

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

เอกสารแนบ 5-1	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ
เอกสารแนบ 5-2	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง
เอกสารแนบ 5-3	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ
เอกสารแนบ 5-4	เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง
เอกสารแนบ 5-5	เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำใต้ดิน
เอกสารแนบ 5-6	เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในสถานประกอบการ
เอกสารแนบ 5-7	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานประกอบการ
เอกสารแนบ 5-8	เอกสารสอบเทียบเครื่องมือการตรวจวัดปริมาณเสียงสะสมติดตัวพนักงาน
เอกสารแนบ 5-9	เอกสารสอบเทียบเครื่องมือการตรวจวัดแสงสว่างในสถานประกอบการ
เอกสารแนบ 5-10	เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับความร้อนในสถานประกอบการ

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศ TSP	High Volume Air Sampler No. R07, R14, R13, R15	Digital Balance
PM ₁₀	High Volume PM10 Air Sampler No. R03, R17, R15, R18	Digital Balance
SO ₂	SO2 Analyzer No. R02, R03, R09, R10	SO2 Analyzer No. R02, R03, R09, R10
NO ₂	NO Analyzer No. R03, R04, R08, R11	NO Analyzer No. R03, R04, R08, R11
Acetaldehyde	Mass Flow Meter	GC/MS
คุณภาพอากาศจากปล่อง TSP	Console No. R04 Pitot Tube No. B16, B27, B40	Digital Balance
NO _x	Vacuum Gauge	Spectrophotometer
SO ₂	Personal Pump SKC No. R14, R45 Rotameter No. H-R06	-
Acetaldehyde	Personal Pump SKC No. B21 Rotameter No. H-R06, H-L06	GC/FID
Ethylene Glycol	Personal Pump SKC No. B71 Rotameter No. H-R06, H-L06	GC/FID
ระดับเสียง Leq 24 hr Lmax L90	Acoustic Calibrator	-
	Sound Level Meter No. ACO-R21, R22	
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 Spectrophotometer
Hexavalent Chromium	-	Spectrophotometer
คุณภาพน้ำใต้ดิน Acetaldehyde	-	GC/MS
คุณภาพอากาศในสถานประกอบการ Acetaldehyde	Personal Pump No. R07, R13, R15, R19, R28, R31, R32, R36, R38, R49 Rotameter No. L-R02, L-R06	GC/FID
Ethylene Glycol	Personal Pump No. R11, R15, R17, R28, R30, R31, R34, R36, R42 Rotameter No. H-R02, H-R06	GC/FID
Total Dust	Personal Pump No. R11, R15, R17, R26, R28, R44, R48 Rotameter No. H-R02, H-R06	Digital Balance
Respirable Dust	Personal Pump No. R10, R12, R19, R28, R30, R47 Rotameter No. H-R02, H-R06	Digital Balance
Phosphoric Acid	Personal Pump No. R02, R11, R26, R28, R36, R43 Rotameter No. L-R02, L-R06	IC
Sodium Hydroxide	Personal Pump No. R10, R11, R22, R34, R39, R47 Rotameter No. H-R02, H-R06	-
Sodium Hypochlorite as Sodium	Personal Pump No. R11, R36 Rotameter No. H-R02, H-R06	ICP
Hydrogen Sulfide	Personal Pump No. R19, R24 Rotameter No. L-R02, L-R06	IC
Acetone	Personal Pump No. R36, R44 Rotameter No. L-R02, L-R06	GC/FID
Ethanol	Personal Pump No. R36, R44 Rotameter No. L-R02, L-R06	GC/FID
Chloroform	Personal Pump No. R11 Rotameter No. L-R02, L-R06	GC/FID

