 2023		Serial No.	: 201-S	
Reference Standard Gas					
Standard Gas	: Nitric Oxide (NO)		Cylinder No.	: A00726SV	
Certified Date	: 05 January 2023		Expired Date	: 05 January 2026	
Cylinder Conc.	: 48.8 ppm				
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
% RH	48				
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.004
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	508	cc/min	500 ± 50		
OZONE FLOW	78	cc/min	80 ± 15		
PMT	103.4	mV	-20 - 150		
AZERO	94.2	mV	-20 - 150		
HVPS	671	V	420 - 900 constant		
RCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	29.1	°C	8 - 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	IN-Hg-A	25 - 30 constant		
NO Span Conc	400	PPB	20 - 20,000		
NO _x Span Conc	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO _x Slope	1.008	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO _x Offset	0.6	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkac Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th



CALIBRATION CERTIFICATE

Certificate No. : L202312097-0001

Date Issued : 25-Dec-23

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

Equipment : Mass flow meter

Manufacturer : Dwyer

Model : GMF-2101

Serial No. : -

ID No./Tag No. : MF01/51

Date Received : 14-Dec-23

Date Calibrated : 25-Dec-23

Calibrated by : Mr. Jame Khaothong

Calibration Method or Calibration Procedure Used

In-house method : CP-34 by comparison against mass flow calibrator.

This certificate is traceable to national standards, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

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

This certificate may not be reproduced other than in full except with the prior written approval of the Miracle International Technology Company Limited.

Approved by:

Sasayuth T.



Page 1 of 3

Certificate No. : L202312097-0001

Environment : Ambient temperature : (23 \pm 2) °C

Relative humidity : (50 \pm 15) % RH

Capacity Range : 17 ml/min

Calibration Media : Air

Type : Mass Flowmeter

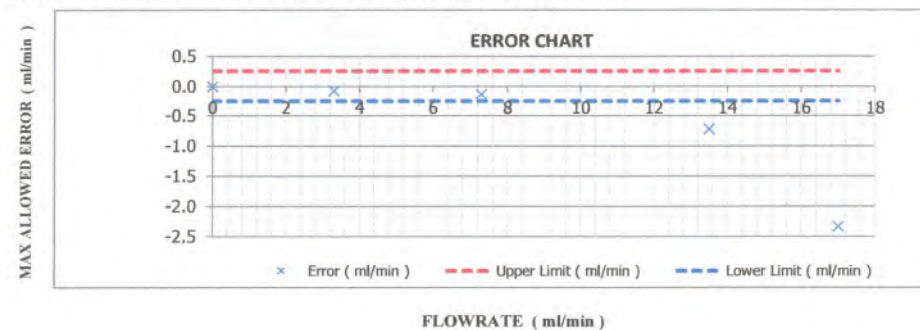
Unit Under Calibration Reference Condition : Pressure 101.325 kPa(abs) , 21 °C , Nitrogen

Temperature (° C)	Pressure (kPa)	UUC Reading (ml/min)	STD Reading (ml/min)	Error (ml/min)	Uncertainty (\pm ml/min)	MPE \pm (ml/min)	Pass / Fail Simple Acceptance
23.28	101.87	0.00	0.000 *	0.000	0.063	0.255	Pass
23.29	101.88	3.30	3.365	-0.065	0.14	0.255	Pass
23.25	101.90	7.30	7.428	-0.128	0.15	0.255	Pass
23.27	101.94	13.50	14.217	-0.717	0.16	0.255	Failed
23.26	101.97	17.00	19.331	-2.331	0.20	0.255	Failed

Error = Unit Under Calibration - Standard **Pass = |error| \leq |MPE|**

MPE = Maximum Permissible Error **Fail = |error| > |MPE|**

Marked * are not included in the NSC-ONSC accreditation schedule for our laboratory.



Certificate No. : L202312097-0001

Note : The actual flow rate is determined by the equation :

$$Q_{Meas} = Q_{Ref} \times \frac{P_{Ref}}{P_{Meas}} \times \frac{T_{Meas}}{T_{Ref}}$$

; Q = Flow rate

; P = Absolute pressure

; T = Absolute temperature

; Subscript "Meas" = Measurement condition

; Subscript "Ref" = Reference condition

Condition As-Received : Used Item

The measurement results and statements of conformity with specification only relate to the item calibrated.


Traceability of Certificate :

The International System of Units (SI) through

NIMT Calibration Certificate No. MW-0013-22 for Mass Flow Calibrator (20 SCCM) Serial No. G500971G20, Due 22-Feb-24

End of 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:	2 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-02927336
Date PM Performed: (DD-MMM-YYYY)	22-Aug-2024	Next PM Due Date: (DD-MMM-YYYY)	22-Feb-2025

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

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

General Instructions:

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

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Component List

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

Parts lists

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

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

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

Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

เอกสารแนบ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง



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

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	ΔH_g (mmH ₂ O)
B01	1563	03/06/2024	0.996	50.07
B02	8002514	04/06/2024	0.995	49.98
B03	1503016	04/06/2024	0.994	50.19
B04	00006659	03/06/2024	0.995	50.28
B05	00007428	03/06/2024	0.997	49.75
R01	1561	05/06/2024	0.994	50.23
R02	8002513	04/06/2024	0.993	50.35
R03	1570	03/06/2024	0.994	50.12
R04	8002519	05/06/2024	0.993	49.89
R05	1503015	04/06/2024	0.996	49.92

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

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

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

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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

CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : HI-LIGHT
MODEL / TYPE : N/A
SERIAL NO. : N/A[64-220088-1]
CLID. NO. : 212301419
JOB CONTROL NO. : 240720076545
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 20 July 2024

DATE OF ISSUED : 23 July 2024

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

Calibrated By : Sittipong Pimdee
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
23 July 2024



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

Certificate No. Q24076545

F3-011-05/12-23

page 1 of 3

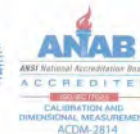


@clccalibration



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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 : 22 July 2024
DUE DATE OF CALIBRATION : 22 July 2025

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. MP-0040-24, Due Date 08 February 2025.

UNCERTAINTY :

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

Certificate No. Q24076545

F3-011-05/12-23

page 2 of 3



@clccalibration



CALIBRATION LABORATORY Co., LTD.

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

DUC Test point (inHg)	STD Reading (kPa)		Conversion to inHg		Correction (inHg)	
	Up	Down	Up	Down	Up	Down
0	0.00	0.00	0.0	0.0	0.0	0.0
-5	-15.58	-15.58	-4.6	-4.6	+0.4	+0.4
-10	-32.51	-32.84	-9.6	-9.7	+0.4	+0.3
-15	-49.44	-49.77	-14.6	-14.7	+0.4	+0.3
-20	-66.70	-66.70	-19.7	-19.7	+0.3	+0.3
-25	-83.63	-83.97	-24.7	-24.8	+0.3	+0.2
-30	-100.90	-100.90	-29.8	-29.8	+0.2	+0.2

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 012 Page 43 of 67

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

End of Certificate

Certificate No. Q24076545

F3-011-05/12-23

page 3 of 3



@clccalibration

SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

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



NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

Calibration Certificate

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(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

T. Petchur

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



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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
R01	SKC	224-PCXR4	602467	05/07/2024	1,000	1,500	2,000	1,008	1,502	2,010	1.012x - 20.053	0.999
R02	SKC	224-PCXR4	626450	05/07/2024	1,000	2,000	3,000	997	1,499	1,996	0.999x - 0.979	1.000
R03	SKC	224-PCXR4	691592	05/07/2024	1,000	1,500	2,000	997	1,512	2,002	1.011x - 21.792	0.999
R04	SKC	224-PCXR4	691672	05/07/2024	1,000	1,500	2,000	996	1,504	2,004	1.008x - 14.228	1.000
R05	SKC	224-PCXR4	798470	03/07/2024	1,000	1,500	2,000	1,004	1,503	2,007	1.004x - 3.422	1.000
R06	SKC	224-PCXR4	798456	03/07/2024	1,000	1,500	2,000	1,005	1,493	2,002	0.999x + 3.190	1.000
R07	SKC	224-PCXR4	798480	03/07/2024	1,000	1,500	2,000	1,007	1,514	2,010	1.007x - 6.069	0.999
R08	SKC	224-PCXR4	883215	03/07/2024	1,000	1,500	2,000	1,005	1,505	2,008	1.006x - 9.814	0.999
R09	SKC	224-PCXR4	034650	03/07/2024	1,000	1,500	2,000	1,007	1,509	2,008	1.012x - 17.190	0.999
R10	SKC	224-PCXR4	091765	03/07/2024	1,000	1,500	2,000	998	1,507	2,006	1.005x - 6.520	1.000
R11	SKC	224-PCXR4	091763	02/07/2024	1,000	1,500	2,000	996	1,503	1,999	1.002x - 5.913	1.000
R12	SKC	224-PCXR4	091568	03/07/2024	1,000	1,500	2,000	1,003	1,499	1,996	0.993x - 9.175	1.000
R13	SKC	224-PCXR4	091638	03/07/2024	1,000	1,500	2,000	1,007	1,502	2,005	1.010x - 15.387	0.999
R14	SKC	224-PCXR4	091764	03/07/2024	1,000	1,500	2,000	998	1,504	2,004	1.001x - 1.195	1.000
R15	SKC	224-PCXR8	529457	03/07/2024	1,000	1,500	2,000	1,004	1,503	2,013	1.010x - 12.457	1.000
R16	SKC	224-PCXR8	529643	03/07/2024	1,000	1,500	2,000	1,009	1,493	2,003	0.998x + 0.991	1.000
R17	SKC	224-PCXR8	529645	03/07/2024	1,000	1,500	2,000	999	1,510	2,003	1.008x - 14.420	0.999
R18	SKC	224-PCXR8	566756	01/07/2024	1,000	1,500	2,000	1,003	1,505	2,007	1.009x - 13.532	1.000
R19	SKC	224-PCXR8	566802	01/07/2024	1,000	1,500	2,000	999	1,510	2,005	1.008x - 15.091	0.999
R20	SKC	224-PCXR8	529089	01/07/2024	1,000	1,500	2,000	998	1,518	2,006	1.009x - 13.117	0.999
R21	SKC	224-PCXR8	665728	01/07/2024	1,000	1,500	2,000	997	1,501	1,997	1.002x - 4.913	1.000
R22	SKC	224-PCXR8	707444	03/07/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.006x - 10.166	0.999
R23	SKC	224-PCXR8	761067	03/07/2024	1,000	1,500	2,000	997	1,505	1,998	1.001x - 2.491	1.000
R24	SKC	224-PCXR8	707893	03/07/2024	1,000	1,500	2,000	1,009	1,502	2,005	1.005x - 9.866	0.999
R25	SKC	224-PCXR8	761052	03/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.996x + 1.763	0.999
R26	SKC	224-PCXR8	707956	03/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.994x + 4.162	0.999
R27	SKC	224-PCXR8	707398	04/07/2024	1,000	1,500	2,000	1,007	1,509	2,006	1.008x - 10.258	0.999
R28	SKC	224-PCXR8	707481	04/07/2024	1,000	1,500	2,000	1,004	1,506	2,003	1.003x - 2.295	1.000
R29	SKC	224-PCXR8	707402	04/07/2024	1,000	1,500	2,000	995	1,508	2,003	1.013x - 23.523	0.999
R30	SKC	224-PCXR8	099811	03/07/2024	1,000	1,500	2,000	995	1,509	2,007	1.009x - 14.484	1.000
R31	SKC	224-PCXR8	099183	03/07/2024	1,000	1,500	2,000	1,005	1,502	2,005	1.011x - 19.1536	0.999
R32	SKC	224-PCXR8	671950	03/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.994x + 5.441	0.999
R33	SKC	224-PCXR4	626254	03/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.995x + 2.722	0.999
R34	SKC	224-PCXR4	626131	02/07/2024	1,000	1,500	2,000	1,009	1,504	2,001	1.004x - 8.131	0.999
R35	SKC	224-PCXR8	707460	03/07/2024	1,000	1,500	2,000	1,001	1,497	1,999	0.999x + 0.923	1.000
R36	SKC	224-PCXR8	707446	03/07/2024	1,000	1,500	2,000	1,000	1,495	1,996	0.994x + 5.157	1.000
R37	SKC	224-PCXR8	707432	03/07/2024	1,000	1,500	2,000	997	1,495	2,003	1.005x - 7.592	1.000
R38	SKC	224-PCXR8	707349	03/07/2024	1,000	1,500	2,000	1,000	1,500	2,000	1.001x - 3.738	1.000
R39	SKC	224-PCXR8	761095	03/07/2024	1,000	1,500	2,000	998	1,502	2,002	1.003x - 6.248	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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

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	02/07/2024	1,000	1,500	2,000	1,000	1,507	2,005	1.008x - 14.072	0.999
R41	SKC	224-PCXR4	626140	02/07/2024	1,000	1,500	2,000	1,005	1,498	2,004	0.998x + 3.290	1.000
R42	SKC	224-PCXR4	626463	03/07/2024	1,000	1,500	2,000	1,005	1,506	2,010	1.011x - 15.343	0.999
R43	SKC	224-PCXR4	626129	03/07/2024	1,000	1,500	2,000	1,004	1,503	2,002	1.004x - 8.463	0.999
R44	SKC	224-PCXR4	602753	01/07/2024	1,000	1,500	2,000	999	1,500	2,001	0.999x + 1.755	1.000
R45	SKC	224-PCXR4	626137	01/07/2024	1,000	1,500	2,000	1,000	1,500	2,000	1.002x - 3.046	1.000
R47	SKC	224-PCXR4	A129234	05/07/2024	1,000	1,500	2,000	1,005	1,503	2,004	1.007x - 10.710	1.000
R48	SKC	224-PCXR4	A129253	05/07/2024	1,000	1,500	2,000	1,005	1,494	1,994	0.992x + 8.239	1.000
R49	SKC	224-PCXR4	A129168	05/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.993x + 6.081	0.999
R50	SKC	224-PCXR4	A129282	01/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.991x + 10.238	0.999
R51	SKC	224-PCXR4	A129284	01/07/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.999x + 2.639	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	504.1	997.1	1991.2	0.995x + 6.628	1.000
H-B02	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	497.3	1003.5	2015.2	0.998 + 5.168	1.000
H-B03	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	498.4	994.8	2013.0	1.005x - 12.628	0.999
H-B04	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.1	997.9	1992.5	0.996x + 6.085	1.000
H-B05	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	497.9	1004.0	2014.2	0.998x + 4.472	1.000
H-B06	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	499.7	997.9	2015.7	1.004x - 9.662	0.999
H-B07	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	501.4	1002.3	1990.2	0.999x + 4.103	1.000
H-B08	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	501.5	999.6	1988.9	0.991x + 12.846	1.000
H-B09	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	502.7	1003.8	1984.8	0.997x + 6.523	0.999
H-B10	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	501.5	999.7	1988.7	0.994x + 9.648	1.000

Calibrated by :

Adul Dangkom
(Mr Adul Dangkom)

Approved by :

(Mr. Peera Detudom)



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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	03/07/2024	500	1,000	2,000	499.7	999.5	1990.4	1.002x - 0.454	1.000
H-R02	Dwyer	VFB-65	03/07/2024	500	1,000	2,000	502.9	997.7	1989.8	1.001x - 1.587	0.999
H-R03	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.2	996.0	2002.7	0.995x + 5.824	1.000
H-R04	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	502.1	998.9	1988.8	1.002x - 3.023	0.999
H-R05	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	501.1	1003.8	2003.1	1.003x - 0.016	1.000
H-R06	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	502.3	1005.5	2003.7	1.001x + 3.330	1.000

Calibrated by :

Adul Dangkom
(Mr. Adul Dangkom)

Approved by :

(Mr. Peera Detudom)



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

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
L-R01	Dwyer	VFA-21	04/07/2024	50	100	200	50.4	99.3	200.4	$0.992x + 0.838$	1.000
L-R02	Dwyer	VFA-21	04/07/2024	50	100	200	50.7	99.2	199.1	$1.001x + 0.439$	0.999
L-R03	Dwyer	VFA-21	05/07/2024	50	100	200	50.2	101.1	199.3	$1.003x - 0.202$	1.000
L-R04	Dwyer	VFA-21	02/07/2024	50	100	200	50.1	100.5	202.3	$0.996x + 1.455$	1.000
L-R05	Dwyer	VFA-21	02/07/2024	50	100	200	50.3	101.2	199.4	$1.002x - 0.013$	1.000
L-R06	Dwyer	VFA-21	01/07/2024	50	100	200	50.6	100.3	201.7	$0.998x + 1.163$	1.000
L-R07	Dwyer	VFA-21	01/07/2024	50	100	200	50.8	100.1	201.3	$0.997x + 1.558$	0.999
L-R08	Dwyer	VFA-21	04/07/2024	50	100	200	50.9	101.6	199.8	$0.999x + 0.563$	1.000
L-R09	Dwyer	VFA-21	05/07/2024	50	100	200	50.5	99.3	201.7	$1.000x + 0.963$	0.999
L-R10	Dwyer	VFA-21	05/07/2024	50	100	200	50.6	99.8	201.3	$1.004x + 0.228$	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)			y	R ²
				1	2	3	1	2	3		
L-R01	Dwyer	VFA-21	03/07/2024	50	100	200	50.7	101.9	201.5	$1.004x + 0.202$	0.999
L-R02	Dwyer	VFA-21	03/07/2024	50	100	200	50.1	100.8	201.6	$1.001x + 0.433$	1.000
L-R03	Dwyer	VFA-21	02/07/2024	50	100	200	50.2	101.2	201.3	$1.005x - 0.046$	1.000
L-R04	Dwyer	VFA-21	02/07/2024	50	100	200	50.3	100.3	201.4	$1.002x + 0.230$	1.000
L-R05	Dwyer	VFA-21	02/07/2024	50	100	200	50.4	101.9	200.3	$1.003x - 0.041$	0.999
L-R06	Dwyer	VFA-21	01/07/2024	50	100	200	50.8	100.5	200.7	$1.006x + 0.021$	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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. : SV0824/22063

Instrument Type : Gas Chromatography

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 : 05/08/2024

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) = 156,955 Counts.



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

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

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	16,400	≥ 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 (%)	1.71	≤ 5
Retention Time C15(%)	0	≤ 0.5

APPROVAL :

Signature: Suwarot.