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในสถานประกอบการ (ต่อ) Phenol	Personal Pump No. R02, R26 Rotameter No. L-R02, L-R06	GC/FID
Isopropyl Alcohol	Personal Pump No. R13, R48 Rotameter No. L-R02, L-R06	GC/FID
Hydrochloric Acid	Personal Pump No. R45, R47 Rotameter No. L-R02, L-R06	IC
Acetic Acid	Personal Pump No. R32, R34, R36, R38 Rotameter No. L-R02, L-R06	GC/FID
ระดับเสียงในสถานประกอบการ Leq 12 hr Lmax	Acoustic Calibrator No. 130006	-
	Sound Level Meter No. ACO- B36, B43, R41, R50, R51, R52	-
ปริมาณเสียงสะสมติดตัวพนักงาน Noise Dose	Acoustic Calibrator No. 83820	-
	Noise Dosimeter No. NMD-B12, B13, B14, B15, B16, R35	-
ระดับความเข้มของแสงสว่างในสถาน ประกอบการ Light Intensity	Light Meter No. R09	-
ระดับความร้อนในสถานประกอบการ WBGT	Heat Stress WBGT Meter No. B33, R04, R05, R06	-

เอกสารแนบ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ



High Volume Air Sampler Calibration Report

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

Calibration Data

High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft ³ /min)	R ²
B01	B01	02/02/2026	$y = 1.147x - 3.983$	0.998
B02	B02	02/02/2026	$y = 1.158x - 3.531$	0.997
B03	B03	02/02/2026	$y = 1.109x - 2.595$	0.999
B04	B04	02/02/2026	$y = 1.123x - 1.928$	0.998
B05	B05	02/02/2026	$y = 1.145x - 3.659$	0.999
B06	B06	02/02/2026	$y = 1.100x - 2.379$	0.999
B07	B07	02/02/2026	$y = 1.122x - 2.377$	0.999
B08	B08	02/02/2026	$y = 1.102x - 2.500$	0.998
B09	B09	02/02/2026	$y = 1.121x - 3.479$	0.999
B10	B10	02/02/2026	$y = 1.143x - 3.199$	0.996
B11	B11	03/02/2026	$y = 1.105x - 1.251$	0.999
B12	B12	03/02/2026	$y = 1.136x - 3.106$	0.996
B13	B13	03/02/2026	$y = 1.142x - 2.536$	0.998
B14	B14	03/02/2026	$y = 1.135x - 3.133$	0.998
B15	B15	03/02/2026	$y = 1.111x - 2.932$	0.998
B16	B16	04/02/2026	$y = 1.104x - 3.794$	0.998
B17	B17	04/02/2026	$y = 1.151x - 2.773$	0.998
B18	B18	04/02/2026	$y = 1.140x - 2.730$	0.998
B19	B19	04/02/2026	$y = 1.137x - 2.624$	0.998
B20	B20	04/02/2026	$y = 1.139x - 1.402$	0.998
B21	B21	04/02/2026	$y = 1.131x - 1.657$	0.999
B22	B22	04/02/2026	$y = 1.166x - 3.867$	0.997
B23	B23	04/02/2026	$y = 1.162x - 4.278$	0.998
B24	B24	04/02/2026	$y = 1.128x - 2.436$	0.998
B25	B25	04/02/2026	$y = 1.159x - 4.833$	0.998
B26	B26	03/02/2026	$y = 1.103x - 1.969$	0.997
B27	B27	04/02/2026	$y = 1.149x - 3.761$	0.997
B28	B28	04/02/2026	$y = 1.134x - 3.377$	0.999
B29	B29	04/02/2026	$y = 1.118x - 2.905$	0.997
B30	B30	04/02/2026	$y = 1.157x - 2.504$	0.999
B31	B31	04/02/2026	$y = 1.165x - 3.108$	0.999
B32	B32	04/02/2026	$y = 1.113x - 2.480$	0.999
B33	B33	04/02/2026	$y = 1.155x - 2.774$	0.997
B34	B34	04/02/2026	$y = 1.125x - 1.805$	0.997

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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	04/02/2026	$y = 1.154x - 3.696$	0.996
B36	B36	04/02/2026	$y = 1.119x - 2.463$	0.997
B37	B37	04/02/2026	$y = 1.129x - 3.721$	0.998
B38	B38	02/02/2026	$y = 1.182x - 2.931$	0.997
B39	B39	02/02/2026	$y = 1.062x - 1.512$	0.999
B40	B40	02/02/2026	$y = 1.163x - 3.556$	0.997
B41	B41	02/02/2026	$y = 1.116x - 1.975$	0.996
B42	B42	02/02/2026	$y = 1.152x - 4.140$	0.997
B43	B43	02/02/2026	$y = 1.167x - 3.646$	0.996
B44	B44	02/02/2026	$y = 1.178x - 4.362$	0.999
B01	B01	03/02/2026	$y = 1.097x - 2.630$	0.997
B02	B02	02/02/2026	$y = 1.138x - 3.218$	0.996
B03	B03	02/02/2026	$y = 1.133x - 3.084$	0.998
B04	B04	02/02/2026	$y = 1.121x - 2.102$	0.998
B05	B05	02/02/2026	$y = 1.041x - 0.894$	0.997
B06	B06	02/02/2026	$y = 1.075x - 0.258$	0.997
B07	B07	03/02/2026	$y = 1.126x - 2.841$	0.996
B08	B08	03/02/2026	$y = 1.091x - 2.104$	0.996
B09	B09	03/02/2026	$y = 1.065x - 0.597$	0.996
B10	B10	03/02/2026	$y = 1.093x - 1.217$	0.999
B11	B11	03/02/2026	$y = 1.130x - 3.938$	0.999
B12	B12	05/02/2026	$y = 1.164x - 2.698$	0.997
B13	B13	05/02/2026	$y = 1.120x - 3.330$	0.998
B14	B14	05/02/2026	$y = 1.034x - 0.445$	0.997
B15	B15	05/02/2026	$y = 1.076x - 0.429$	0.998
B16	B16	05/02/2026	$y = 1.107x - 1.468$	0.996
B17	B17	05/02/2026	$y = 1.078x - 1.668$	0.998
B18	B18	05/02/2026	$y = 1.160x - 5.001$	0.997
B19	B19	05/02/2026	$y = 1.077x - 2.680$	0.997
B20	B20	05/02/2026	$y = 1.185x - 4.839$	0.998

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
B01	B01	02/02/2026	$y = 1.056x - 0.702$	0.998
B02	B02	02/02/2026	$y = 1.076x + 0.303$	0.999
B03	B03	02/02/2026	$y = 1.040x + 0.622$	0.997
B04	B04	02/02/2026	$y = 1.135x - 2.410$	0.998
B05	B05	02/02/2026	$y = 1.073x - 1.284$	0.997
B06	B06	02/02/2026	$y = 1.017x - 2.340$	0.998
B07	B07	02/02/2026	$y = 1.036x - 0.117$	0.998
B08	B08	02/02/2026	$y = 1.145x - 2.648$	0.997
B09	B09	02/02/2026	$y = 1.115x - 4.423$	0.999
B10	B10	02/02/2026	$y = 1.090x - 2.056$	0.999
B11	B11	03/02/2026	$y = 1.112x - 3.640$	0.997
B12	B12	03/02/2026	$y = 1.136x - 4.495$	0.997
B13	B13	03/02/2026	$y = 1.119x - 2.873$	0.999
B14	B14	03/02/2026	$y = 1.145x - 5.948$	0.998
B15	B15	03/02/2026	$y = 1.137x - 2.722$	0.997
B16	B16	03/02/2026	$y = 1.087x + 0.251$	0.997
B17	B17	03/02/2026	$y = 1.096x - 0.862$	0.998
B18	B18	03/02/2026	$y = 1.111x - 3.264$	0.998
B19	B19	03/02/2026	$y = 1.081x + 0.507$	0.998
B20	B20	03/02/2026	$y = 1.137x - 3.001$	0.999
B21	B21	03/02/2026	$y = 1.129x - 3.073$	0.999
B22	B22	03/02/2026	$y = 1.130x - 2.275$	0.998
B23	B23	03/02/2026	$y = 1.149x - 4.649$	0.997
B24	B24	03/02/2026	$y = 1.103x - 2.139$	0.999
B25	B25	03/02/2026	$y = 1.065x - 1.466$	0.999
B26	B26	03/02/2026	$y = 1.035x + 0.731$	0.998
B27	B27	03/02/2026	$y = 1.102x - 2.849$	0.998
B28	B28	03/02/2026	$y = 1.138x - 3.506$	0.998
B29	B29	03/02/2026	$y = 1.046x + 0.180$	0.997
B30	B30	03/02/2026	$y = 1.146x - 5.125$	0.997
B31	B31	03/02/2026	$y = 1.028x + 0.644$	0.998
B32	B32	04/02/2026	$y = 1.044x + 1.254$	0.999
B33	B33	04/02/2026	$y = 1.106x - 2.101$	0.999
B34	B34	04/02/2026	$y = 1.059x + 0.598$	0.998