Engineer : Suwarot Trikanut

Date : 05/08/2024



VARIAN

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SERVICE DEPARTMENT
FR-SV-029 Rev.04



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev.04



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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	157,309
C15 Area 2	159,359
C15 Area 3	157,349
C15 Area 4	152,379
C15 Area 5	158,379
C15 Area Average	156,955
* % RSD (< 5 %)	1.71

* 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	Samarot.	
Date	05/08/2567	



Comments	-		
Reviewed by	Samarot P.	Date	05/08/2024



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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	4.128
C15 RT 2	4.128
C15 RT 3	4.128
C15 RT 4	4.128
C15 RT 5	4.128
C15 RT Average	4.128
* % RSD (< 0.5 %)	0

* 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	Samarot.	
Date	05/08/2024	



Comments	-		
Reviewed by	Samarot P.	Date	05/08/2024



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

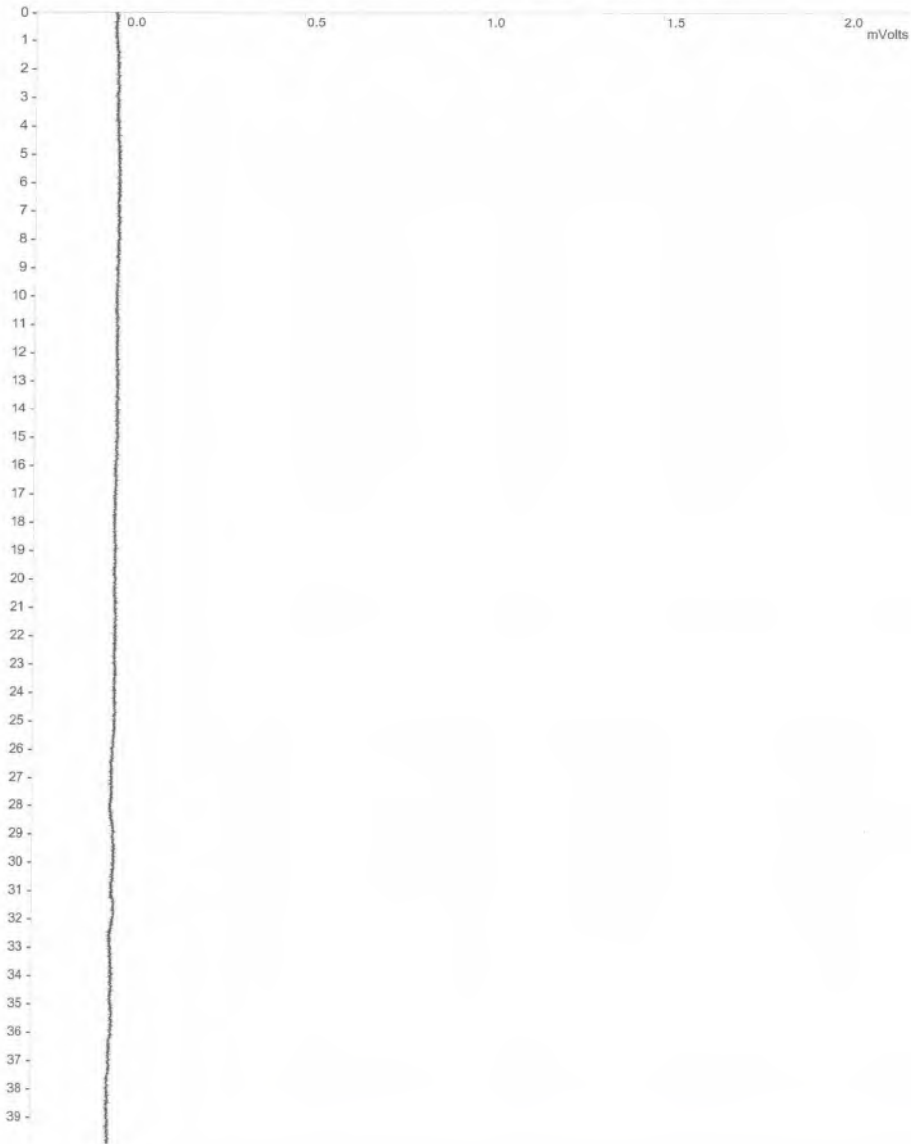
Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 39.960 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Chart Speed = 0.56 cm/min Attenuation = 1 Zero Offset = 10%
Start Time = 0.000 min End Time = 39.960 min Min / Tick = 1.00



Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 39.960 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
Totals:		0.0000		0.000	0			

Total Unidentified Counts : 0 counts
Detected Peaks: 0 Rejected Peaks: 0 Identified Peaks: 0
Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0
Baseline Offset: -16 microVolts LSB: 1 microVolts
Noise (used): 22 microVolts - monitored before this run
Manual injection
Data Handling: No peaks

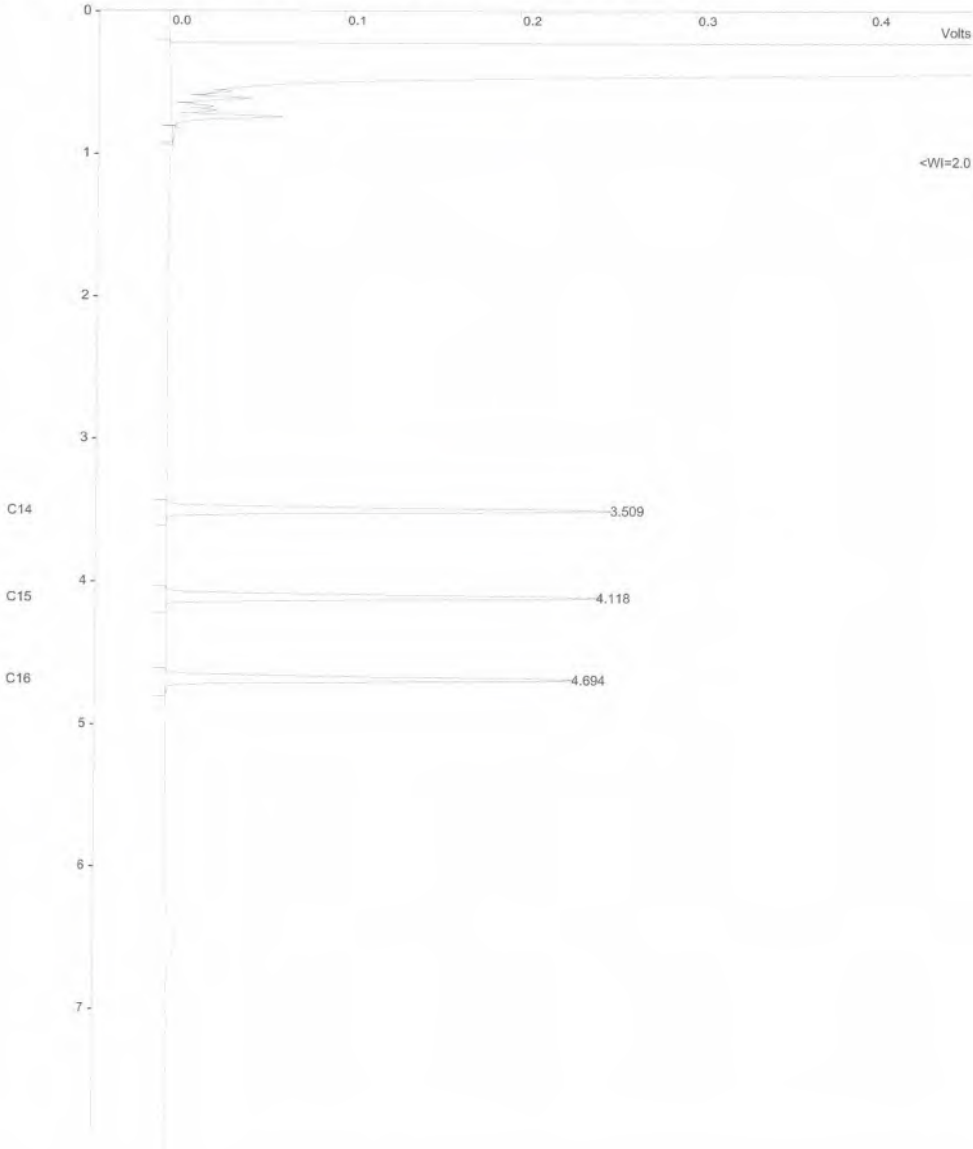
Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\caf2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Chart Speed = 2.83 cm/min Attenuation = 205 Zero Offset = 8%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\fid2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	54.1202	3.509	-0.005	163565	BB	2.1	C
2	C15	53.5241	4.118	-0.005	157309	BB	2.2	C
3	C16	52.2361	4.694	0.001	146804	BB	2.3	C
Totals:		159.8804		-0.009	1704289			

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

Detected Peaks: 11 Rejected Peaks: 0 Identified Peaks: 3

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts LSB: 1 microVolts

Noise (used): 28 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

Sample ID: fid std

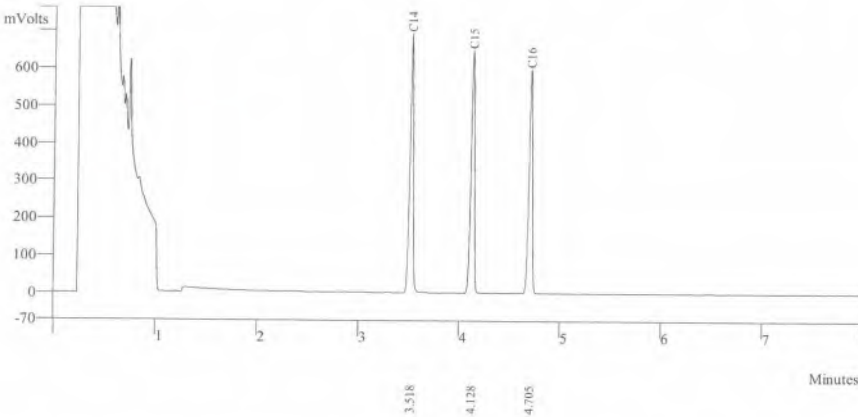
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024001.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	152.6865	3.518	163565	BB	2.2
2	C15	147.1889	4.128	157309	BB	2.3
3	C16	138.7997	4.705	146804	BB	2.3
Totals		438.6751		467678		

Sample ID: fid std

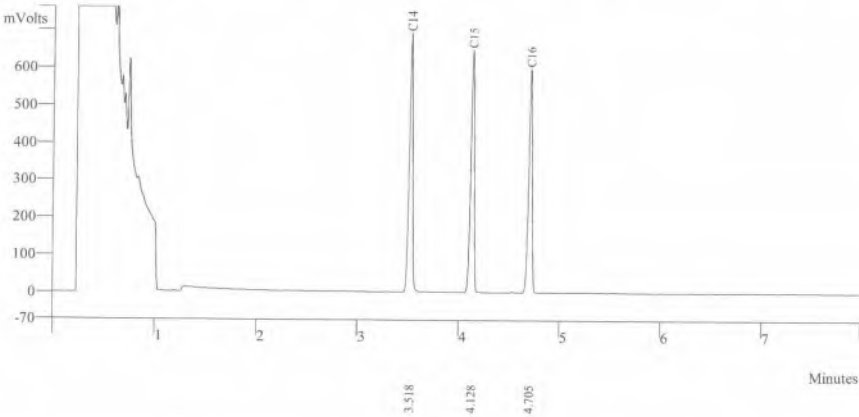
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024002.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	152.6865	3.518	168565	BB	2.2
2	C15	137.1189	4.128	159359	BB	2.3
3	C16	128.7997	4.705	147834	BB	2.3
Totals		418.6042		475758		

Sample ID: fid std

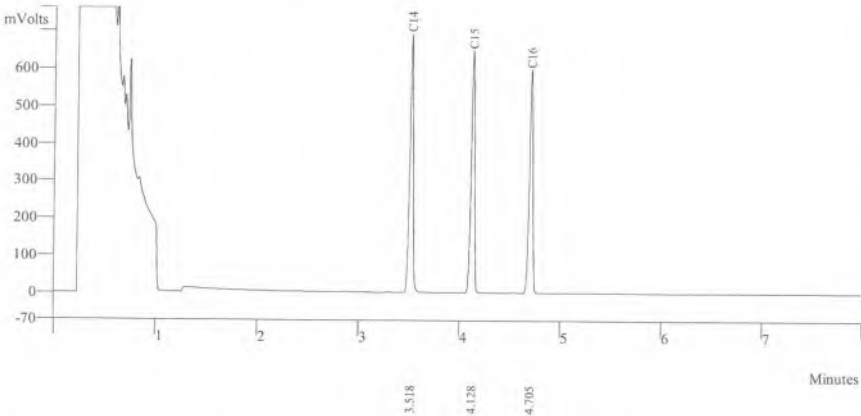
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024003.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	152.7865	3.518	169535	BB	2.2
2	C15	197.1159	4.128	157349	BB	2.3
3	C16	128.5997	4.705	149834	BB	2.3
Totals		478.5021		476718		

Sample ID: fid std

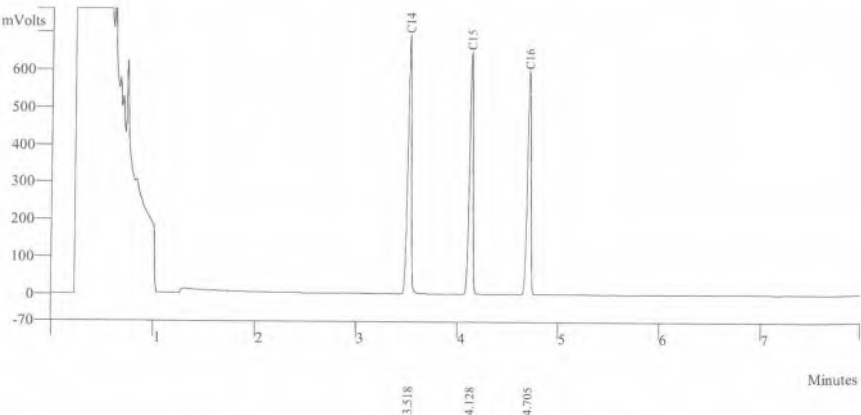
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024004.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	162.7865	3.518	165521	BB	2.2
2	C15	157.1159	4.128	152379	BB	2.3
3	C16	138.5997	4.705	146834	BB	2.3
Totals		458.5021		464734		

Sample ID: **fid std**

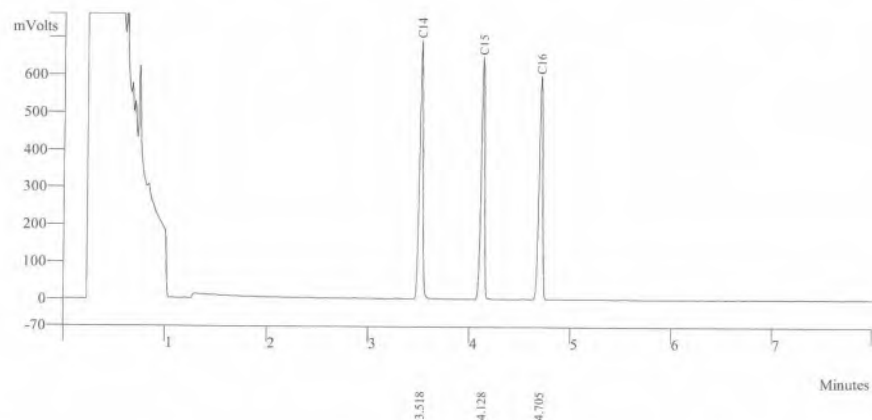
Operator (Inj): suwarot
 Injection Date: 05/08/2024
 Calc Date: 05/08/2024
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024005.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	162.7965	3.518	164521	BB	2.2
2	C15	137.1159	4.128	158379	BB	2.3
3	C16	128.1947	4.705	149834	BB	2.3
Totals		428.1071		472734		



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: 0006750304

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.

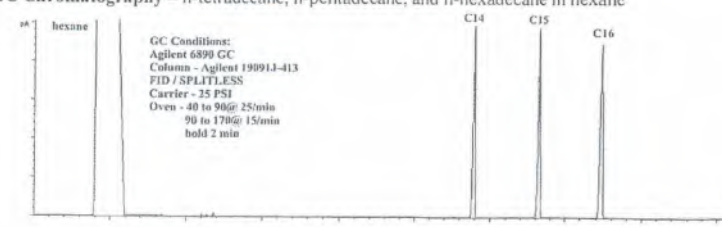
Concentrations:		
n-tetradecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-pentadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-hexadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %

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	99.5%
hexane	99%

Typical Analytical Spectrum or Chromatography
 GC Chromatography – n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 June 2023
 Date of expiration: 31 July 2025

Monica Bourgeois
 Monica Bourgeois
 QMS Representative

Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

Customer : THAI UNIQUE CO., LTD.
80-82 PRACHATHIPATAI RD., BANGKHUNPHROM,
PRANAKORN, BANGKOK 10200

Instrument	: AMD Flow Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Agilent Technologies	Humidity	: (50 ± 15) %RH
Model	: G6691A	Received Date	: 6-Dec-23
Serial No.	: MY16470347	Calibrated Date	: 7-Dec-23
Identity No.	: SV-DF-001	Issued Date	: 12-Dec-23
Range	: 0 ml/min to 750 ml/min	Calibrated Location	: In Lab
Resolution	: See to data		
Calibration Method	: CP-WK-M10		

Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Flow Calibrator	140215-134	L202304114-001	18-Apr-25	MIT
Primary Flow Calibrator	1107-S	WK2305-049-5	22-May-24	WK Electric Co.,Ltd.

MIT : Miracle International Technology Co.,Ltd.

This result calibrate was found accurate as shown on date place of calibrate only

This certificate is traceability to the International System of Unit (SI)

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%

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.

Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

Function : Flow Measurement
Range : 0 ml/min to 750 ml/min
Resolution : 0.01 / 0.1 / 1 ml/min

UUC Setting		STD Reading	Error	Uncertainty (±)	Tolerance Limit Values (ml/min)
Scale	ml/min				
0	0.00	0.00	0.00	3.3	-0.20 ~ 0.20
50	50.7	51.15	-0.45	3.3	48.80 ~ 51.20
300	300	300.4	-0.4	3.3	293.8 ~ 306.2
450	450	450.7	-0.7	3.3	440.8 ~ 459.2
550	550	549.5	0.5	3.3	533.5 ~ 566.5
650	650	649.3	0.7	3.3	630.5 ~ 669.5
700	700	699.2	0.8	3.3	679.0 ~ 721.0

(X) Without Adjustment () After Adjustment

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**** End of Certificate****



Measuretronix Limited
2425/2 Lat Phrao Road, Saphan Song
Wangthonglang, Bangkok 10310, Thailand
Phone : 0-2514-1000, 0-2514-1234
Fax : 0-2514-0001, 0-2514-0003
Website : www.measuretronix.com



Certificate of Calibration

Certificate Number : LF24-0278
Equipment : Thermometer
Manufacturer : Fluke
Model : 51
Serial Number : 5910857
Asset Number : 5910857
Customer : Thai Unique Co., Ltd.
80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200
Date of Calibrate : 26-Jun-2024
Date of Issue : 27-Jun-2024

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

This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab. Calibration certificates without signature are not valid.

The measurements marked with an asterisk () in this certificate are outside our range of accreditation. They have been included for completeness.*

The Calibration interval (Cal.Due) is the responsibility of the end user.

Calibrated by

Nanthiya Ngampring
Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

A. S.
Mrs. Arunee Bamrungham
Cal-Lab Manager

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3



Measuretronix Limited

Calibration Report

UUC : Fluke 51 Thermometer

Serial No. : 5910857

Asset No. : 5910857

Procedure : CP-LP-04:Rev.02

Note : Refer to Fluke 51,52 Operator's Manual Rev I 3/86, Oct 1985

Certificate No. : LF24-0278

Report data type : As-Found

Date of Calibrate : 26-Jun-2024

Date of Receive : 17-Jun-2024

Environment condition

Temperature : 23 °C ± 3 °C

Humidity : 50 %RH ± 20 %RH

Customer : Thai Unique Co., Ltd.

Address : 80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200

Measuretronix Cal-Lab certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). The measurements are traceable to national or international measurement standards or accept fundamental or natural physical constants or have been derived by approved ratio techniques as state in the Standard Used below. The policies and procedures used comply with ISO/IEC 17025:2017.

This report applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab.

The uncertainties shown are the expanded uncertainties, which calculated from the standard uncertainties multiplied by a coverage factor of $k = 2$, providing a measurement confidence level of approximately 95%.

No statement of compliance with specifications is made or implied on this certificate.

Remark : The units of uncertainty values in this report are referred to the below details :

"Volt" or "V" for voltage, "Ampere" or "A" for current, "Ohm" or "Ω" for resistance, "Farad" or "F" for capacitance, "Hertz" or "Hz" for frequency, "deg C" or "°C" for degree Celsius, "deg F" or "°F" for degree Fahrenheit, etc.

Standard Used

Serial/Asset	Description	Traceable	Cert.No.	Cal.Date	Due Date
6400011	Fluke 5500A Calibrator	NIMT	EE-0017-24	7-Mar-2024	6-Mar-2025

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 2 of 3

Test Data

TEST	RANGE	Nominal Value	UUC Tol. (+/-)	Test Result	Error	Uncertainty (+/-)
THERMOCOUPLE MEASUREMENT CALIBRATION						
TYPE K THERMOCOUPLE						
1		-195.0 °C*	0.9 °C	-195.4 °C	-0.4 °C	0.27 °C
2		-100.0 °C	0.8 °C	-100.5 °C	-0.5 °C	0.21 °C
3		-50.0 °C	0.8 °C	-50.2 °C	-0.2 °C	0.21 °C
4		0.0 °C	0.7 °C	0.0 °C	0.0 °C	0.21 °C
5		100.0 °C	0.8 °C	100.1 °C	0.1 °C	0.21 °C
6		300.0 °C	1.0 °C	300.2 °C	0.2 °C	0.21 °C
7		500.0 °C	1.2 °C	500.1 °C	0.1 °C	0.21 °C
8		1365.0 °C	2.1 °C	1365.2 °C	0.2 °C	0.32 °C
TYPE J THERMOCOUPLE						
9		-195.0 °C*	1.0 °C	-194.4 °C	0.6 °C	0.22 °C
10		-100.0 °C	0.9 °C	-99.3 °C	0.7 °C	0.18 °C
11		-50.0 °C	0.9 °C	-49.4 °C	0.6 °C	0.18 °C
12		0.0 °C	0.8 °C	0.5 °C	0.5 °C	0.18 °C
13		100.0 °C	0.9 °C	100.4 °C	0.4 °C	0.18 °C
14		300.0 °C	1.1 °C	300.8 °C	0.8 °C	0.18 °C
15		755.0 °C	1.6 °C	755.3 °C	0.3 °C	0.18 °C

End of Calibration Report

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

S. Pohtongkam

Service Manager

เอกสารแนบ 5-3

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment

Temperature : (23 + 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 / 2

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

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

FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 201126702200795001

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev.4

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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
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E-mail : sumalee@tistr.or.th



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

Noise B_000/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R12	ACO	6236	00172040	18 August 2024	93.9	93.9
ACO-R16	ACO	6236	00172063	18 August 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

เอกสารแนบ 5-4

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง



CERTIFICATE No : 24E6416
REFERENCE No : 73694-I

PAGE : 1 OF 3

Certificate of Calibration

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

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

APPROVED BY : PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24



CERTIFICATE No : 24E6416

PAGE : 2 OF 3

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3



CERTIFICATE No : 24E6416

PAGE : 3 OF 3

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

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

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

3. DISPLAY UNIT WITH TEMPERATURE

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

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

CERT.No.: HS-V015C

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, Bangkac, 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 : PONGSAK J.

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.

F-G010 REV : 02

**QUALITY CALIBRATION CO.,LTD.**

235 Petchkasem 63/2 Road, Laksong, Bangkac, 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.

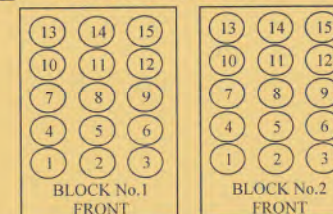
2. REFERENCE STANDARD INSTRUMENTS :-

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**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	0.86

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

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

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

END OF CALIBRATION REPORT

F-G010 REV : 02

CERTIFICATE No : 24M2229
REFERENCE No : 72448-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2229

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW

MANUFACTURER : SARTORIUS S/N : 36591843

ID No : BA 09/61 RECEIVED DATE : 08-Mar-24

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

AMBIENT TEMPERATURE : 25° C \pm 1° C RELATIVE HUMIDITY : 55 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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



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

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

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: Suwarot.

Engineer : Suwarot Trikanut

Date : 09/08/2023



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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

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	Sunaret.	
Date	09/08/2023	



Comments	-		
Reviewed by	Sunaret P.	Date	09/08/2023



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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

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	Sunaret.	
Date	09/08/2023	



Comments	-		
Reviewed by	Sunaret P.	Date	09/08/2023



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Sample ID: **fid std**

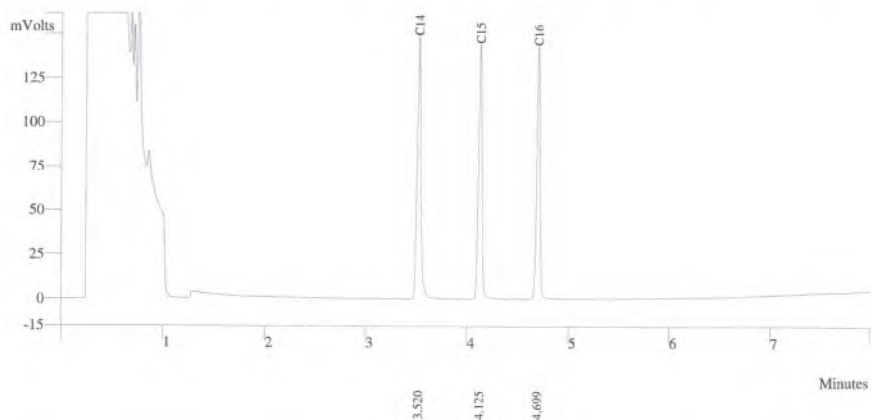
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



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

c:\star\data\tu\cal2023\fid\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**

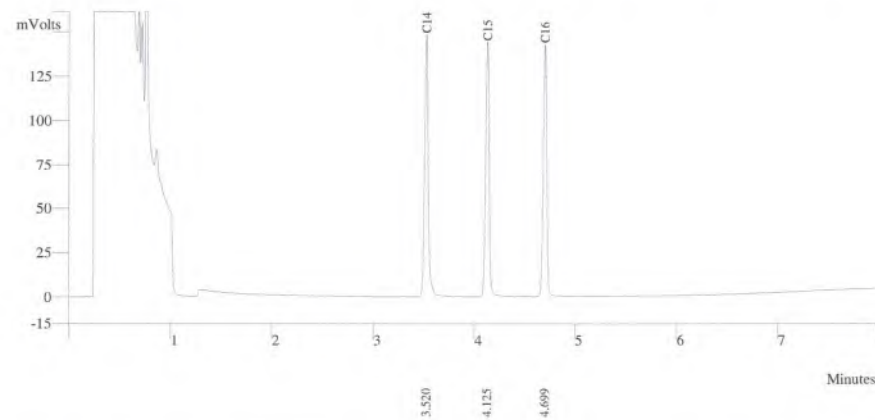
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: **fid std**

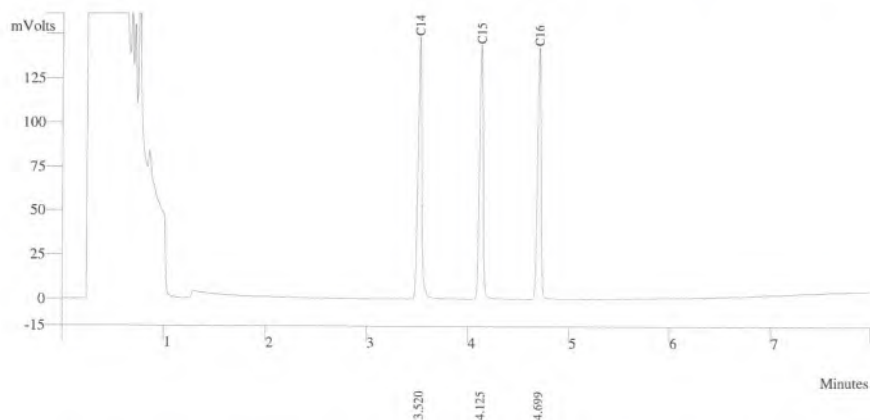
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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

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

A = FID 10 V RESULTS



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

Sample ID: **fid std**

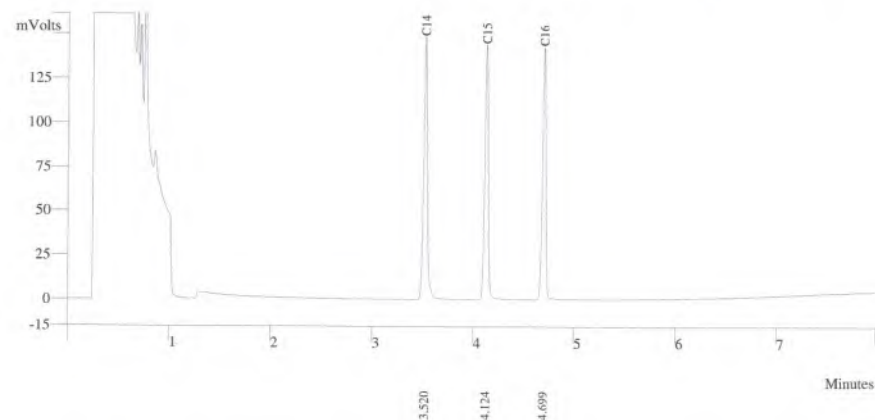
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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

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

A = FID 10 V RESULTS



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

Sample ID: **fid std**

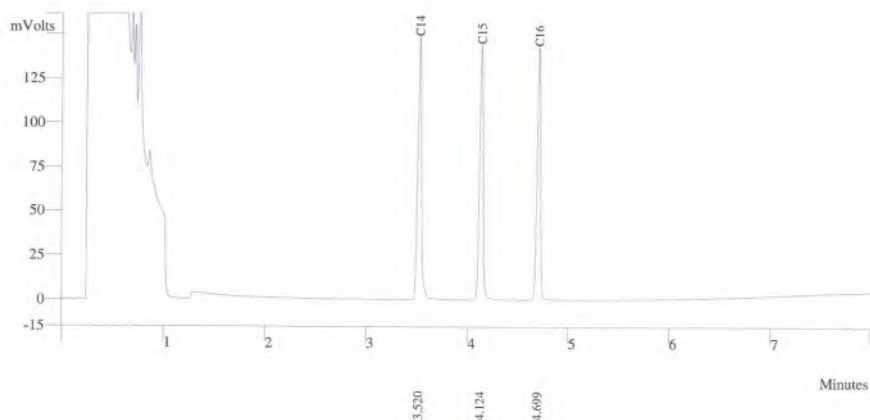
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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

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

A = FID 10 V RESULTS

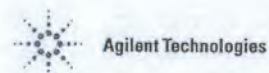


Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
	Totals	99.9552		1087210		



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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 %

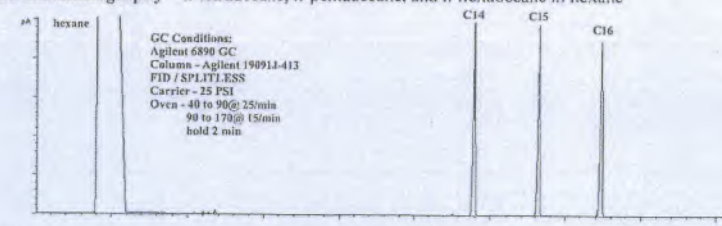
Solvent: hexane

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



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GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

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 : 05/08/2024

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) = 156,955 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)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	16,400	≥ 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 (%)	1.71	≤ 5
Retention Time C15(%)	0	≤ 0.5

APPROVAL :

Signature: Suwarot.

Engineer : Suwarot Trikanut

Date : 05/08/2024



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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

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	157,309
C15 Area 2	159,359
C15 Area 3	157,349
C15 Area 4	152,379
C15 Area 5	158,379
C15 Area Average	156,955
* % RSD (< 5 %)	1.71

* 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	Sunarot.	
Date	05/08/2567	



Comments	-		
Reviewed by	Sun P.	Date	05/08/2024



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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

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	4.128
C15 RT 2	4.128
C15 RT 3	4.128
C15 RT 4	4.128
C15 RT 5	4.128
C15 RT Average	4.128
* % RSD (< 0.5 %)	0

* 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	Sunarot.	
Date	05/08/2024	



Comments	-		
Reviewed by	Sun P.	Date	05/08/2024



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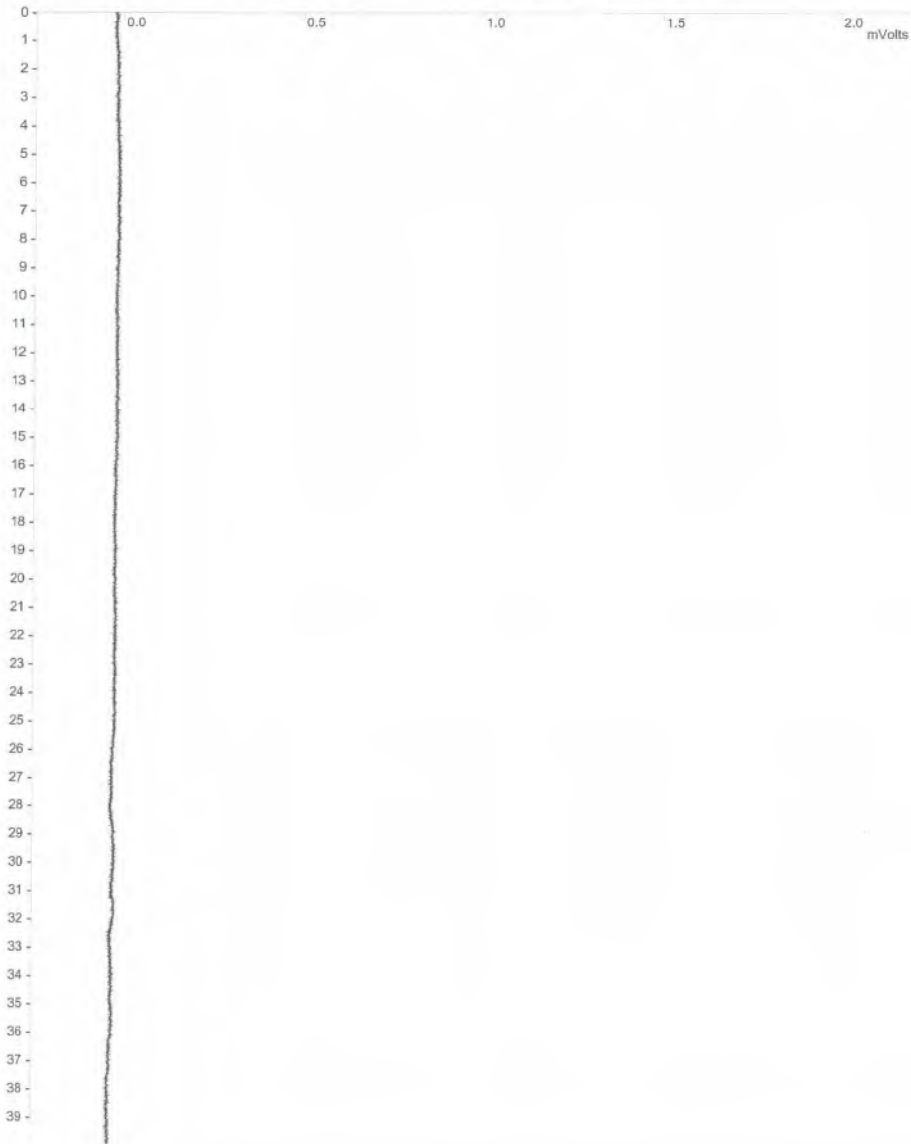
Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 39.960 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Chart Speed = 0.56 cm/min Attenuation = 1 Zero Offset = 10%
Start Time = 0.000 min End Time = 39.960 min Min / Tick = 1.00



Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 39.960 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
Totals:			0.0000	0.000	0			

Total Unidentified Counts : 0 counts
Detected Peaks: 0 Rejected Peaks: 0 Identified Peaks: 0
Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0
Baseline Offset: -16 microVolts LSB: 1 microVolts
Noise (used): 22 microVolts - monitored before this run
Manual injection
Data Handling: No peaks

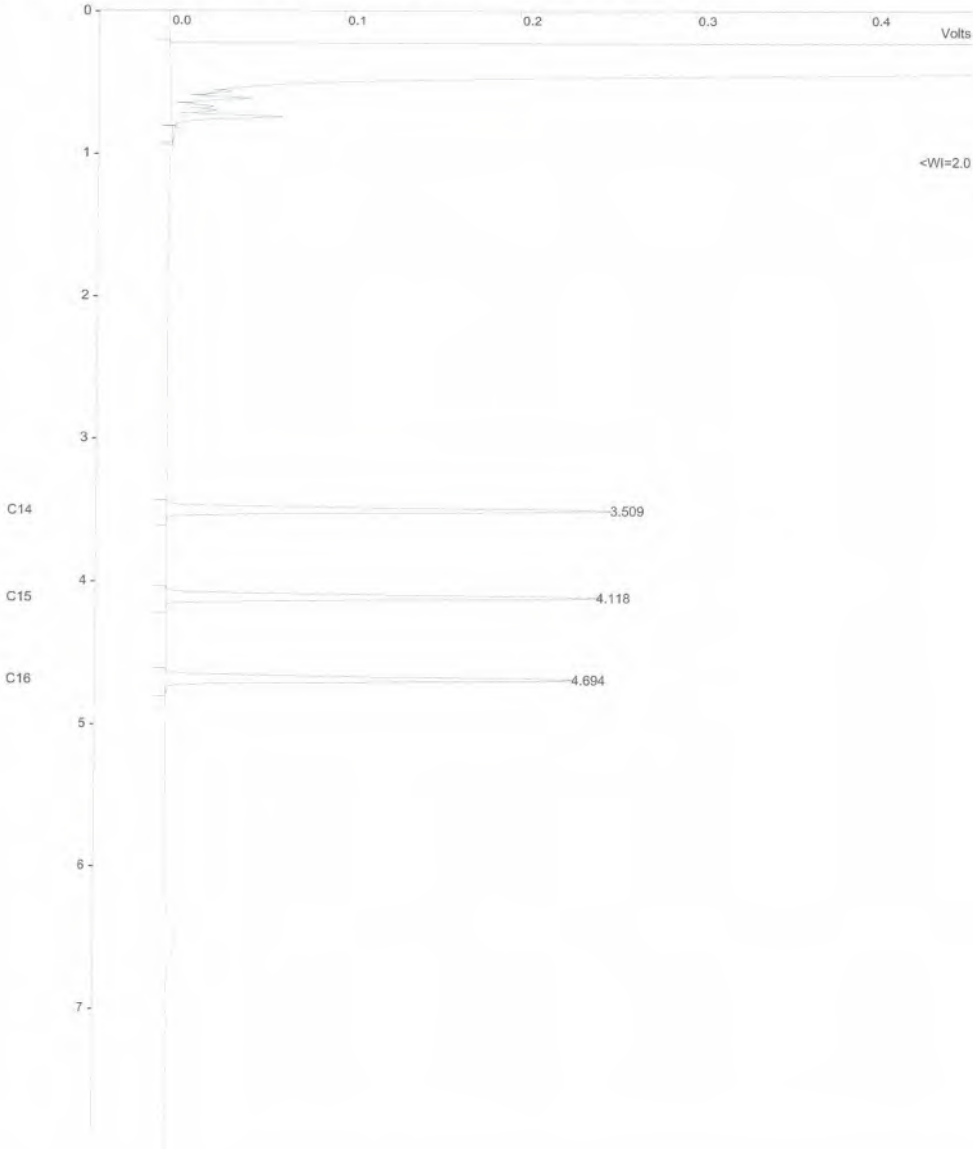
Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\caf2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Chart Speed = 2.83 cm/min Attenuation = 205 Zero Offset = 8%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\fid2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	54.1202	3.509	-0.005	163565	BB	2.1	C
2	C15	53.5241	4.118	-0.005	157309	BB	2.2	C
3	C16	52.2361	4.694	0.001	146804	BB	2.3	C
Totals:		159.8804		-0.009	1704289			

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

Detected Peaks: 11 Rejected Peaks: 0 Identified Peaks: 3

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts LSB: 1 microVolts

Noise (used): 28 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

Sample ID: fid std

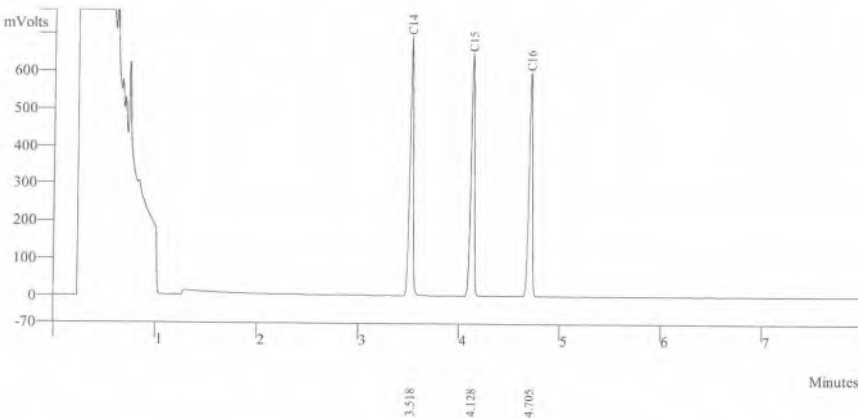
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024001.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	152.6865	3.518	163565	BB	2.2
2	C15	147.1889	4.128	157309	BB	2.3
3	C16	138.7997	4.705	146804	BB	2.3
Totals		438.6751		467678		

Sample ID: fid std

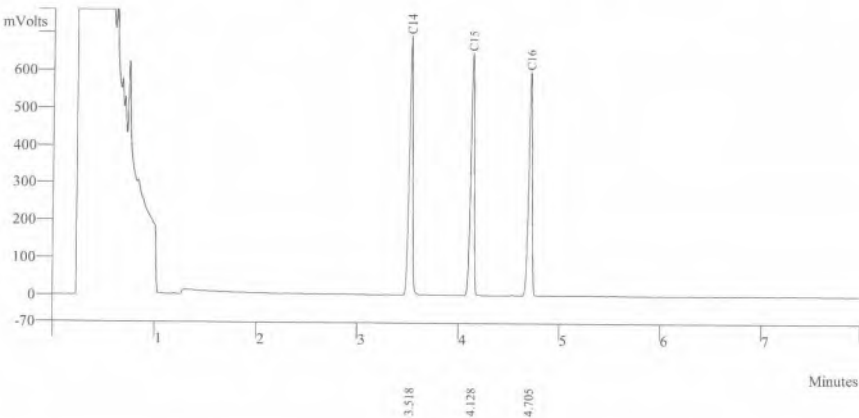
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024002.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	152.6865	3.518	168565	BB	2.2
2	C15	137.1189	4.128	159359	BB	2.3
3	C16	128.7997	4.705	147834	BB	2.3
Totals		418.6042		475758		

Sample ID: fid std

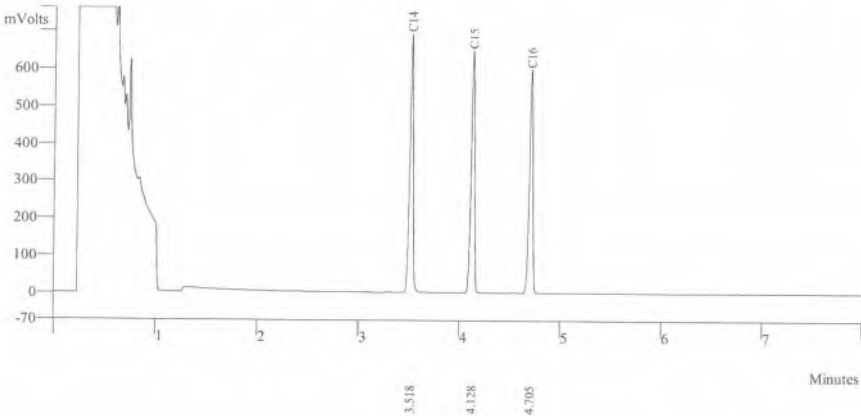
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024003.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	152.7865	3.518	169535	BB	2.2
2	C15	197.1159	4.128	157349	BB	2.3
3	C16	128.5997	4.705	149834	BB	2.3
Totals		478.5021		476718		

Sample ID: fid std

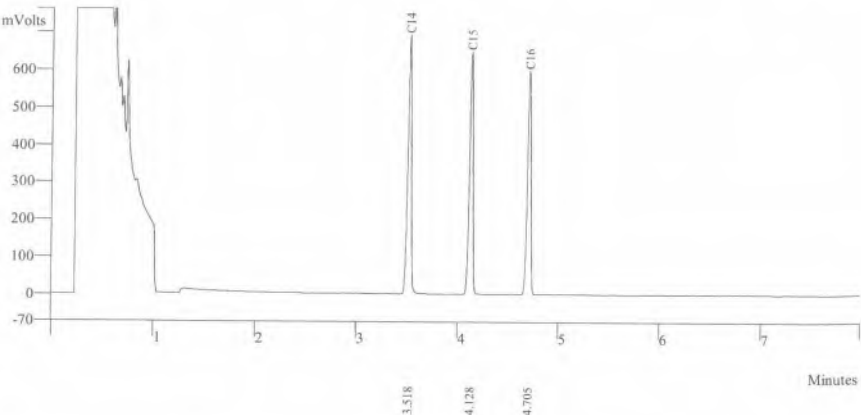
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024004.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	162.7865	3.518	165521	BB	2.2
2	C15	157.1159	4.128	152379	BB	2.3
3	C16	138.5997	4.705	146834	BB	2.3
Totals		458.5021		464734		

Sample ID: **fid std**

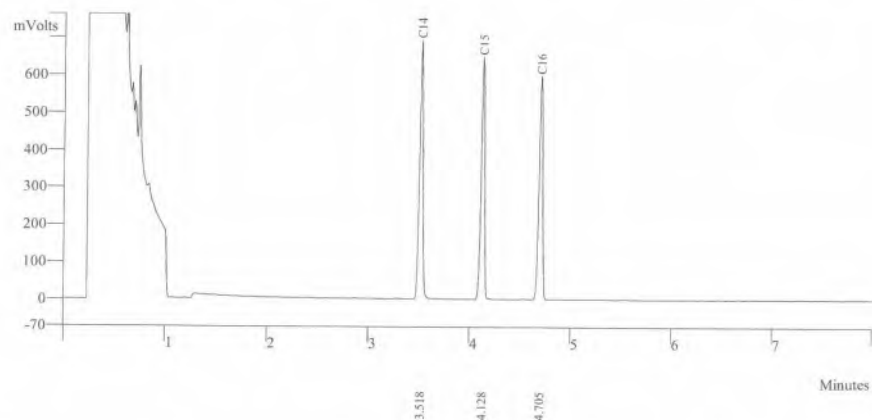
Operator (Inj): suwarot
 Injection Date: 05/08/2024
 Calc Date: 05/08/2024
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024005.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	162.7965	3.518	164521	BB	2.2
2	C15	137.1159	4.128	158379	BB	2.3
3	C16	128.1947	4.705	149834	BB	2.3
Totals		428.1071		472734		



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: 0006750304

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.