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	04/02/2026	$y = 1.057x + 0.776$	0.998
R02	R02	04/02/2026	$y = 1.126x - 3.679$	0.999
R03	R03	04/02/2026	$y = 1.099x - 1.897$	0.998
R04	R04	04/02/2026	$y = 1.130x - 5.885$	0.998
R05	R05	04/02/2026	$y = 1.082x - 2.165$	0.999
R06	R06	04/02/2026	$y = 1.132x - 2.551$	0.997
R07	R07	04/02/2026	$y = 1.116x - 2.326$	0.998
R08	R08	02/02/2026	$y = 1.133x - 2.604$	0.998
R09	R09	02/02/2026	$y = 1.063x + 0.125$	0.998
R10	R10	02/02/2026	$y = 1.119x - 2.628$	0.997
R11	R11	02/02/2026	$y = 1.030x + 1.723$	0.999
R12	R12	02/02/2026	$y = 1.035x + 0.921$	0.999
R13	R13	02/02/2026	$y = 1.117x - 3.172$	0.999
R14	R14	02/02/2026	$y = 1.083x - 2.455$	0.999
R15	R15	02/02/2026	$y = 1.103x - 3.395$	0.997
R16	R16	02/02/2026	$y = 1.146x + 0.022$	0.998
R17	R17	02/02/2026	$y = 1.091x + 1.835$	0.998
R18	R18	02/02/2026	$y = 1.104x - 4.944$	0.998
R19	R19	03/02/2026	$y = 1.097x + 0.011$	0.998
R20	R20	03/02/2026	$y = 1.107x - 2.872$	0.998

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

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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 : 07-Mar-25

APPROVED BY : PONGSAK J.
ISSUED DATE : 13-Mar-25
RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
ID No : BA05/50
AIR PRESSURE : 1009mbar $\pm$ 1mbar
AMBIENT TEMPERATURE : 24°C $\pm$ 1°C
MODEL : XS105DU
S/N : 1126422905
RECEIVED DATE : 07-Mar-25
CALIBRATION DATE : 07-Mar-25
RELATIVE HUMIDITY : 54%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	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 120 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	0.01999	0.00001	0.000065
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50002	-0.00002	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00000	0.00000	0.000070
20.00	20.00004	-0.00004	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.00001	-0.00001	0.00019
120.00	120.00002	-0.00002	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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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	15 February 2026	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R02	SERIAL NO.	3431		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700	
Last Cal. Date	: 24 October 2025		Serial No.	: 421	
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	1010	mmbar	Temp.	24.5	°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	399.9	-0.025	400.0	1.003
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	0-500		
SAMPLE PRESS	28.5	in-Hg	25-35		
SAMPLE FLOW	658	cc/min	550 ± 10%		
PMT	103.6	mV	20-150 with Zero Air		
UV LAMP	2891.5	mV	1000-4900		
STR LGT	60.7	PPB	<100		
DRK PMT	64.5	mV	-50 - 200		
DRK LAMP	57.2	mV	-50 - 200		
HVPS	678	V	550-900 constant		
DCPS	2515	mV	2500 ± 200		
CELL TEMP	50.0	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.003	-	1.0 ± 0.3		
SO ₂ Offset	21.6	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 : Heeson L.
(Mr.Heeson Lormae)

Approved by : Yutthana T.
(Mr.Yutthana Tanatharanit)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	15 February 2026	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R03	SERIAL NO.	3488		
Calibrator (Dilution System)					
Brand	: Teledyne		Model	: 700	
Last Cal. Date	: 24 October 2025		Serial No.	: 421	
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	1010	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	400.3	0.075	400.0	1.007
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	550 ± 10%		
PMT	103.2	mV	20-150 with Zero Air		
UV LAMP	2882.3	mV	1000-4900		
STR LGT	61.4	PPB	<100		
DRK PMT	63.1	mV	-50 - 200		
DRK LAMP	57.8	mV	-50 - 200		
HVPS	670	V	550-900 constant		
DCPS	2518	mV	2500 ± 200		
CELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.1	°C	5-40		
PMT TEMP	7.0	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.007	-	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 : Heeson L.
(Mr.Heeson Lormae)

Approved by : Yutthana T.
(Mr.Yutthana Tanatharanit)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	15 February 2026	BRAND :	API	MODEL :	100E
NO.	SO ₂ -R09	SERIAL NO.	76		
Calibrator (Dilution System)					
Brand : Teledyne		Model : 700			
Last Cal. Date : 24 October 2025		Serial No. : 421			
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	1010	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	400.2	0.050	400.0	1.004
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	300	PPB	0-500		
SAMPLE PRESS	28.3	in-Hg	25-35		
SAMPLE FLOW	654	cc/min	650 ± 10%		
PMT	103.1	mV	20-150 with Zero Air		
UV LAMP	3017.8	mV	1000-4900		
STR. LGT	61.2	PPB	<100		
DRK PMT	63.5	mV	50 - 200		
DRK LAMP	57.8	mV	50 - 200		
HVPS	674	V	550-900 constant		
DCPS	2515	mV	2500 ± 200		
CELL TEMP	30.1	°C	50 ± 1		
BOX TEMP	29.3	°C	5-40		
PMT TEMP	7.1	°C	7 ± 2.0		
SO ₂ Span Conc	400	PPB	20-20,000		
SO ₂ Slope	1.004	-	1.0 ± 0.3		
SO ₂ Offset	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 :

Heeson L
(Mr.Heeson Lormae)

Approved by :

Yutthana S.
(Mr.Yutthana Tanatharanit)



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CALIBRATION REPORT					
SO ₂ FLUORESCENT ANALYZER					
DATE :	15 February 2026	BRAND :	TELEDYNE	MODEL :	100E
NO.	SO ₂ -R10	SERIAL NO.	TR51065		
Calibrator (Dilution System)					
Brand : Teledyne		Model : 700			
Last Cal. Date : 24 October 2025		Serial No. : 421			
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	1010	mmbar	Temp.	24.5	°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	1.004
API Model 100E SO ₂ Analyzer Check list					
Test Values	Observed Value	Units	Nominal Range		
RANGE	300	PPB	0-500		
SAMPLE PRESS	28.3	in-Hg	25-35		
SAMPLE FLOW	655	cc/min	650 ± 10%		
PMT	103.2	mV	20-150 with Zero Air		
UV LAMP	3017.8	mV	1000-4900		
STR. LGT	61.4	PPB	<100		
DRK PMT	63.3	mV	50 - 200		
DRK LAMP	57.5	mV	50 - 200		
HVPS	678	V	550-900 constant		
DCPS	2515	mV	2500 ± 200		
CELL TEMP	30.1	°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	1.004	-	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 :