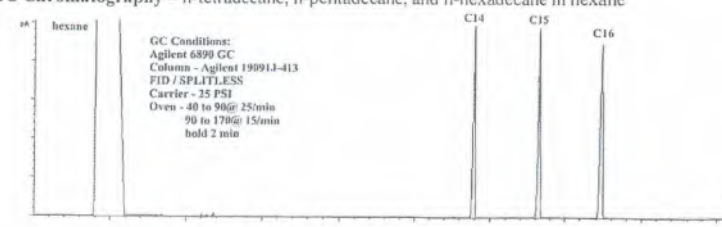
Concentrations:		
n-tetradecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-pentadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-hexadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %

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	99.5%
hexane	99%

Typical Analytical Spectrum or Chromatography
 GC Chromatography – n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 June 2023

Date of expiration: 31 July 2025

Monica Bourgeois
 Monica Bourgeois
 QMS Representative

Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

Customer : THAI UNIQUE CO., LTD.
80-82 PRACHATHIPATAI RD., BANGKHUNPHROM,
PRANAKORN, BANGKOK 10200

Instrument	: AMD Flow Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Agilent Technologies	Humidity	: (50 ± 15) %RH
Model	: G6691A	Received Date	: 6-Dec-23
Serial No.	: MY16470347	Calibrated Date	: 7-Dec-23
Identity No.	: SV-DF-001	Issued Date	: 12-Dec-23
Range	: 0 ml/min to 750 ml/min	Calibrated Location	: In Lab
Resolution	: See to data		
Calibration Method	: CP-WK-M10		

Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Flow Calibrator	140215-134	L202304114-001	18-Apr-25	MIT
Primary Flow Calibrator	1107-S	WK2305-049-5	22-May-24	WK Electric Co.,Ltd.

MIT : Miracle International Technology Co.,Ltd.

This result calibrate was found accurate as shown on date place of calibrate only

This certificate is traceability to the International System of Unit (SI)

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%

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

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Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

Function : Flow Measurement
Range : 0 ml/min to 750 ml/min
Resolution : 0.01 / 0.1 / 1 ml/min

UUC Setting		STD Reading	Error	Uncertainty (±)	Unit : ml/min Tolerance Limit Values (ml/min)
Scale	ml/min				
0	0.00	0.00	0.00	3.3	-0.20 ~ 0.20
50	50.7	51.15	-0.45	3.3	48.80 ~ 51.20
300	300	300.4	-0.4	3.3	293.8 ~ 306.2
450	450	450.7	-0.7	3.3	440.8 ~ 459.2
550	550	549.5	0.5	3.3	533.5 ~ 566.5
650	650	649.3	0.7	3.3	630.5 ~ 669.5
700	700	699.2	0.8	3.3	679.0 ~ 721.0

(X) Without Adjustment () After Adjustment

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**** End of Certificate****



Measuretronix Limited
2425/2 Lat Phrao Road, Saphan Song
Wangthonglang, Bangkok 10310, Thailand
Phone : 0-2514-1000, 0-2514-1234
Fax : 0-2514-0001, 0-2514-0003
Website : www.measuretronix.com



Certificate of Calibration

Certificate Number : LF24-0278
Equipment : Thermometer
Manufacturer : Fluke
Model : 51
Serial Number : 5910857
Asset Number : 5910857
Customer : Thai Unique Co., Ltd.
80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200
Date of Calibrate : 26-Jun-2024
Date of Issue : 27-Jun-2024

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

This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab. Calibration certificates without signature are not valid.

The measurements marked with an asterisk () in this certificate are outside our range of accreditation. They have been included for completeness.*

The Calibration interval (Cal.Due) is the responsibility of the end user.

Calibrated by

Nanthiya Ngampring
Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

A. S.
Mrs. Arunee Bamrungham
Cal-Lab Manager

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3



Measuretronix Limited

Calibration Report

UUC : Fluke 51 Thermometer

Serial No. : 5910857

Asset No. : 5910857

Procedure : CP-LP-04:Rev.02

Note : Refer to Fluke 51,52 Operator's Manual Rev I 3/86, Oct 1985

Certificate No. : LF24-0278

Report data type : As-Found

Date of Calibrate : 26-Jun-2024

Date of Receive : 17-Jun-2024

Environment condition

Temperature : 23 °C ± 3 °C

Humidity : 50 %RH ± 20 %RH

Customer : Thai Unique Co., Ltd.

Address : 80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200

Measuretronix Cal-Lab certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). The measurements are traceable to national or international measurement standards or accept fundamental or natural physical constants or have been derived by approved ratio techniques as state in the Standard Used below. The policies and procedures used comply with ISO/IEC 17025:2017.

This report applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab.

The uncertainties shown are the expanded uncertainties, which calculated from the standard uncertainties multiplied by a coverage factor of $k = 2$, providing a measurement confidence level of approximately 95%.

No statement of compliance with specifications is made or implied on this certificate.

Remark : The units of uncertainty values in this report are referred to the below details :

"Volt" or "V" for voltage, "Ampere" or "A" for current, "Ohm" or "Ω" for resistance, "Farad" or "F" for capacitance, "Hertz" or "Hz" for frequency, "deg C" or "°C" for degree Celsius, "deg F" or "°F" for degree Fahrenheit, etc.

Standard Used

Serial/Asset	Description	Traceable	Cert.No.	Cal.Date	Due Date
6400011	Fluke 5500A Calibrator	NIMT	EE-0017-24	7-Mar-2024	6-Mar-2025

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 2 of 3

Test Data

TEST	RANGE	Nominal Value	UUC Tol. (+/-)	Test Result	Error	Uncertainty (+/-)
THERMOCOUPLE MEASUREMENT CALIBRATION						
TYPE K THERMOCOUPLE						
1		-195.0 °C*	0.9 °C	-195.4 °C	-0.4 °C	0.27 °C
2		-100.0 °C	0.8 °C	-100.5 °C	-0.5 °C	0.21 °C
3		-50.0 °C	0.8 °C	-50.2 °C	-0.2 °C	0.21 °C
4		0.0 °C	0.7 °C	0.0 °C	0.0 °C	0.21 °C
5		100.0 °C	0.8 °C	100.1 °C	0.1 °C	0.21 °C
6		300.0 °C	1.0 °C	300.2 °C	0.2 °C	0.21 °C
7		500.0 °C	1.2 °C	500.1 °C	0.1 °C	0.21 °C
8		1365.0 °C	2.1 °C	1365.2 °C	0.2 °C	0.32 °C
TYPE J THERMOCOUPLE						
9		-195.0 °C*	1.0 °C	-194.4 °C	0.6 °C	0.22 °C
10		-100.0 °C	0.9 °C	-99.3 °C	0.7 °C	0.18 °C
11		-50.0 °C	0.9 °C	-49.4 °C	0.6 °C	0.18 °C
12		0.0 °C	0.8 °C	0.5 °C	0.5 °C	0.18 °C
13		100.0 °C	0.9 °C	100.4 °C	0.4 °C	0.18 °C
14		300.0 °C	1.1 °C	300.8 °C	0.8 °C	0.18 °C
15		755.0 °C	1.6 °C	755.3 °C	0.3 °C	0.18 °C

End of Calibration Report

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

S. Pohtongkam

Service Manager

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-YYYY)	22-Feb-2024	Next PM Due Date: (DD-MMM-YYYY)	22-Aug-2024

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

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

General Instructions:

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

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Component List

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

Parts lists

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

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

Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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

Review:

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


Additional Comments

Additional Comments Regarding the PM

Review

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

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

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

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

General Instructions:

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

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Component List

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

Parts lists

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

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

Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

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

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

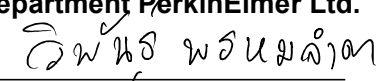
PinAAcle 900T

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

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 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>January 4, 2025</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>January 4, 2024</u>
Phone: <u>083-9269252</u>	Visit Number: <u>1 of 2</u>
Fax: <u>02-513-4221</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
	PerkinElmer Fax: <u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<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>September 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>January 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
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>July 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>July 4, 2024</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00550
	Ni 231.604 nm	≤ 0.008	0.00714
	Ni 341.476 nm	≤ 0.012	0.00790
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01655
	Ba 455.403 nm	≤ 0.025	0.02391
Precision	As 193.656 nm	% RSD < 1.0	0.72 %
	Zn 213.856 nm	% RSD < 1.0	0.66 %
	Mn 257.610 nm	% RSD < 1.0	0.30 %
	La 379.478 nm	% RSD < 1.0	0.98 %
	Ba 455.403 nm	% RSD < 1.0	0.95 %
	Ba 493.408 nm	% RSD < 1.0	0.78 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	6.22 ppb
	As 193.696 nm	3(sd)	6.44 ppb
	Pb 220.353 nm	3(sd)	2.06 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	78.26 ppb
	Zn 213.856 nm	3(sd)	2.07 ppb
	Mn 257.610 nm	3(sd)	0.52 ppb
	La 379.478 nm	3(sd)	2.63 ppb
	Ba 455.403 nm	3(sd)	0.08 ppb
	Ba 493.408 nm	3(sd)	0.75 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	64.72
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	15.04



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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

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:

(
Wiphan Promlumda
)

Service Engineer

Cert. No. : SP24020
Pages 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

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

Location : WET CHEMISTRY LABORATORY IV

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

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

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
 associates



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

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Filter S/N	Nominal Absorbance (A)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Neutral Density glass filter	440.0	29360	1.0	1.0517	1.0550	0.0033	0.0029	2.00
		29914	0.7	0.7445	0.7460	0.0015	0.0029	2.00
		29381	0.5	0.5416	0.5431	0.0015	0.0030	2.00
	546.1	29360	1.0	0.9821	0.9820	-0.0001	0.0028	2.00
		29914	0.7	0.6961	0.6958	-0.0003	0.0028	2.00
		29381	0.5	0.5073	0.5080	0.0007	0.0029	2.00
	590.0	29360	1.0	1.0222	1.0210	-0.0012	0.0028	2.00
		29914	0.7	0.7237	0.7221	-0.0016	0.0029	2.00
		29381	0.5	0.5361	0.5361	0.0000	0.0031	2.00
	635.0	29360	1.0	0.9753	0.9745	-0.0008	0.0028	2.00
		29914	0.7	0.6910	0.6900	-0.0010	0.0029	2.00
		29381	0.5	0.5211	0.5210	-0.0001	0.0032	2.00

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

UUC* = Unit Under Calibration

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

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

Parameter Setting
 Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm

Scanning Speed 7.5 nm/min

Data Pitch 0.1 nm

Band width(Wavelength) 1.0 nm

Band width(Vis) 1.0 nm

Band width(Uv) 1.0 nm

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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


End of Calibration Certificate

T. Petch

เอกสารแนบ 5-5

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำใต้ดิน

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

Part Number	Release	Publication Date	
TH09370064	C	March 2013	

Scope

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

General Instructions:

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

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Component List

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

Parts lists

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

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

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

Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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

Review:

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

Additional Comments

Additional Comments Regarding the PM


Review

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

เอกสารแนบ 5-6

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพดิน

Turbomass/Clarus Mass/ SQ8 MS Preventive Maintenance (PM)			
Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	648N4050804	PM Number:	2 of 2
Customer Name (if applicable):	Ms. Naruecha	Telephone Number:	NA
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-02927336
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Part Number	Release	Publication Date	
TH09370064	C	March 2013	

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Component List

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

Parts lists

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

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

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

Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

PC Maintenance:

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

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

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

เอกสารแนบ 5-7

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในสถานประกอบการ



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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.)					R ²
					1	2	3	1	2	3	y		
B01	SKC	224-PCXR4	262101	05/04/2024	1,000	1,500	2,000	993	1,496	1,998	1.001x - 3.430	1.000	
B02	SKC	224-PCXR4	626166	05/04/2024	1,000	1,500	2,000	1,004	1,506	2,000	1.007x - 16.572	0.999	
B03	SKC	224-PCXR4	612968	09/04/2024	1,000	1,500	2,000	997	1,498	2,004	1.008x - 13.756	1.000	
B04	SKC	224-PCXR4	602804	08/04/2024	1,000	1,500	2,000	1,001	1,511	1,993	0.997x + 4.427	1.000	
B05	SKC	224-PCXR4	612693	08/04/2024	1,000	1,500	2,000	1,005	1,510	2,002	1.009x - 16.400	0.999	
B06	SKC	224-PCXR4	262188	08/04/2024	1,000	1,500	2,000	1,003	1,510	2,004	1.005x - 8.687	0.999	
B07	SKC	224-PCXR4	626262	05/04/2024	1,000	1,500	2,000	997	1,500	1,996	0.995x + 4.930	1.000	
B08	SKC	224-PCXR4	626100	04/04/2024	1,000	1,500	2,000	1,003	1,508	2,002	1.011x - 19.679	0.999	
B09	SKC	224-PCXR4	626479	08/04/2024	1,000	1,500	2,000	996	1,499	1,994	0.994x + 3.159	1.000	
B10	SKC	224-PCXR4	091950	04/04/2024	1,000	1,500	2,000	995	1,512	2,000	1.015x - 30.041	0.998	
B11	SKC	224-PCXR8	564315	08/04/2024	1,000	1,500	2,000	994	1,494	2,000	1.006x - 10.717	1.000	
B12	SKC	224-PCXR4	034656	08/04/2024	1,000	1,500	2,000	1,005	1,511	2,002	1.008x - 14.857	0.999	
B13	SKC	224-PCXR4	602073	05/04/2024	1,000	1,500	2,000	998	1,501	1,997	0.998x + 2.728	1.000	
B14	SKC	224-PCXR4	626313	04/04/2024	1,000	1,500	2,000	998	1,491	1,991	0.994x + 4.411	1.000	
B15	SKC	224-PCXR4	626474	04/04/2024	1,000	1,500	2,000	1,004	1,505	2,003	1.009x - 16.951	0.999	
B16	SKC	224-PCXR4	626477	04/04/2024	1,000	1,500	2,000	997	1,502	2,000	1.005x - 13.936	1.000	
B17	SKC	224-PCXR4	626860	05/04/2024	1,000	1,500	2,000	998	1,495	1,990	0.995x + 3.681	1.000	
B18	SKC	224-PCXR4	691484	05/04/2024	1,000	1,500	2,000	1,004	1,506	2,001	1.007x - 12.627	0.999	
B19	SKC	224-PCXR4	691599	08/04/2024	1,000	1,500	2,000	994	1,507	1,997	1.003x - 4.519	1.000	
B20	SKC	224-PCXR4	691587	08/04/2024	1,000	1,500	2,000	993	1,514	1,999	1.013x - 27.943	0.998	
B21	SKC	224-PCXR4	691531	08/04/2024	1,000	1,500	2,000	997	1,498	1,993	0.996x - 1.121	1.000	
B22	SKC	224-PCXR4	691654	08/04/2024	1,000	1,500	2,000	1,002	1,500	2,005	1.013x - 23.316	0.999	
B23	SKC	224-PCXR4	798393	09/04/2024	1,000	1,500	2,000	995	1,506	1,999	1.014x - 28.370	0.999	
B24	SKC	224-PCXR4	626363	04/04/2024	1,000	1,500	2,000	997	1,505	2,003	1.016x - 28.805	0.999	
B25	SKC	224-PCXR4	798489	04/04/2024	1,000	1,500	2,000	1,000	1,494	2,002	0.999x - 1.300	1.000	
B26	SKC	224-PCXR4	798479	05/04/2024	1,000	1,500	2,000	1,001	1,501	1,997	0.998x + 2.010	1.000	
B27	SKC	224-PCXR4	691673	08/04/2024	1,000	1,500	2,000	995	1,505	2,001	1.014x - 28.031	0.999	
B28	SKC	224-PCXR4	691570	08/04/2024	1,000	1,500	2,000	1,004	1,498	2,000	1.007x - 15.352	0.999	
B29	SKC	224-PCXR4	626472	08/04/2024	1,000	1,500	2,000	1,003	1,496	2,003	1.003x - 5.903	1.000	
B30	SKC	224-PCXR4	691489	05/04/2024	1,000	1,500	2,000	1,005	1,511	2,005	1.007x - 8.527	0.999	
B31	SKC	224-PCXR4	691509	09/04/2024	1,000	1,500	2,000	991	1,495	1,998	1.006x - 14.067	1.000	
B32	SKC	224-PCXR4	091567	05/04/2024	1,000	1,500	2,000	993	1,504	1,999	1.013x - 26.659	0.999	
B33	SKC	224-PCXR4	091756	05/04/2024	1,000	1,500	2,000	994	1,500	1,995	1.000x - 2.836	1.000	
B34	SKC	224-PCXR4	612962	08/04/2024	1,000	1,500	2,000	1,004	1,503	2,001	1.006x - 11.243	0.999	
B35	SKC	224-PCXR4	602682	08/04/2024	1,000	1,500	2,000	997	1,496	1,995	0.998x - 2.772	1.000	
B36	SKC	224-PCXR4	626164	05/04/2024	1,000	1,500	2,000	997	1,506	2,000	1.006x - 14.159	0.999	
B37	SKC	224-PCXR4	626256	04/04/2024	1,000	1,500	2,000	997	1,507	1,998	1.010x - 23.269	0.999	
B38	SKC	224-PCXR4	626167	04/04/2024	1,000	1,500	2,000	996	1,496	1,997	1.004x - 7.259	1.000	
B39	SKC	224-PCXR4	034637	04/04/2024	1,000	1,500	2,000	1,007	1,499	2,000	1.003x - 11.120	0.999	
B40	SKC	224-PCXR4	798349	08/04/2024	1,000	1,500	2,000	995	1,506	2,001	1.013x - 28.810	0.999	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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	
B41	SKC	224-PCXR4	612669	05/04/2024	1,000	1,500	2,000	1,001	1,498	1,990	0.994x + 6.342	1.000	
B42	SKC	224-PCXR4	626041	04/04/2024	1,000	1,500	2,000	1,006	1,496	1,990	0.984x + 20.844	1.000	
B43	SKC	224-PCXR4	034636	04/04/2024	1,000	1,500	2,000	998	1,498	1,989	0.989x + 12.360	1.000	
B44	SKC	224-PCXR8	529341	09/04/2024	1,000	1,500	2,000	1,000	1,501	2,002	1.005x - 9.213	1.000	
B45	SKC	224-PCXR8	529594	04/04/2024	1,000	1,500	2,000	1,002	1,502	1,989	0.988x + 16.584	1.000	
B46	SKC	224-PCXR8	566743	04/04/2024	1,000	1,500	2,000	996	1,507	2,001	1.012x - 24.724	0.999	
B47	SKC	224-PCXR8	566747	08/04/2024	1,000	1,500	2,000	1,005	1,500	2,002	1.007x - 16.424	0.999	
B48	SKC	224-PCXR8	566753	09/04/2024	1,000	1,500	2,000	998	1,492	1,997	0.998x - 1.157	1.000	
B49	SKC	224-PCXR8	566780	08/04/2024	1,000	1,500	2,000	1,004	1,503	2,005	1.009x - 18.040	0.999	
B50	SKC	224-PCXR8	500400	04/04/2024	1,000	1,500	2,000	1,003	1,495	2,003	1.000x - 1.783	1.000	
B51	SKC	224-PCXR8	500363	04/04/2024	1,000	1,500	2,000	995	1,500	2,002	1.013x - 28.701	0.999	
B52	SKC	224-PCXR8	093186	04/04/2024	1,000	1,500	2,000	992	1,494	1,991	0.996x + 0.116	1.000	
B53	SKC	224-PCXR8	707670	08/04/2024	1,000	1,500	2,000	1,000	1,502	2,001	1.009x - 16.999	0.999	
B54	SKC	224-PCXR3	509821	08/04/2024	1,000	1,500	2,000	996	1,503	2,002	1.015x - 30.009	0.999	
B55	SKC	224-PCXR3	510710	05/04/2024	1,000	1,500	2,000	1,000	1,494	1,993	0.995x + 0.965	1.000	
B56	SKC	224-PCXR3	511450	09/04/2024	1,000	1,500	2,000	1,004	1,499	2,000	1.002x - 4.651	1.000	
B57	SKC	224-PCXR3	510798	08/04/2024	1,000	1,500	2,000	996	1,494	1,998	1.000x - 2.680	1.000	
B58	SKC	224-PCXR3	509852	08/04/2024	1,000	1,500	2,000	1,002	1,501	2,000	1.006x - 16.480	0.999	
B59	SKC	224-PCXR3	509862	08/04/2024	1,000	1,500	2,000	997	1,501	1,998	0.999x + 1.041	1.000	
B60	SKC	224-PCXR3	512655	05/04/2024	1,000	1,500	2,000	1,005	1,507	2,003	1.003x - 4.627	1.000	
B61	SKC	224-PCXR3	503915	05/04/2024	1,000	1,500	2,000	993	1,490	2,000	1.004x - 12.823	1.000	
B62	SKC	224-PCXR3	505975	05/04/2024	1,000	1,500	2,000	1,001	1,495	1,997	0.995x + 2.616	1.000	
B63	SKC	224-PCXR3	511432	05/04/2024	1,000	1,500	2,000	993	1,503	1,999	1.014x - 30.715	0.999	
B64	SKC	224-PCXR3	508302	08/04/2024	1,000	1,500	2,000	1,000	1,493	1,987	0.988x + 13.991	1.000	
B65	SKC	224-PCXR3	508310	09/04/2024	1,000	1,500	2,000	1,003	1,500	2,003	1.006x - 12.021	1.000	
B66	SKC	224-PCXR3	509661	08/04/2024	1,000	1,500	2,000	1,004	1,489	1,990	0.986x + 16.775	1.000	
B67	SKC	224-PCXR3	506295	04/04/2024	1,000	1,500	2,000	997	1,506	2,003	1.004x - 9.094	1.000	
B68	SKC	224-PCXR3	505872	04/04/2024	1,000	1,500	2,000	1,004	1,490	1,997	0.992x + 7.829	1.000	
B69	SKC	224-PCXR3	508375	04/04/2024	1,000	1,500	2,000	1,005	1,500	1,998	1.006x - 13.832	0.999	
B70	SKC	224-PCXR3	510623	08/04/2024	1,000	1,500	2,000	995	1,491	1,996	1.000x - 4.938	1.000	
B71	SKC	224-PCXR3	508367	09/04/2024	1,000	1,500	2,000	996	1,504	2,000	1.012x - 27.572	0.999	
B72	SKC	224-PCXR3	505977	09/04/2024	1,000	1,500	2,000	1,001	1,500	1,995	0.994x + 5.791	1.000	
B73	SKC	224-PCXR3	512606	04/04/2024	1,000	1,500	2,000	1,002	1,499	2,002	1.007x - 12.671	1.000	
B74	SKC	224-PCXR3	505993	04/04/2024	1,000	1,500	2,000	995	1,495	1,996	1.003x - 9.987	1.000	
B75	SKC	224-PCXR3	509820	05/04/2024	1,000	1,500	2,000	998	1,497	1,993	0.997x + 1.432	1.000	
B76	SKC	224-PCXR3	509811	05/04/2024	1,000	1,500	2,000	992	1,497	2,000	1.008x - 17.753	1.000	
B77	SKC	224-PCXR3	508301	05/04/2024	1,000	1,500	2,000	1,004	1,499	2,001	1.010x - 19.743	0.999	
B78	SKC	224-PCXR3	510677	08/04/2024	1,000	1,500	2,000	997	1,505	2,001	1.013x - 27.321	0.999	
B79	SKC	224-PCXR3	510920	09/04/2024	1,000	1,500	2,000	995	1,495	1,993	1.000x - 4.702	1.000	



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R ²
B80	SKC	224-PCXR3	504569	09/04/2024	1,000	1,500	2,000	1,003	1,501	2,004	1.013x - 23.428	0.999
B81	SKC	224-PCXR3	503480	04/04/2024	1,000	1,500	2,000	998	1,499	2,003	1.015x - 30.384	0.999
B82	SKC	224-PCXR3	505673	04/04/2024	1,000	1,500	2,000	995	1,496	1,998	1.001x - 5.105	1.000
B83	SKC	224-PCXR3	510785	08/04/2024	1,000	1,500	2,000	1,012	1,499	2,000	1.002x - 7.135	0.999
B84	SKC	224-PCXR3	508333	08/04/2024	1,000	1,500	2,000	998	1,500	1,990	0.991x + 8.599	1.000
B85	SKC	224-PCXR3	505757	09/04/2024	1,000	1,500	2,000	993	1,503	2,000	1.008x - 16.396	1.000
B86	SKC	224-PCXR3	512625	04/04/2024	1,000	1,500	2,000	1,011	1,501	2,002	1.000x + 0.072	0.999
B87	SKC	224-PCXR3	504324	04/04/2024	1,000	1,500	2,000	998	1,495	2,001	1.003x - 4.738	1.000
B88	SKC	224-PCXR3	508307	08/04/2024	1,000	1,500	2,000	997	1,500	1,994	0.996x + 3.047	1.000
B89	SKC	224-PCXR3	509860	04/04/2024	1,000	1,500	2,000	1,001	1,501	2,006	1.011x - 17.174	1.000
B90	SKC	224-PCXR3	508366	08/04/2024	1,000	1,500	2,000	997	1,510	2,001	1.004x - 8.814	1.000
B91	SKC	224-PCXR3	510919	04/04/2024	1,000	1,500	2,000	1,001	1,502	1,998	0.993x + 7.522	1.000
B92	SKC	224-PCXR3	510987	04/04/2024	1,000	1,500	2,000	1,000	1,504	2,000	1.001x - 0.858	1.000
B93	SKC	224-PCXR3	509845	08/04/2024	1,000	1,500	2,000	998	1,495	2,003	1.007x - 13.389	1.000
B94	SKC	224-PCXR8	A127871	08/04/2024	1,000	1,500	2,000	1,001	1,501	2,004	1.008x - 19.942	0.999
B95	SKC	224-PCXR8	A127921	08/04/2024	1,000	1,500	2,000	996	1,504	2,005	1.016x - 31.417	0.999
B96	SKC	224-PCXR8	A127942	08/04/2024	1,000	1,500	2,000	999	1,500	2,000	1.003x - 5.715	1.000
B97	SKC	224-PCXR8	A127955	08/04/2024	1,000	1,500	2,000	1,004	1,502	2,005	1.011x - 20.122	0.999
B98	SKC	224-PCXR8	A127956	08/04/2024	1,000	1,500	2,000	995	1,496	2,000	1.004x - 9.122	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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	
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 - 17.230	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	08/04/2024	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	1,996	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	08/04/2024	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	08/04/2024	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	08/04/2024	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	08/04/2024	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	08/04/2024	1,000	1,500	2,000	1,005	1,495	1,992	0.987x + 16.057	1.000	
R30	SKC	224-PCXR8	093811	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 + 3.418	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	08/04/2024	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 :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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	08/04/2024	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	1.013x - 21.270	1.000	
R46	SKC	224-PCXR4	A129234	08/04/2024	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 :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve			
					Setting			Actual (Q std.)			y		R ²	
					1	2	3	1	2	3				
B01	SKC	224-PCXR4	262701	05/07/2024	1,000	1,500	2,000	999	1,499	2,006	1.009x - 12.249	1.000		
B02	SKC	224-PCXR4	626166	05/07/2024	1,000	1,500	2,000	1,000	1,494	1,997	0.995x - 6.358	1.000		
B03	SKC	224-PCXR4	612968	05/07/2024	1,000	1,500	2,000	1,006	1,510	2,005	1.010x - 16.611	0.999		
B04	SKC	224-PCXR4	602804	01/07/2024	1,000	1,500	2,000	1,006	1,506	2,008	1.009x - 11.881	1.000		
B05	SKC	224-PCXR4	612693	05/07/2024	1,000	1,500	2,000	998	1,502	2,001	1.003x - 6.328	1.000		
B06	SKC	224-PCXR4	262188	03/07/2024	1,000	1,500	2,000	1,007	1,513	2,006	1.012x - 16.439	0.999		
B07	SKC	224-PCXR4	626262	05/07/2024	1,000	1,500	2,000	1,002	1,498	2,002	0.999x + 1.531	1.000		
B08	SKC	224-PCXR4	612693	04/07/2024	1,000	1,500	2,000	1,005	1,506	2,005	1.008x - 13.624	0.999		
B09	SKC	224-PCXR4	626479	05/07/2024	1,000	1,500	2,000	1,003	1,503	2,002	1.005x - 11.861	0.999		
B10	SKC	224-PCXR4	091950	04/07/2024	1,000	1,500	2,000	994	1,495	2,003	1.007x - 13.804	1.000		
B11	SKC	224-PCXR8	564315	05/07/2024	1,000	1,500	2,000	1,000	1,498	2,000	1.001x - 3.486	1.000		
B12	SKC	224-PCXR4	034656	02/07/2024	1,000	1,500	2,000	1,005	1,513	2,009	1.007x - 8.707	0.999		
B13	SKC	224-PCXR4	602073	05/07/2024	1,000	1,500	2,000	1,006	1,512	2,007	1.009x - 11.410	0.999		
B14	SKC	224-PCXR4	626313	03/07/2024	1,000	1,500	2,000	1,006	1,494	1,995	0.992x + 9.519	1.000		
B15	SKC	224-PCXR4	626474	03/07/2024	1,000	1,500	2,000	997	1,511	2,006	1.010x - 15.823	1.000		
B16	SKC	224-PCXR4	626477	03/07/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.997x + 4.517	1.000		
B17	SKC	224-PCXR4	626860	03/07/2024	1,000	1,500	2,000	996	1,495	2,000	1.001x - 4.046	1.000		
B18	SKC	224-PCXR4	691484	05/07/2024	1,000	1,500	2,000	997	1,499	1,999	1.004x - 8.051	1.000		
B19	SKC	224-PCXR4	691599	05/07/2024	1,000	1,500	2,000	1,007	1,514	2,007	1.008x - 12.253	0.999		
B20	SKC	224-PCXR4	691587	05/07/2024	1,000	1,500	2,000	995	1,512	2,003	1.009x - 12.393	1.000		
B21	SKC	224-PCXR4	691531	03/07/2024	1,000	1,500	2,000	1,007	1,509	2,008	1.012x - 16.990	0.999		
B22	SKC	224-PCXR4	691654	04/07/2024	1,000	1,500	2,000	1,004	1,502	2,002	1.009x - 15.731	0.999		
B23	SKC	224-PCXR4	798393	04/07/2024	1,000	1,500	2,000	999	1,503	2,005	1.007x - 11.817	1.000		
B24	SKC	224-PCXR4	626363	04/07/2024	1,000	1,500	2,000	996	1,502	1,998	1.000x - 0.991	1.000		
B25	SKC	224-PCXR4	798489	04/07/2024	1,000	1,500	2,000	1,012	1,504	2,004	1.006x - 8.339	0.999		
B26	SKC	224-PCXR4	798479	03/07/2024	1,000	1,500	2,000	999	1,500	1,996	0.995x + 5.313	1.000		
B27	SKC	224-PCXR4	691673	03/07/2024	1,000	1,500	2,000	1,000	1,498	2,004	1.003x - 2.207	1.000		
B28	SKC	224-PCXR4	691570	01/07/2024	1,000	1,500	2,000	1,003	1,504	2,009	1.013x - 17.234	1.000		
B29	SKC	224-PCXR4	626472	01/07/2024	1,000	1,500	2,000	1,007	1,509	2,006	1.009x - 12.657	0.999		
B30	SKC	224-PCXR4	691489	01/07/2024	1,000	1,500	2,000	998	1,500	2,009	1.012x - 16.759	1.000		
B31	SKC	224-PCXR4	691509	04/07/2024	1,000	1,500	2,000	1,003	1,503	2,007	1.005x - 11.138	0.999		
B32	SKC	224-PCXR4	091567	04/07/2024	1,000	1,500	2,000	996	1,505	2,007	1.016x - 26.973	0.999		
B33	SKC	224-PCXR4	091756	04/07/2024	1,000	1,500	2,000	1,000	1,500	2,000	1.004x - 7.636	1.000		
B34	SKC	224-PCXR4	612962	04/07/2024	1,000	1,500	2,000	1,005	1,504	2,008	1.012x - 18.993	0.999		
B35	SKC	224-PCXR4	602682	05/07/2024	1,000	1,500	2,000	998	1,500	2,005	1.006x - 8.339	1.000		
B36	SKC	224-PCXR4	626164	04/07/2024	1,000	1,500	2,000	999	1,501	2,002	1.001x - 4.266	1.000		
B37	SKC	224-PCXR4	626256	05/07/2024	1,000	1,500	2,000	1,007	1,502	2,005	1.008x - 12.029	0.999		
B38	SKC	224-PCXR4	626167	04/07/2024	1,000	1,500	2,000	1,001	1,498	2,003	1.003x - 2.605	1.000		
B39	SKC	224-PCXR4	034637	04/07/2024	1,000	1,500	2,000	1,006	1,506	2,006	1.008x - 11.270	0.999		
B40	SKC	224-PCXR4	798349	03/07/2024	1,000	1,500	2,000	998	1,502	1,999	1.002x - 7.748	1.000		

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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	
B41	SKC	224-PCXR4	612669	02/07/2024	1,000	1,500	2,000	1,009	1,502	2,005	1.006x - 11.146	0.999	
B42	SKC	224-PCXR4	626041	02/07/2024	1,000	1,500	2,000	1,005	1,499	2,005	0.997x + 6.432	1.000	
B43	SKC	224-PCXR4	034636	02/07/2024	1,000	1,500	2,000	1,004	1,505	2,013	1.010x - 15.091	0.999	
B44	SKC	224-PCXR8	529341	02/07/2024	1,000	1,500	2,000	1,004	1,506	2,005	1.005x - 9.731	0.999	
B45	SKC	224-PCXR8	529594	03/07/2024	1,000	1,500	2,000	996	1,491	2,002	1.009x - 16.399	1.000	
B46	SKC	224-PCXR8	566743	03/07/2024	1,000	1,500	2,000	996	1,495	2,001	1.001x - 5.621	1.000	
B47	SKC	224-PCXR8	566747	03/07/2024	1,000	1,500	2,000	1,003	1,496	1,996	0.995x + 7.632	1.000	
B48	SKC	224-PCXR8	566753	03/07/2024	1,000	1,500	2,000	1,007	1,503	2,005	1.007x - 9.047	0.999	
B49	SKC	224-PCXR8	566780	05/07/2024	1,000	1,500	2,000	1,005	1,492	2,001	0.998x + 2.047	1.000	
B50	SKC	224-PCXR8	500400	05/07/2024	1,000	1,500	2,000	997	1,513	2,006	1.008x - 10.870	1.000	
B51	SKC	224-PCXR8	500363	05/07/2024	1,000	1,500	2,000	1,007	1,496	2,010	1.003x - 5.258	1.000	
B52	SKC	224-PCXR8	093186	05/07/2024	1,000	1,500	2,000	1,003	1,496	2,002	0.999x + 1.439	1.000	
B53	SKC	224-PCXR8	707670	05/07/2024	1,000	1,500	2,000	999	1,501	1,998	1.002x - 4.254	0.999	
B54	SKC	224-PCXR3	509821	05/07/2024	1,000	1,500	2,000	1,000	1,503	1,998	1.003x - 5.249	1.000	
B55	SKC	224-PCXR3	510710	03/07/2024	1,000	1,500	2,000	998	1,519	2,003	1.006x - 5.785	0.999	
B56	SKC	224-PCXR3	511450	03/07/2024	1,000	1,500	2,000	1,003	1,506	2,001	1.004x - 7.748	1.000	
B57	SKC	224-PCXR3	510798	01/07/2024	1,000	1,500	2,000	1,008	1,505	2,008	1.010x - 16.191	0.999	
B58	SKC	224-PCXR3	509852	01/07/2024	1,000	1,500	2,000	1,002	1,505	2,007	1.012x - 20.201	0.999	
B59	SKC	224-PCXR3	509862	01/07/2024	1,000	1,500	2,000	997	1,501	1,999	1.003x + 0.760	1.000	
B60	SKC	224-PCXR3	512655	05/07/2024	1,000	1,500	2,000	1,014	1,507	2,003	1.002x - 1.563	0.999	
B61	SKC	224-PCXR3	503915	05/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.998x + 5.213	0.999	
B62	SKC	224-PCXR3	505975	05/07/2024	1,000	1,500	2,000	1,000	1,501	2,010	1.008x - 7.876	1.000	
B63	SKC	224-PCXR3	511432	05/07/2024	1,000	1,500	2,000	1,005	1,506	2,009	1.010x - 11.514	1.000	
B64	SKC	224-PCXR3	508302	05/07/2024	1,000	1,500	2,000	999	1,512	2,009	1.009x - 11.825	1.000	
B65	SKC	224-PCXR3	508310	05/07/2024	1,000	1,500	2,000	998	1,499	2,004	1.008x - 11.573	1.000	
B66	SKC	224-PCXR3	509861	05/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.999x + 4.094	0.999	
B67	SKC	224-PCXR3	506295	03/07/2024	1,000	1,500	2,000	997	1,505	2,006	1.011x - 17.514	1.000	
B68	SKC	224-PCXR3	505872	01/07/2024	1,000	1,500	2,000	999	1,517	1,999	0.999x + 3.174	0.999	
B69	SKC	224-PCXR3	506375	01/07/2024	1,000	1,500	2,000	1,008	1,505	2,009	1.013x - 17.610	0.999	
B70	SKC	224-PCXR3	510623	01/07/2024	1,000	1,500	2,000	996	1,504	2,002	1.006x - 9.583	1.000	
B71	SKC	224-PCXR3	508367	01/07/2024	1,000	1,500	2,000	997	1,499	1,996	1.001x - 8.495	1.000	
B72	SKC	224-PCXR3	505977	01/07/2024	1,000	1,500	2,000	997	1,496	1,999	1.005x - 12.009	1.000	
B73	SKC	224-PCXR3	512606	03/07/2024	1,000	1,500	2,000	1,007	1,504	2,007	1.006x - 15.183	0.999	
B74	SKC	224-PCXR3	505993	03/07/2024	1,000	1,500	2,000	1,004	1,504	2,002	1.007x - 14.720	0.999	
B75	SKC	224-PCXR3	509820	03/07/2024	1,000	1,500	2,000	1,005	1,499	2,002	1.000x - 3.606	1.000	
B76	SKC	224-PCXR3	509811	03/07/2024	1,000	1,500	2,000	1,005	1,495	2,002	0.999x - 0.580	1.000	
B77	SKC	224-PCXR3	508301	04/07/2024	1,000	1,500	2,000	1,005	1,505	2,010	1.008 - 12.453	0.999	
B78	SKC	224-PCXR3	510677	04/07/2024	1,000	1,500	2,000	998	1,503	2,005	1.009x - 17.250	1.000	
B79	SKC	224-PCXR3	510920	04/07/2024	1,000	1,500	2,000	998	1,509	1,996	1.002x - 8.222	1.000	



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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
880	SKC	224-PCXR3	504569	04/07/2024	1,000	1,500	2,000	1,006	1,505	2,003	1.009x - 14.904	0.999
881	SKC	224-PCXR3	503480	02/07/2024	1,000	1,500	2,000	1,006	1,503	2,006	1.011x - 19.229	0.999
882	SKC	224-PCXR3	505673	02/07/2024	1,000	1,500	2,000	1,004	1,504	2,007	1.010x - 14.060	1.000
883	SKC	224-PCXR3	510785	02/07/2024	1,000	1,500	2,000	998	1,504	2,002	1.000x - 0.396	1.000
884	SKC	224-PCXR3	508333	04/07/2024	1,000	1,500	2,000	998	1,508	2,005	1.009x - 17.242	0.999
885	SKC	224-PCXR3	505757	04/07/2024	1,000	1,500	2,000	1,009	1,493	2,004	0.999x + 1.151	1.000
886	SKC	224-PCXR3	512625	05/07/2024	1,000	1,500	2,000	1,000	1,495	2,003	1.002x - 3.458	1.000
887	SKC	224-PCXR3	504324	03/07/2024	1,000	1,500	2,000	1,003	1,505	2,006	1.005x - 5.057	1.000
888	SKC	224-PCXR3	508307	03/07/2024	1,000	1,500	2,000	999	1,517	2,000	0.999x + 2.575	0.999
889	SKC	224-PCXR3	509860	03/07/2024	1,000	1,500	2,000	998	1,518	2,006	1.010x - 14.096	0.999
890	SKC	224-PCXR3	508366	03/07/2024	1,000	1,500	2,000	1,000	1,501	2,000	1.005x - 8.991	1.000
891	SKC	224-PCXR3	510919	03/07/2024	1,000	1,500	2,000	1,006	1,503	2,008	1.014x - 22.160	0.999
892	SKC	224-PCXR3	510987	02/07/2024	1,000	1,500	2,000	1,006	1,503	2,006	1.012x - 20.401	0.999
893	SKC	224-PCXR3	509845	02/07/2024	1,000	1,500	2,000	1,003	1,504	2,008	1.006x - 6.113	1.000
894	SKC	224-PCXR8	A127871	02/07/2024	1,000	1,500	2,000	1,012	1,496	1,998	0.997x - 0.876	0.999
895	SKC	224-PCXR8	A127921	01/07/2024	1,000	1,500	2,000	999	1,502	2,000	1.001x - 0.460	1.000
896	SKC	224-PCXR8	A127942	01/07/2024	1,000	1,500	2,000	997	1,501	2,001	1.005x - 7.496	1.000
897	SKC	224-PCXR8	A127955	02/07/2024	1,000	1,500	2,000	1,011	1,496	1,998	0.998x - 1.595	0.999
898	SKC	224-PCXR8	A127956	02/07/2024	1,000	1,500	2,000	1,011	1,496	1,998	0.997x - 0.476	0.999