Heeson L
(Mr.Heeson Lormae)

Approved by :

Yutthana S.
(Mr.Yutthana Tanatharanit)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	15 February 2026	BRAND :	API	MODEL :	200E
NO.	NOX-R03	SERIAL NO.	4410		
Calibrator (Dilution System)					
Brand	Teledyne		Model	700	
Last Cal. Date	24 October 2025		Serial No.	421	
Reference Standard Gas					
Standard Gas	Nitric Oxide (NO)		Cylinder No.	A006745V	
Certified Date	12 March 2025	Expired Date	12 March 2028	Cylinder Conc.	48.7 ppm
CALIBRATING CONDITION					
Pressure	1011	mmbar	Temp.	24.6	°C
			% RH	48	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	400.1	0.025	400.0	1.004
NO _x Span	400	400.2	0.050	400.0	1.005
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	510	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	102.8	mV	-20 - 150		
AZERO	94.0	mV	-20 - 150		
HMPS	673	V	420 - 900 constant		
RCELL TEMP	50.4	°C	50 ± 1		
BOX TEMP	29.0	°C	8 - 48		
PMT TEMP	7.5	°C	7 ± 2		
MOLY TEMP	315.3	°C	315 ± 5		
RCELL PRESS	8.3	in-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	in-Hg-A	25 - 30 constant		
NO Span Conc.	400	PPB	20 - 20,000		
NO _x Span Conc.	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO _x Slope	1.005	-	1.0 ± 0.3		
NO Offset	0.8	mV	-20 to +150		
NO _x Offset	0.3	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 : Heeson L.
(Mr.Heeson Lormae)

Approved by : Yuthana S.
(Mr.Yuthana Tanatharant)

CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	15 February 2026	BRAND :	API	MODEL :	200E
NO.	NOX-R04	SERIAL NO.	4411		
Calibrator (Dilution System)					
Brand	Teledyne		Model	700	
Last Cal. Date	24 October 2025		Serial No.	421	
Reference Standard Gas					
Standard Gas	Nitric Oxide (NO)		Cylinder No.	A006745V	
Certified Date	12 March 2025	Expired Date	12 March 2028	Cylinder Conc.	48.7 ppm
CALIBRATING CONDITION					
Pressure	1010	mmbar	Temp.	24.5	°C
			% RH	48	
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.004
NO _x Span	400	400.2	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	504	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	102.9	mV	-20 - 150		
AZERO	93.9	mV	-20 - 150		
HMPS	674	V	420 - 900 constant		
RCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	29.2	°C	8 - 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	315.1	°C	315 ± 5		
RCELL PRESS	8.3	in-Hg-A	2 - 10 constant		
SAMPLE PRESS	28.5	in-Hg-A	25 - 30 constant		
NO Span Conc.	400	PPB	20 - 20,000		
NO _x Span Conc.	400	PPB	20 - 20,000		
NO Slope	1.004	-	1.0 ± 0.3		
NO _x Slope	1.007	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO _x Offset	0.5	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by : Heeson L.
(Mr.Heeson Lormae)