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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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

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	05/07/2024	1,000	1,500	2,000	1,008	1,502	2,010	1.012x - 20.053	0.999
R02	SKC	224-PCXR4	626450	05/07/2024	1,000	2,000	3,000	997	1,499	1,996	0.999x - 0.979	1.000
R03	SKC	224-PCXR4	691592	05/07/2024	1,000	1,500	2,000	997	1,512	2,002	1.011x - 21.792	0.999
R04	SKC	224-PCXR4	691672	05/07/2024	1,000	1,500	2,000	996	1,504	2,004	1.008x - 14.228	1.000
R05	SKC	224-PCXR4	798470	03/07/2024	1,000	1,500	2,000	1,004	1,503	2,007	1.004x - 3.422	1.000
R06	SKC	224-PCXR4	798456	03/07/2024	1,000	1,500	2,000	1,005	1,493	2,002	0.999x + 3.190	1.000
R07	SKC	224-PCXR4	798480	03/07/2024	1,000	1,500	2,000	1,007	1,514	2,010	1.007x - 6.069	0.999
R08	SKC	224-PCXR4	883215	03/07/2024	1,000	1,500	2,000	1,005	1,505	2,008	1.006x - 9.814	0.999
R09	SKC	224-PCXR4	034650	03/07/2024	1,000	1,500	2,000	1,007	1,509	2,008	1.012x - 17.190	0.999
R10	SKC	224-PCXR4	091765	03/07/2024	1,000	1,500	2,000	998	1,507	2,006	1.005x - 6.520	1.000
R11	SKC	224-PCXR4	091763	02/07/2024	1,000	1,500	2,000	996	1,503	1,999	1.002x - 5.913	1.000
R12	SKC	224-PCXR4	091568	03/07/2024	1,000	1,500	2,000	1,003	1,499	1,996	0.993x - 9.175	1.000
R13	SKC	224-PCXR4	091638	03/07/2024	1,000	1,500	2,000	1,007	1,502	2,005	1.010x - 15.387	0.999
R14	SKC	224-PCXR4	091764	03/07/2024	1,000	1,500	2,000	998	1,504	2,004	1.001x - 1.195	1.000
R15	SKC	224-PCXR4	529457	03/07/2024	1,000	1,500	2,000	1,004	1,503	2,013	1.010x - 12.457	1.000
R16	SKC	224-PCXR4	529643	03/07/2024	1,000	1,500	2,000	1,009	1,493	2,003	0.998x + 0.991	1.000
R17	SKC	224-PCXR4	529645	03/07/2024	1,000	1,500	2,000	999	1,510	2,003	1.008x - 14.420	0.999
R18	SKC	224-PCXR4	566756	01/07/2024	1,000	1,500	2,000	1,003	1,505	2,007	1.009x - 13.532	1.000
R19	SKC	224-PCXR4	566802	01/07/2024	1,000	1,500	2,000	999	1,510	2,005	1.008x - 15.091	0.999
R20	SKC	224-PCXR4	529089	01/07/2024	1,000	1,500	2,000	998	1,518	2,006	1.009x - 13.117	0.999
R21	SKC	224-PCXR4	665728	01/07/2024	1,000	1,500	2,000	997	1,501	1,997	1.002x - 4.913	1.000
R22	SKC	224-PCXR4	707444	03/07/2024	1,000	1,500	2,000	1,005	1,503	2,006	1.006x - 10.166	0.999
R23	SKC	224-PCXR4	761067	03/07/2024	1,000	1,500	2,000	997	1,505	1,998	1.001x - 2.491	1.000
R24	SKC	224-PCXR4	707893	03/07/2024	1,000	1,500	2,000	1,009	1,502	2,005	1.005x - 9.866	0.999
R25	SKC	224-PCXR4	761052	03/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.996x + 1.763	0.999
R26	SKC	224-PCXR4	707956	03/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.994x + 4.162	0.999
R27	SKC	224-PCXR4	707398	04/07/2024	1,000	1,500	2,000	1,007	1,509	2,006	1.008x - 10.258	0.999
R28	SKC	224-PCXR4	707481	04/07/2024	1,000	1,500	2,000	1,004	1,506	2,003	1.003x - 2.295	1.000
R29	SKC	224-PCXR4	707402	04/07/2024	1,000	1,500	2,000	995	1,508	2,003	1.013x - 23.523	0.999
R30	SKC	224-PCXR4	099811	03/07/2024	1,000	1,500	2,000	995	1,509	2,007	1.009x - 14.484	1.000
R31	SKC	224-PCXR4	099183	03/07/2024	1,000	1,500	2,000	1,005	1,502	2,005	1.011x - 19.1536	0.999
R32	SKC	224-PCXR4	671950	03/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.994x + 5.441	0.999
R33	SKC	224-PCXR4	626254	03/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.995x + 2.722	0.999
R34	SKC	224-PCXR4	626131	02/07/2024	1,000	1,500	2,000	1,009	1,504	2,001	1.004x - 8.131	0.999
R35	SKC	224-PCXR4	707460	03/07/2024	1,000	1,500	2,000	1,001	1,497	1,999	0.999x + 0.923	1.000
R36	SKC	224-PCXR4	707446	03/07/2024	1,000	1,500	2,000	1,000	1,495	1,996	0.994x + 5.157	1.000
R37	SKC	224-PCXR4	707432	03/07/2024	1,000	1,500	2,000	997	1,495	2,003	1.005x - 7.592	1.000
R38	SKC	224-PCXR4	707349	03/07/2024	1,000	1,500	2,000	1,000	1,500	2,000	1.001x - 3.738	1.000
R39	SKC	224-PCXR4	761095	03/07/2024	1,000	1,500	2,000	998	1,502	2,002	1.003x - 6.248	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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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

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	02/07/2024	1,000	1,500	2,000	1,000	1,507	2,005	1.008x - 14.072	0.999
R41	SKC	224-PCXR4	626140	02/07/2024	1,000	1,500	2,000	1,005	1,498	2,004	0.998x + 3.290	1.000
R42	SKC	224-PCXR4	626463	03/07/2024	1,000	1,500	2,000	1,005	1,506	2,010	1.011x - 15.343	0.999
R43	SKC	224-PCXR4	626129	03/07/2024	1,000	1,500	2,000	1,004	1,503	2,002	1.004x - 8.463	0.999
R44	SKC	224-PCXR4	602753	01/07/2024	1,000	1,500	2,000	999	1,500	2,001	0.999x + 1.755	1.000
R45	SKC	224-PCXR4	626137	01/07/2024	1,000	1,500	2,000	1,000	1,500	2,000	1.002x - 3.046	1.000
R47	SKC	224-PCXR4	A129234	05/07/2024	1,000	1,500	2,000	1,005	1,503	2,004	1.007x - 10.710	1.000
R48	SKC	224-PCXR4	A129253	05/07/2024	1,000	1,500	2,000	1,005	1,494	1,994	0.992x + 8.239	1.000
R49	SKC	224-PCXR4	A129168	05/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.993x + 6.081	0.999
R50	SKC	224-PCXR4	A129282	01/07/2024	1,000	1,500	2,000	1,014	1,494	1,998	0.991x + 10.238	0.999
R51	SKC	224-PCXR4	A129284	01/07/2024	1,000	1,500	2,000	1,005	1,494	2,002	0.999x + 2.639	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
H-B01	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	504.1	997.1	1991.2	0.995x + 6.628	1.000
H-B02	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	497.3	1003.5	2015.2	0.998 + 5.168	1.000
H-B03	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	498.4	994.8	2013.0	1.005x - 12.628	0.999
H-B04	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.1	997.9	1992.5	0.996x + 6.085	1.000
H-B05	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	497.9	1004.0	2014.2	0.998x + 4.472	1.000
H-B06	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	499.7	997.9	2015.7	1.004x - 9.662	0.999
H-B07	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	501.4	1002.3	1990.2	0.999x + 4.103	1.000
H-B08	Dwyer	VFB-65	04/07/2024	500	1,000	2,000	501.5	999.6	1988.9	0.991x + 12.846	1.000
H-B09	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	502.7	1003.8	1984.8	0.997x + 6.523	0.999
H-B10	Dwyer	VFB-65	05/07/2024	500	1,000	2,000	501.5	999.7	1988.7	0.994x + 9.648	1.000

Calibrated by :

Adul Dangkom
(Mr Adul Dangkom)

Approved by :

(Mr. Peera Detudom)



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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	03/07/2024	500	1,000	2,000	499.7	999.5	1990.4	1.002x - 0.454	1.000
H-R02	Dwyer	VFB-65	03/07/2024	500	1,000	2,000	502.9	997.7	1989.8	1.001x - 1.587	0.999
H-R03	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.2	996.0	2002.7	0.995x + 5.824	1.000
H-R04	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	502.1	998.9	1988.8	1.002x - 3.023	0.999
H-R05	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	501.1	1003.8	2003.1	1.003x - 0.016	1.000
H-R06	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	502.3	1005.5	2003.7	1.001x + 3.330	1.000

Calibrated by :

Adul Dangkom
(Mr. Adul Dangkom)

Approved by :

(Mr. Peera Detudom)

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. Abdul Dangklom)

Approved by :


 (Mr. Peera Detudom)

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

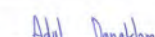
Model : Defender 510-H

S/N : 136164


Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (mU/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. Abdul Dangklom)

Approved by :


 (Mr. Peera Detudom)



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

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.)			y	R ²
				1	2	3	1	2	3		
H-R01	Dwyer	VFB-65	03/07/2024	500	1,000	2,000	499.7	999.5	1990.4	1.002x - 0.454	1.000
H-R02	Dwyer	VFB-65	03/07/2024	500	1,000	2,000	502.9	997.7	1989.8	1.001x - 1.587	0.999
H-R03	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	503.2	996.0	2002.7	0.995x + 5.824	1.000
H-R04	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	502.1	998.9	1988.8	1.002x - 3.023	0.999
H-R05	Dwyer	VFB-65	02/07/2024	500	1,000	2,000	501.1	1003.8	2003.1	1.003x - 0.016	1.000
H-R06	Dwyer	VFB-65	01/07/2024	500	1,000	2,000	502.3	1005.5	2003.7	1.001x + 3.330	1.000

Calibrated by : <u>Adul Dangklom</u> (Mr.Adul Dangklom)	Approved by : <u>Peera Detudom</u> (Mr. Peera Detudom)
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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@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.)			y	R ²
				1	2	3	1	2	3		
L-R01	Dwyer	VFA-21	03/07/2024	50	100	200	50.7	101.9	201.5	1.004x + 0.202	0.999
L-R02	Dwyer	VFA-21	03/07/2024	50	100	200	50.1	100.8	201.6	1.001x + 0.433	1.000
L-R03	Dwyer	VFA-21	02/07/2024	50	100	200	50.2	101.2	201.3	1.005x - 0.046	1.000
L-R04	Dwyer	VFA-21	02/07/2024	50	100	200	50.3	100.3	201.4	1.002x + 0.230	1.000
L-R05	Dwyer	VFA-21	02/07/2024	50	100	200	50.4	101.9	200.3	1.003x - 0.041	0.999
L-R06	Dwyer	VFA-21	01/07/2024	50	100	200	50.8	100.5	200.7	1.006x + 0.021	1.000

Calibrated by : <u>Adul Dangklom</u> (Mr.Adul Dangklom)	Approved by : <u>Peera Detudom</u> (Mr. Peera Detudom)
--	---



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: Suwarot.

Engineer : Suwarot Trikinut

Date : 09/08/2023



VARIAN

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SERVICE DEPARTMENT
FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



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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

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	Sunaret.	
Date	09/08/2023	



Comments	-		
Reviewed by	Sunaret P.	Date	09/08/2023



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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	Sunaret.	
Date	09/08/2023	



Comments	-		
Reviewed by	Sunaret P.	Date	09/08/2023



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

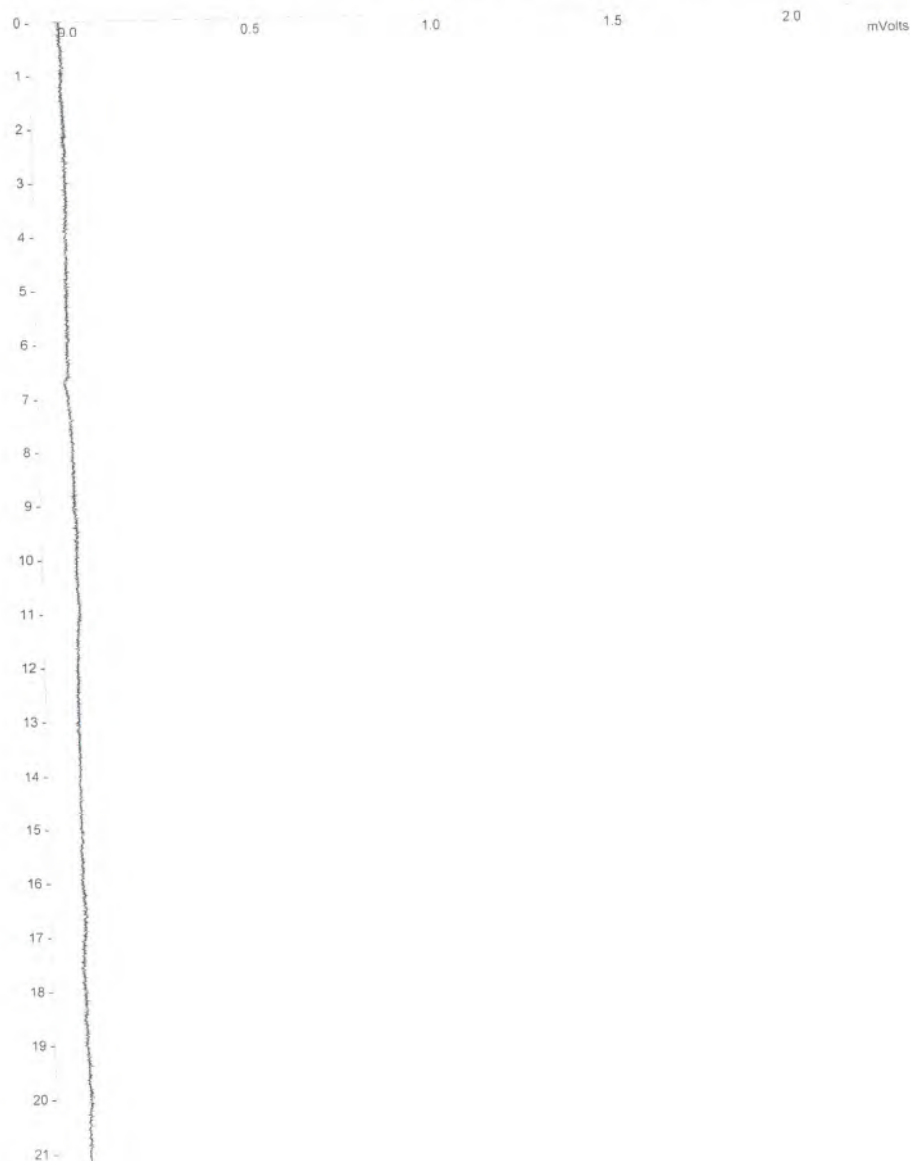
Title :
Run File : d:\ceiA0A gc\ceiA0A.NeSEEA\drive-d\2017\2023\08\blk2023.run
Method File : C:\star\data\TU\cal2023\baseline FID.mth
Sample ID : Blk2023

Injection Date: 9/8/2566 13:13 Calculation Date: 9/8/2566 13:34

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 21.208 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Chart Speed = 1.03 cm/min Attenuation = 1 Zero Offset = 3%
Start Time = 0.000 min End Time = 21.208 min Min / Tick = 1.00



Print Date: Wed Aug 09 13:35:26 2023

Page 1 of 1

Title :
Run File : d:\ceiA0A gc\ceiA0A.NeSEEA\drive-d\2017\2023\08\blk2023.run
Method File : C:\star\data\TU\cal2023\baseline FID.mth
Sample ID : Blk2023

Injection Date: 9/8/2566 13:13 Calculation Date: 9/8/2566 13:34

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 21.208 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Run Mode : Blank Baseline
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
Totals:		0.0000		0.000	0			

Total Unidentified Counts : 0 counts

Detected Peaks: 0 Rejected Peaks: 0 Identified Peaks: 0

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -14 microVolts LSB: 1 microVolts

Noise (used): 19 microVolts - monitored before this run

Manual injection

Title :
Run File : c:\star\data\tu\cal2023\fid\calfid2023003.run
Method File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth
Sample ID : Manual Sample

Injection Date: 9/8/2566 10:31 Calculation Date: 9/8/2566 10:40

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	33.8385	3.520	-0.003	362495	BB	2.2	C
2	C15	33.4804	4.125	-0.006	357824	BB	2.3	C
3	C16	32.6143	4.699	-0.001	344951	BB	2.2	
Totals:		99.9332		-0.010	1065270			

Status Codes:

C - Out of calibration range

Total Unidentified Counts : 0 counts

Detected Peaks: 3 Rejected Peaks: 0 Identified Peaks: 3

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: 28 microVolts LSB: 1 microVolts

Noise (used): 26 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

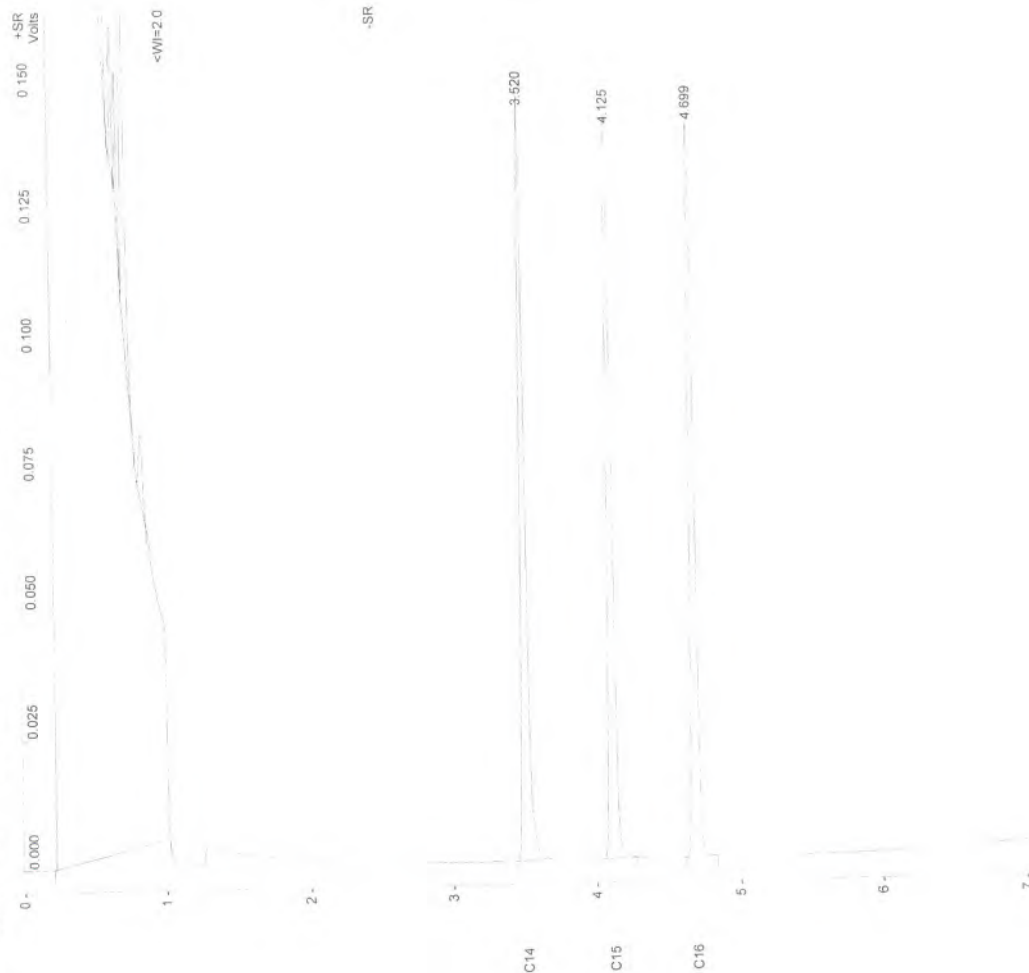
Title : c:\star\data\tu\cal2023\fid\calfid2023003.run
Run File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth
Method File : d:\method-gc\star c\star\method\cp-wax\without glasswool\calfid2023003-front.mth
Sample ID : Manual Sample

Injection Date: 9/8/2566 10:31 Calculation Date: 9/8/2566 10:40

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** GC Workstation Version 6.41 ** 03334-6390-826-0764 **

Chart Speed = 2.73 cm/min Attenuation = 70 Zero Offset = 23
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Sample ID: **fid std**

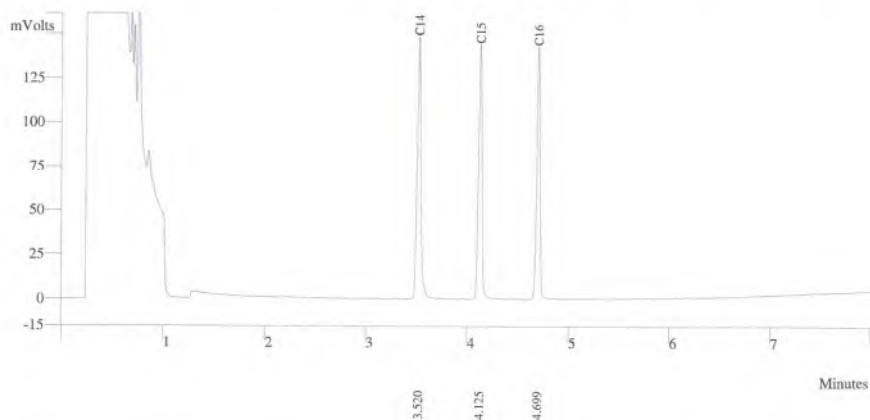
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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

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

A = FID 10 V RESULTS



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

Sample ID: **fid std**

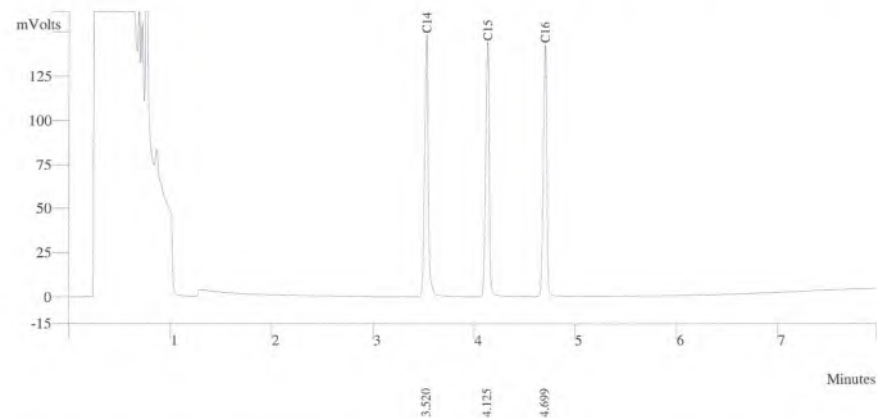
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: **fid std**

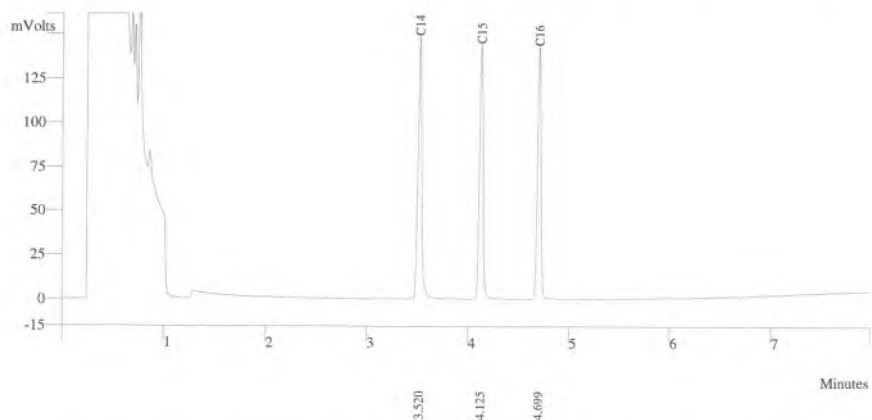
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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

Sample ID: **fid std**

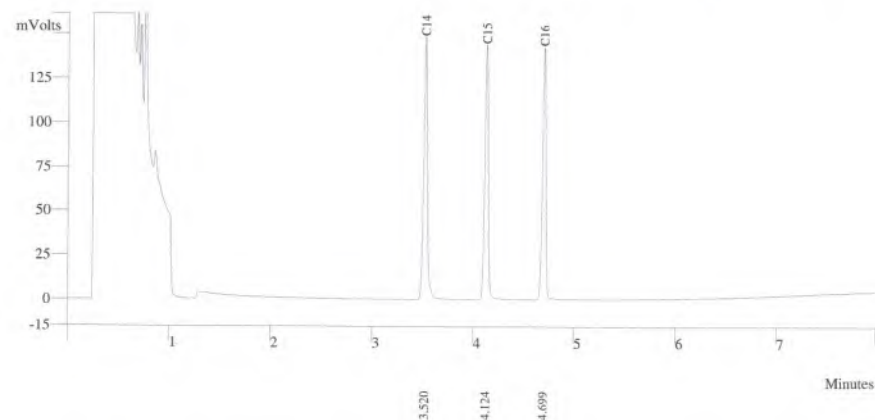
Operator (Inj): Suwarot
Injection Date: 09/08/2023
Calc Date: 09/08/2023
Run Time (min): 7.993
Workstation: Local Disk
Instrument (Inj):



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

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

A = FID 10 V RESULTS



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



Sample ID: **fid std**

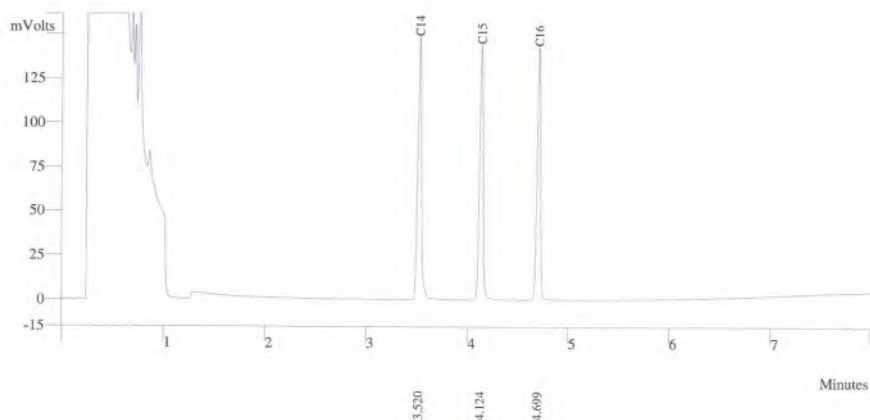
Operator (Inj): Suwarot
 Injection Date: 09/08/2023
 Calc Date: 09/08/2023
 Run Time (min): 7.993
 Workstation: Local Disk
 Instrument (Inj):



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

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

A = FID 10 V RESULTS

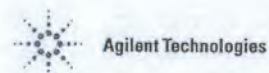


Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	33.8385	3.520	362495	BB	2.2
2	C15	33.4824	4.124	369724	BB	2.3
3	C16	32.6143	4.699	354591	BB	2.2
	Totals	99.9552		1087210		



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 %

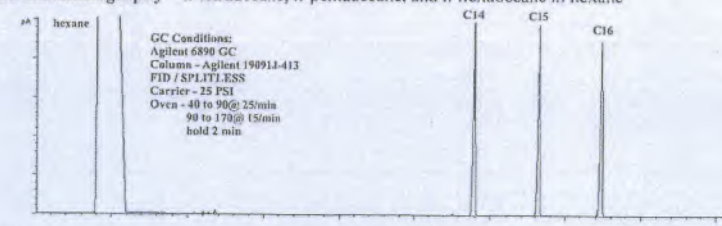
Solvent: hexane

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. Pohtongkam

Service Manager



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. : SV0824/22063

Instrument Type : Gas Chromatography

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 : 05/08/2024

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) = 156,955 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)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	16,400	≥ 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 (%)	1.71	≤ 5
Retention Time C15(%)	0	≤ 0.5

APPROVAL :

Signature: Suwarot.

Engineer : Suwarot Trikanut

Date : 05/08/2024



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	157,309
C15 Area 2	159,359
C15 Area 3	157,349
C15 Area 4	152,379
C15 Area 5	158,379
C15 Area Average	156,955
* % RSD (< 5 %)	1.71

* 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	Samarot.	
Date	05/08/2567	



Comments	-		
Reviewed by	Samarot P.	Date	05/08/2024



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	4.128
C15 RT 2	4.128
C15 RT 3	4.128
C15 RT 4	4.128
C15 RT 5	4.128
C15 RT Average	4.128
* % RSD (< 0.5 %)	0

* 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	Samarot.	
Date	05/08/2024	



Comments	-		
Reviewed by	Samarot P.	Date	05/08/2024



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

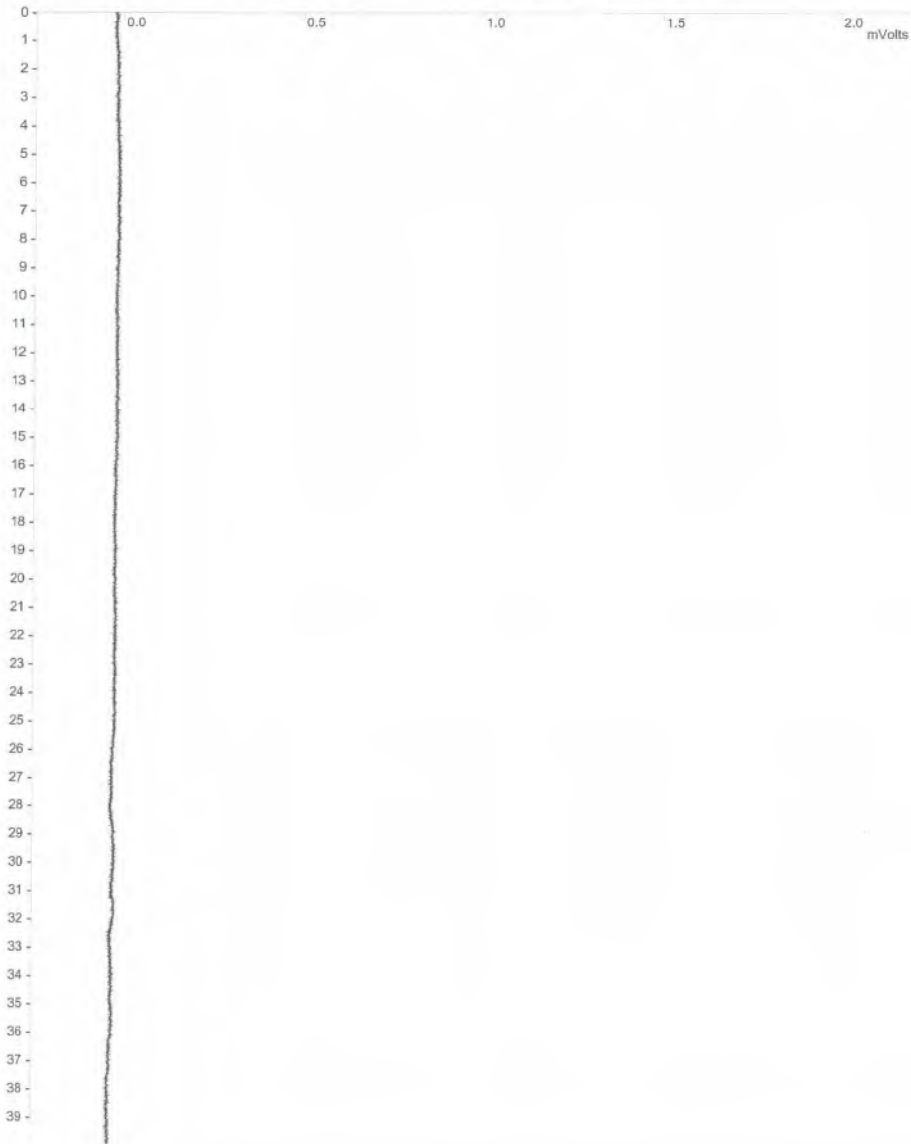
Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 39.960 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Chart Speed = 0.56 cm/min Attenuation = 1 Zero Offset = 10%
Start Time = 0.000 min End Time = 39.960 min Min / Tick = 1.00



Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: Local Disk Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 39.960 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
Totals:			0.0000	0.000	0			

Total Unidentified Counts : 0 counts
Detected Peaks: 0 Rejected Peaks: 0 Identified Peaks: 0
Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0
Baseline Offset: -16 microVolts LSB: 1 microVolts
Noise (used): 22 microVolts - monitored before this run
Manual injection
Data Handling: No peaks

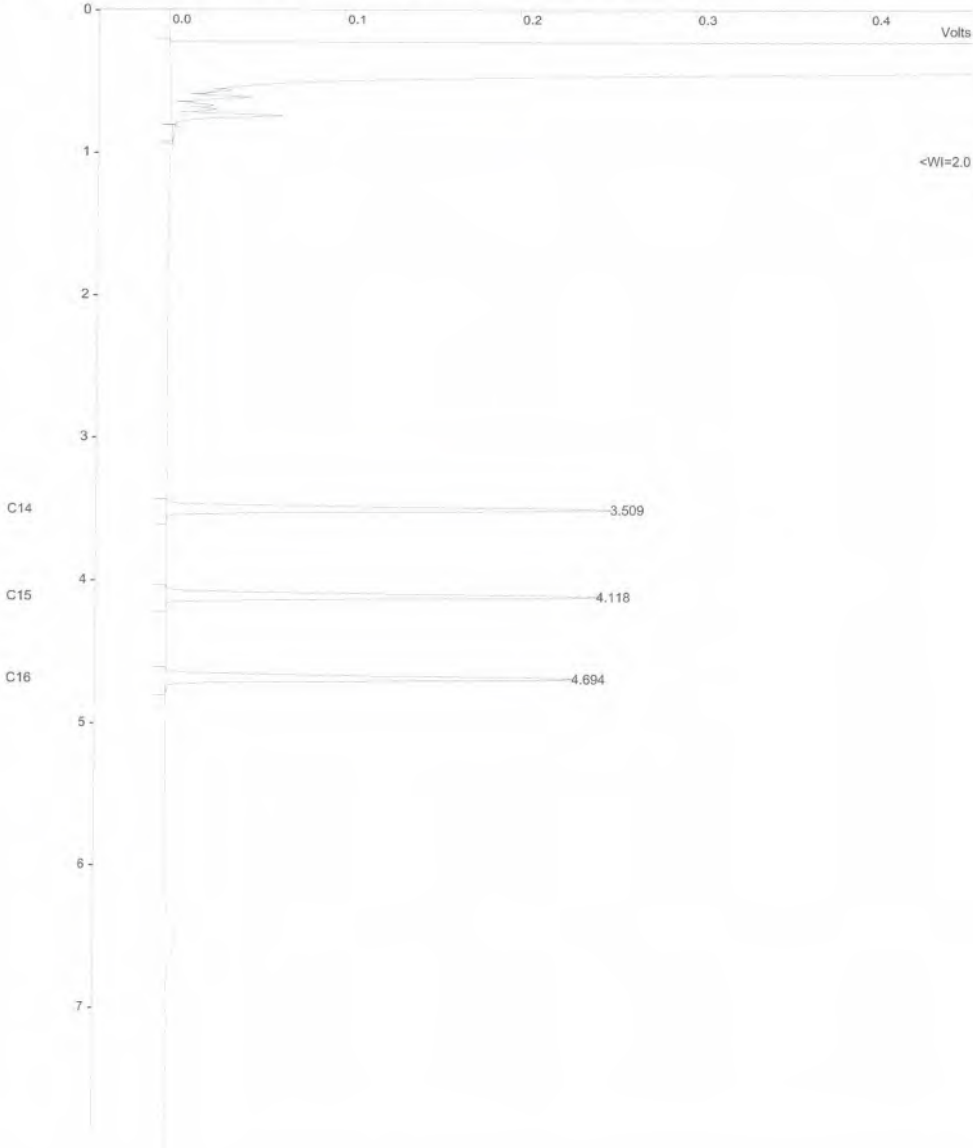
Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\caf2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Chart Speed = 2.83 cm/min Attenuation = 205 Zero Offset = 8%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Print Date: Sat Jan 01 19:35:30 2005 Page 1 of 1

Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\fid2024003-front.mth
Sample ID : FID2024

Injection Date: 5/8/2567 9:16 Calculation Date: 5/8/2567 9:26

Operator : suwarot Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 7.993 min

** LC Workstation Version 6.20 ** 02511-7390-ae7-0265 **

Run Mode : Analysis
Peak Measurement: Peak Area
Calculation Type: External Standard

Peak No.	Peak Name	Result ()	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	54.1202	3.509	-0.005	163565	BB	2.1	C
2	C15	53.5241	4.118	-0.005	157309	BB	2.2	C
3	C16	52.2361	4.694	0.001	146804	BB	2.3	C
Totals:		159.8804		-0.009	1704289			

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

Detected Peaks: 11 Rejected Peaks: 0 Identified Peaks: 3

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts LSB: 1 microVolts

Noise (used): 28 microVolts - monitored before this run

Manual injection

Calib. out of range; No Recovery Action Specified

Sample ID: **fid std**

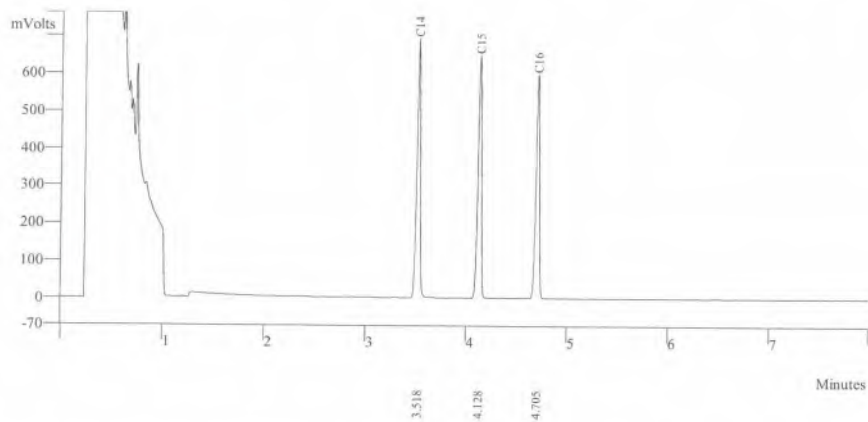
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024001.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	152.6865	3.518	163565	BB	2.2
2	C15	147.1889	4.128	157309	BB	2.3
3	C16	138.7997	4.705	146804	BB	2.3
Totals		438.6751		467678		

Sample ID: **fid std**

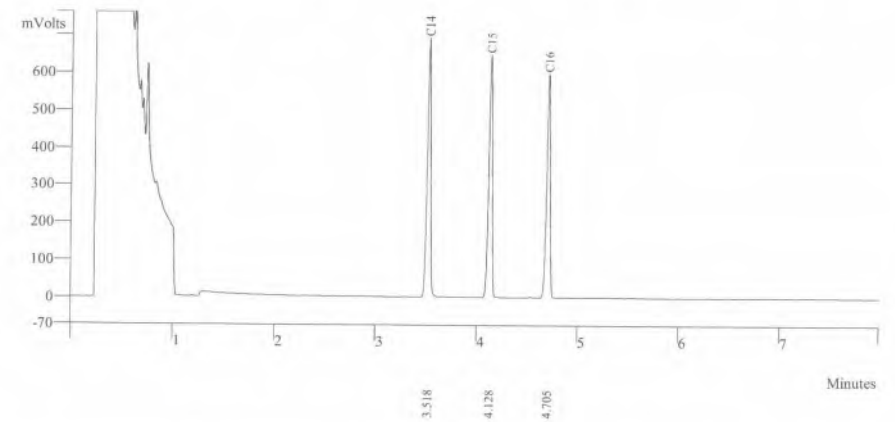
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024002.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	152.6865	3.518	168565	BB	2.2
2	C15	137.1189	4.128	159359	BB	2.3
3	C16	128.7997	4.705	147834	BB	2.3
Totals		418.6042		475758		



Sample ID: **fid std**

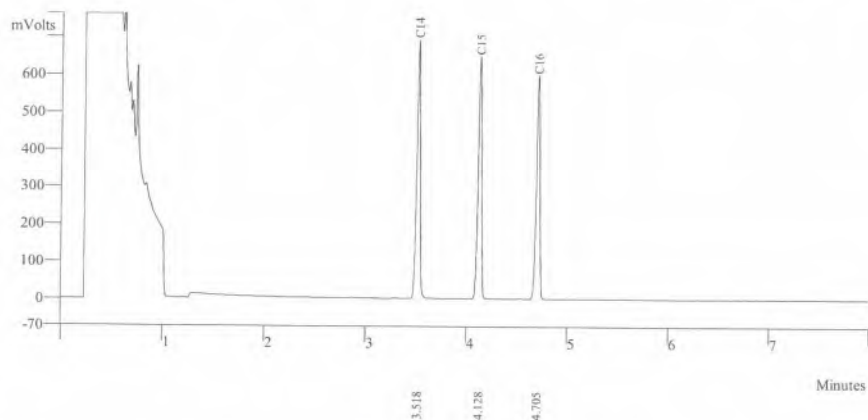
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024003.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	152.7865	3.518	169535	BB	2.2
2	C15	197.1159	4.128	157349	BB	2.3
3	C16	128.5997	4.705	149834	BB	2.3
Totals		478.5021		476718		

Sample ID: **fid std**

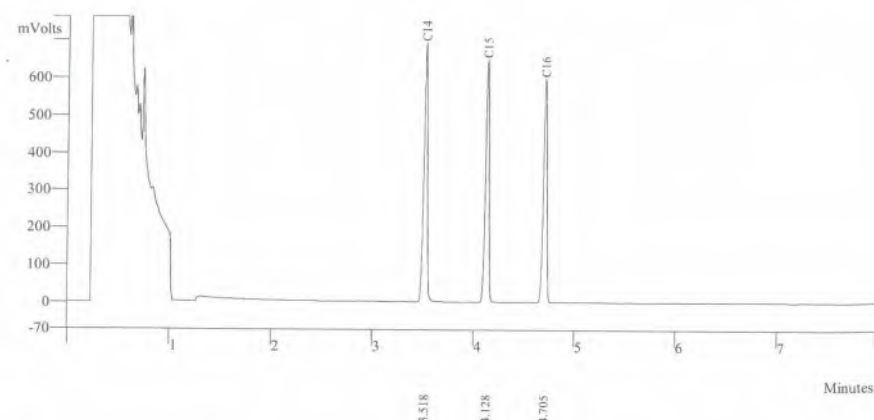
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024004.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	162.7865	3.518	165521	BB	2.2
2	C15	157.1159	4.128	152379	BB	2.3
3	C16	138.5997	4.705	146834	BB	2.3
Totals		458.5021		464734		



Sample ID: **fid std**

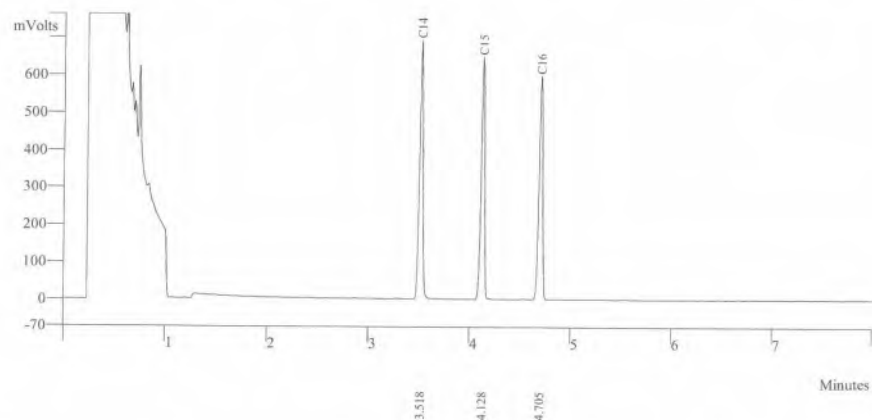
Operator (Inj): suwarot
 Injection Date: 05/08/2024
 Calc Date: 05/08/2024
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024005.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	162.7965	3.518	164521	BB	2.2
2	C15	137.1159	4.128	158379	BB	2.3
3	C16	128.1947	4.705	149834	BB	2.3
Totals		428.1071		472734		



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: 0006750304

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.

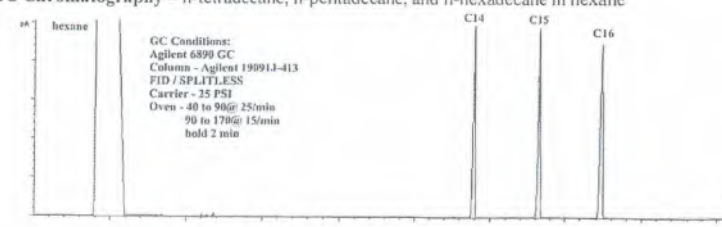
Concentrations:		
n-tetradecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-pentadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-hexadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %

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	99.5%
hexane	99%

Typical Analytical Spectrum or Chromatography
 GC Chromatography – n-tetradecane, n-pentadecane, and n-hexadecane in hexane



Date of release: 30 June 2023

Date of expiration: 31 July 2025

Monica Bourgeois
 Monica Bourgeois
 QMS Representative

Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

Customer : THAI UNIQUE CO., LTD.
80-82 PRACHATHIPATAI RD., BANGKHUNPHROM,
PRANAKORN, BANGKOK 10200

Instrument	: AMD Flow Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Agilent Technologies	Humidity	: (50 ± 15) %RH
Model	: G6691A	Received Date	: 6-Dec-23
Serial No.	: MY16470347	Calibrated Date	: 7-Dec-23
Identity No.	: SV-DF-001	Issued Date	: 12-Dec-23
Range	: 0 ml/min to 750 ml/min	Calibrated Location	: In Lab
Resolution	: See to data		
Calibration Method	: CP-WK-M10		

Reference standard instruments :

Instrument	Serial No.	Certificate No.	Due Date	Traceability to
Flow Calibrator	140215-134	L202304114-001	18-Apr-25	MIT
Primary Flow Calibrator	1107-S	WK2305-049-5	22-May-24	WK Electric Co.,Ltd.

MIT : Miracle International Technology Co.,Ltd.

This result calibrate was found accurate as shown on date place of calibrate only

This certificate is traceability to the International System of Unit (SI)

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%

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

This certificate may not be reproduced except in full unless permission for the reproduction has been obtained in writing from the laboratory.

Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

Function : Flow Measurement
Range : 0 ml/min to 750 ml/min
Resolution : 0.01 / 0.1 / 1 ml/min

UUC Setting		STD Reading	Error	Uncertainty (±)	Unit : ml/min
Scale	ml/min				Tolerance Limit Values (ml/min)
0	0.00	0.00	0.00	3.3	-0.20 ~ 0.20
50	50.7	51.15	-0.45	3.3	48.80 ~ 51.20
300	300	300.4	-0.4	3.3	293.8 ~ 306.2
450	450	450.7	-0.7	3.3	440.8 ~ 459.2
550	550	549.5	0.5	3.3	533.5 ~ 566.5
650	650	649.3	0.7	3.3	630.5 ~ 669.5
700	700	699.2	0.8	3.3	679.0 ~ 721.0

(X) Without Adjustment () After Adjustment

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**** End of Certificate****



Measuretronix Limited
2425/2 Lat Phrao Road, Saphan Song
Wangthonglang, Bangkok 10310, Thailand
Phone : 0-2514-1000, 0-2514-1234
Fax : 0-2514-0001, 0-2514-0003
Website : www.measuretronix.com



Certificate of Calibration

Certificate Number : LF24-0278
Equipment : Thermometer
Manufacturer : Fluke
Model : 51
Serial Number : 5910857
Asset Number : 5910857
Customer : Thai Unique Co., Ltd.
80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200
Date of Calibrate : 26-Jun-2024
Date of Issue : 27-Jun-2024

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

This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab. Calibration certificates without signature are not valid.

The measurements marked with an asterisk () in this certificate are outside our range of accreditation. They have been included for completeness.*

The Calibration interval (Cal.Due) is the responsibility of the end user.

Calibrated by

Nanthiya Ngampring
Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

A. S.
Mrs. Arunee Bamrungham
Cal-Lab Manager

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3



Measuretronix Limited

Calibration Report

UUC : Fluke 51 Thermometer

Serial No. : 5910857

Asset No. : 5910857

Procedure : CP-LP-04:Rev.02

Note : Refer to Fluke 51,52 Operator's Manual Rev I 3/86, Oct 1985

Certificate No. : LF24-0278

Report data type : As-Found

Date of Calibrate : 26-Jun-2024

Date of Receive : 17-Jun-2024

Environment condition

Temperature : 23 °C ± 3 °C

Humidity : 50 %RH ± 20 %RH

Customer : Thai Unique Co., Ltd.

Address : 80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200

Measuretronix Cal-Lab certifies that the above listed instrument meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). The measurements are traceable to national or international measurement standards or accept fundamental or natural physical constants or have been derived by approved ratio techniques as state in the Standard Used below. The policies and procedures used comply with ISO/IEC 17025:2017.

This report applies only to the item identified and shall not be reproduced other than in full, without specific written approved by Measuretronix Cal-Lab.

The uncertainties shown are the expanded uncertainties, which calculated from the standard uncertainties multiplied by a coverage factor of $k = 2$, providing a measurement confidence level of approximately 95%.

No statement of compliance with specifications is made or implied on this certificate.

Remark : The units of uncertainty values in this report are referred to the below details :

"Volt" or "V" for voltage, "Ampere" or "A" for current, "Ohm" or "Ω" for resistance, "Farad" or "F" for capacitance, "Hertz" or "Hz" for frequency, "deg C" or "°C" for degree Celsius, "deg F" or "°F" for degree Fahrenheit, etc.

Standard Used

Serial/Asset	Description	Traceable	Cert.No.	Cal.Date	Due Date
6400011	Fluke 5500A Calibrator	NIMT	EE-0017-24	7-Mar-2024	6-Mar-2025

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 2 of 3

Test Data

TEST	RANGE	Nominal Value	UUC Tol. (+/-)	Test Result	Error	Uncertainty (+/-)
THERMOCOUPLE MEASUREMENT CALIBRATION						
TYPE K THERMOCOUPLE						
1		-195.0 °C*	0.9 °C	-195.4 °C	-0.4 °C	0.27 °C
2		-100.0 °C	0.8 °C	-100.5 °C	-0.5 °C	0.21 °C
3		-50.0 °C	0.8 °C	-50.2 °C	-0.2 °C	0.21 °C
4		0.0 °C	0.7 °C	0.0 °C	0.0 °C	0.21 °C
5		100.0 °C	0.8 °C	100.1 °C	0.1 °C	0.21 °C
6		300.0 °C	1.0 °C	300.2 °C	0.2 °C	0.21 °C
7		500.0 °C	1.2 °C	500.1 °C	0.1 °C	0.21 °C
8		1365.0 °C	2.1 °C	1365.2 °C	0.2 °C	0.32 °C
TYPE J THERMOCOUPLE						
9		-195.0 °C*	1.0 °C	-194.4 °C	0.6 °C	0.22 °C
10		-100.0 °C	0.9 °C	-99.3 °C	0.7 °C	0.18 °C
11		-50.0 °C	0.9 °C	-49.4 °C	0.6 °C	0.18 °C
12		0.0 °C	0.8 °C	0.5 °C	0.5 °C	0.18 °C
13		100.0 °C	0.9 °C	100.4 °C	0.4 °C	0.18 °C
14		300.0 °C	1.1 °C	300.8 °C	0.8 °C	0.18 °C
15		755.0 °C	1.6 °C	755.3 °C	0.3 °C	0.18 °C

End of Calibration Report

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

S. Pohtongkam

Service Manager

CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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

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.



บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO., LTD.

Operator Signature: _____

Date: June 24, 2024

(Mr. Ponwut Kornthongnimit)

Test Engineer



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 <u>077C7042401</u>	DATE TESTED <u>January 4, 2024</u>
----------------------------------	------------------------------------

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



WO-02612424/2024

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer : <u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested: <u>July 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>January 4, 2025</u>
User Name: <u>K.Phenpha Vipasthawatt</u>	Date Last Certified: <u>January 4, 2024</u>
Phone: <u>083-9269252</u>	Visit Number: <u>1 of 2</u>
Fax: <u>02-513-4221</u>	PerkinElmer Phone: <u>02-719-6420 ext 206</u>
	PerkinElmer Fax: <u>02-318-5597</u>

CONFIGURATION TESTED		ACCESSORIES/COMPONENT NOT INCLUDED
MODEL	SERIAL NUMBER	
<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>September 30, 2024</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>January 30, 2025</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2024</u>
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>July 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>July 4, 2024</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00550
	Ni 231.604 nm	≤ 0.008	0.00714
	Ni 341.476 nm	≤ 0.012	0.00790
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01655
	Ba 455.403 nm	≤ 0.025	0.02391
Precision			
	As 193.656 nm	% RSD < 1.0	0.72 %
	Zn 213.856 nm	% RSD < 1.0	0.66 %
	Mn 257.610 nm	% RSD < 1.0	0.30 %
	La 379.478 nm	% RSD < 1.0	0.98 %
	Ba 455.403 nm	% RSD < 1.0	0.95 %
	Ba 493.408 nm	% RSD < 1.0	0.78 %
Detection Limits : Axial	Tl 190.080 nm	3(sd)	6.22 ppb
	As 193.696 nm	3(sd)	6.44 ppb
	Pb 220.353 nm	3(sd)	2.06 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	78.26 ppb
	Zn 213.856 nm	3(sd)	2.07 ppb
	Mn 257.610 nm	3(sd)	0.52 ppb
	La 379.478 nm	3(sd)	2.63 ppb
	Ba 455.403 nm	3(sd)	0.08 ppb
	Ba 493.408 nm	3(sd)	0.75 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	64.72
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	15.04



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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

Commissioning follow as commissioning performance sheets.

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: 

(Wiphan Promlumda)

Service Engineer

เอกสารแนบ 5-8

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Keithley 2015-P S/N4106495.

7. Condenser Microphone B&K 4180 S/N 2889871.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 / 2

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

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

FM.BL.MTC.002 Rev.4



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion

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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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

FM.BL.MTC.002 Rev.4

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

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

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

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

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Fax. (66) 0 2323 9165
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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. 21-67/0304

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.

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

FM.BL.MTC.002 Rev.4

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

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

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



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

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 μPa at 1000 Hz

Acoustic Output in dB re 20 μPa , Corrected to Reference Conditions : 101.325 kPa, 23.0 $^\circ\text{C}$ and 50 %RH

1. Sound Pressure Level

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

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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Amphoe Muang, Changwat Samutprakan 10280, Thailand
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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 แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

Noise R_600/24

Sound Level Meter Calibration Report

Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	30 September 2024	93.9	93.9
ACO-B29	ACO	6236	00182011	30 September 2024	93.8	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : (Signature)
(Mr. Peera Detudom)



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

Noise R_600-01/24

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-B05	Cirrus	CR161B	G301134	30 September 2024	94.0	94.0
CR-B06	Cirrus	CR161B	G301151	30 September 2024	94.1	94.0
CR-B09	Cirrus	CR161B	G301401	30 September 2024	94.0	94.0
CR-B10	Cirrus	CR161B	G301407	30 September 2024	94.0	94.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					94.04 ± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : (Signature)
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

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

Noise R_734/24

Sound Level Meter Calibration Report

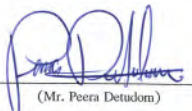
Acoustic Calibrator Data

Brand	ACO	Number	AC 03/56
Model	2127	Serial No.	130006
Calibration Range	94 dB, 1000 Hz	Last Calibration	04 March 2024
		Due Date	04 March 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R50	ACO	6236	00192062	25 November 2024	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : 
(Mr. Peera Detudom)

เอกสารแนบ 5-9

เอกสารสอบเทียบเครื่องมือการตรวจวัดปริมาณเสียงสะสมติดตัวพนักงาน



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0562

MTC No. EEL. BP. 71/0767

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 generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 31 Jul. 2024

Date of Calibration : 6 Aug. 2024

1/2

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

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

FM.BLMTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0562

MTC No. EEL. BP. 71/0767

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	113.50	-0.50	± 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	0.48	± 0.50	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 6 Aug. 2024

Date of Issue : 7 Aug. 2024

Ref : 2011267073102836002

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.5

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(66) 08 3219 9440
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Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

Noise Dose R_601/24

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	06 August 2024		
			Due Date	06 August 2025		
Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B01	SVANTEK	SV-104IS	80840	30 September 2024	113.5	113.5
NMD-B02	SVANTEK	SV-104IS	80842	30 September 2024	113.5	113.5
NMD-B03	SVANTEK	SV-104IS	80852	30 September 2024	113.4	113.5
NMD-B04	SVANTEK	SV-104IS	80854	30 September 2024	113.5	113.5
NMD-R02	SVANTEK	SV-104IS	60152	30 September 2024	113.5	113.5
NMD-R13	SVANTEK	SV-104IS	63438	30 September 2024	113.5	113.5
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.50± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)

Noise Dose R_735/24

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	06 August 2024		
			Due Date	06 August 2025		
Calibration Data						
Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B01	SVANTEK	SV-104IS	80840	25 November 2024	113.5	113.5
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					113.50± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)

เอกสารแนบ 5-10

เอกสารสอบเทียบเครื่องมือการตรวจวัดแสงสว่างในสถานประกอบการ



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24070449-2 Page : 1 of 3
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,
Bangkok 10900

Equipment Name : Light Meter
Manufacturer : Extech
Model : 407026
Serial Number : A.052151
ID. Number : LUX- B07
Environmental Conditions
Ambient Temperature : $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ Received Date : 24 Jul 2024
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 29 Jul 2024
Location of Calibration : In-Lab Recommend Due Date : 29 Jul 2025
Calibration Procedure : SP-CPE-04-32 Date of Issue : 30 Jul 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.Chumpon Dokpikul

Calibration Officer

Approved by :

(Mr.Prayoon Topart)
Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24070449-2 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Digital Light Meter	LX-73	Q842777	23PH462	05 Sep 2024

Traceability

This certification is traceable to the International System of Unit maintained at :
TPA - Technology Promotion Association (Thailand-Japan)



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24070449-2

Page : 3 of 3

Function: Illumination Measurement

Unit : Lux

Calibration Point	Standard Reading	UUC Reading	Error	Uncertainty (±)
100	100.0	101	1	1.3
200	200.0	201	1	6.6
300	300	300	0	6.6
1000	1000	999	-1	13
2000	2000	1985	-15	26
3000	3000	2990	-10	41

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 $k = 2.00$, providing a level of confidence approximately 95 %

- End of Certificate -

เอกสารแนบ 5-11

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับความร้อนในสถานประกอบการ



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24080586-1 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor
Manufacturer : Quest Technologies
Model : QUESTemp 34
Serial Number : TEN040005
ID. Number : R04

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 30 Aug 2024
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 30 Aug 2024
Location of Calibration : In-Lab Recommend Due Date : 30 Aug 2025
Calibration Procedure : SP-CPT-04-13 Date of Issue : 31 Aug 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 : Ms. Apinya Pinyo

Calibration Officer

Approved by :

(Mr. Prayoon Topart)
Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24080586-1 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. : SPR24080586-1

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.025	30.1	0.075	0.20
35.0	35.020	35.1	0.080	0.20
40.0	40.018	40.1	0.082	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.025	30.0	-0.025	0.20
35.0	35.020	35.0	-0.020	0.20
40.0	40.018	40.0	-0.018	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.025	30.2	0.175	0.20
35.0	35.020	35.2	0.180	0.20
40.0	40.018	40.2	0.182	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 : SPR24030285-6

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

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 : SPR24030285-6

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 -



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24080586-2

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 : Metrosonics

Model : hs-32

Serial Number : MCD070028

ID. Number : R06

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C

Relative Humidity : 50 % ± 15 %

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 30 Aug 2024

Calibration Date : 30 Aug 2024

Recommend Due Date : 30 Aug 2025

Date of Issue : 31 Aug 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 : Ms.Apinya Pinyo

Calibration Officer

Approved by :

(Mr. Prayoon Topart)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24080586-2

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. : SPR24080586-2

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.018	30.0	-0.018	0.20
35.0	35.012	35.0	-0.012	0.20
40.0	40.022	40.0	-0.022	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.018	30.0	-0.018	0.20
35.0	35.012	35.0	-0.012	0.20
40.0	40.022	40.0	-0.022	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.018	30.1	0.082	0.20
35.0	35.012	35.1	0.088	0.20
40.0	40.022	40.1	0.078	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 : SPR24030285-1 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 34

Serial Number : TEH090208

ID. Number : R08

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



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24030285-1

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. : SPR24030285-1

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.8	-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. (DRY)

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	39.7	-0.315	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Humidity 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

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 : SPR24080586-3

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 : TKE060012

ID. Number : R09

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C

Relative Humidity : 50 % ± 15 %

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 30 Aug 2024

Calibration Date : 30 Aug 2024

Recommend Due Date : 30 Aug 2025

Date of Issue : 31 Aug 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 : Ms. Apinya Pinyo

Calibration Officer

Approved by :


(Mr. Prayoon Topart)
Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24080586-3

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 :
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ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24080586-3

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.020	30.2	0.180	0.20
35.0	35.022	35.2	0.178	0.20
40.0	40.016	40.2	0.184	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.020	30.1	0.080	0.20
35.0	35.022	35.1	0.078	0.20
40.0	40.016	40.1	0.084	0.20

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.020	30.1	0.080	0.20
35.0	35.022	35.1	0.078	0.20
40.0	40.016	40.1	0.084	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 : SPR24030285-3 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 : TPE070001
ID. Number : R12

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



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24030285-3 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 :
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Quality Reborn Co., Ltd



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24030285-3

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	29.9	-0.112	0.20
35.0	35.010	34.9	-0.110	0.20
40.0	40.015	39.9	-0.115	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.012	30.1	0.088	0.20
35.0	35.010	35.1	0.090	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	30.1	0.088	0.20
35.0	35.010	35.1	0.090	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 -



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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

Heat R133

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R04	Verification Date	: 30 September 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	12.7	-0.2	± 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 : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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Heat R133

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R05	Verification Date	: 30 September 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	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.3	-0.2	± 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 : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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Heat R133

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	R06	Verification Date :	30 September 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	12.5	0.0	± 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 : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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Heat R133

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	R08	Verification Date :	30 September 2024
Brand :	Ouest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp 34	Barometric Pressure :	1011 mmbar
Serial No. :	TEH090208	Relative Humidity :	49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 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	69.4	-0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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Heat R133

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	R09	Verification Date :	30 September 2024
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp 36	Barometric Pressure :	1011 mmbar
Serial No. :	TKE060012	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	47.1	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 : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



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

Heat R133

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No. :	R12	Verification Date :	30 September 2024
Brand :	Quest Technologies	Ambient Temp. :	24.5 °C
Model :	QUESTemp 32	Barometric Pressure :	1011 mmbar
Serial No. :	TPE070001	Relative Humidity :	49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	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	69.5	-0.2	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)