Approved by : Yuthana S.
(Mr.Yuthana Tanatharant)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	15 February 2026	BRAND :	API	MODEL :	200E
NO.	NOX-R08	SERIAL NO.	243		
Calibrator (Dilution System)					
Brand :	Teledyne	Model :	700		
Last Cal. Date :	24 October 2025	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A006745V		
Certified Date :	12 March 2025	Expired Date :	12 March 2028	Cylinder Conc. :	48.7 ppm
CALIBRATING CONDITION					
Pressure	1010 mmbar	Temp.	24.6 °C	% RH	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.9	-0.025	400.0	1.005
NO ₂ Span	400	400.3	0.075	400.0	1.009
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	507	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.4	mV	-20 ~ 150		
AZERO	94.2	mV	-20 ~ 150		
HVPS	672	V	420 ~ 900 constant		
RCCELL TEMP	50.3	°C	50 ± 1		
BOX TEMP	28.6	°C	8 ~ 48		
PMT TEMP	7.4	°C	7 ± 2		
MOLY TEMP	315.3	°C	315 ± 5		
RCCELL PRESS	8.5	in-Hg-A	2 ~ 10 constant		
SAMPLE PRESS	28.3	in-Hg-A	25 ~ 30 constant		
NO Span Conc	400	PPB	20 ~ 20,000		
NO ₂ Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.005	-	1.0 ± 0.3		
NO ₂ Slope	1.009	-	1.0 ± 0.3		
NO Offset	1.0	mV	-20 to +150		
NO ₂ Offset	0.6	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Heeson L

(Mr.Heeson Lormae)

Approved by :

Yuthana S.

(Mr.Yuthana Tanatharant)



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CALIBRATION REPORT					
CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER					
DATE :	15 February 2026	BRAND :	API	MODEL :	200E
NO.	NOX-R11	SERIAL NO.	2621		
Calibrator (Dilution System)					
Brand :	Teledyne	Model :	700		
Last Cal. Date :	24 October 2025	Serial No. :	421		
Reference Standard Gas					
Standard Gas :	Nitric Oxide (NO)	Cylinder No. :	A006745V		
Certified Date :	12 March 2025	Expired Date :	12 March 2028	Cylinder Conc. :	48.7 ppm
CALIBRATING CONDITION					
Pressure	1010 mmbar	Temp.	24.6 °C	% RH	48
CALIBRATION SETTING					
Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
Set Point	Expected Concentration	Analyzer Response	%Diff	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.001
NO ₂ Span	400	400.1	0.025	400.0	1.004
API Model 200E NO _x Analyzer Check List					
Test Values	Observed Value	Units	Nominal Range		
RANGE	500	PPB	500 standard		
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air		
SAMPLE FLOW	506	cc/min	500 ± 50		
OZONE FLOW	79	cc/min	80 ± 15		
PMT	103.2	mV	-20 ~ 150		
AZERO	94.1	mV	-20 ~ 150		
HVPS	671	V	420 ~ 900 constant		
RCCELL TEMP	50.2	°C	50 ± 1		
BOX TEMP	28.9	°C	8 ~ 48		
PMT TEMP	7.1	°C	7 ± 2		
MOLY TEMP	314.9	°C	315 ± 5		
RCCELL PRESS	8.4	in-Hg-A	2 ~ 10 constant		
SAMPLE PRESS	28.4	in-Hg-A	25 ~ 30 constant		
NO Span Conc	400	PPB	20 ~ 20,000		
NO ₂ Span Conc	400	PPB	20 ~ 20,000		
NO Slope	1.001	-	1.0 ± 0.3		
NO ₂ Slope	1.004	-	1.0 ± 0.3		
NO Offset	0.9	mV	-20 to +150		
NO ₂ Offset	0.5	mV	-20 to 150		
Stability at Zero	0.1	PPB	< 0.2		
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas		

Calibrated by :

Heeson L

(Mr.Heeson Lormae)

Approved by :

Yuthana S.

(Mr.Yuthana Tanatharant)



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangkok Bangkok 10160
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CALIBRATION CERTIFICATE

Page 1 of 3

Certificate No. : L202511307-0001

Date Issued : 01-Dec-25

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 : 27-Nov-25

Date Calibrated : 30-Nov-25

Calibrated by : Nattawat Laochai

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:

K. Nuthany
(Nathapong Krudaum)



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Certificate No. : L202511307-0001

Ambient Temperature : $(25 \pm 2)^\circ\text{C}$

Relative Humidity : $(50 \pm 15)\%\text{RH}$

Capacity Range : 17 ml/min

Calibration Media : Nitrogen

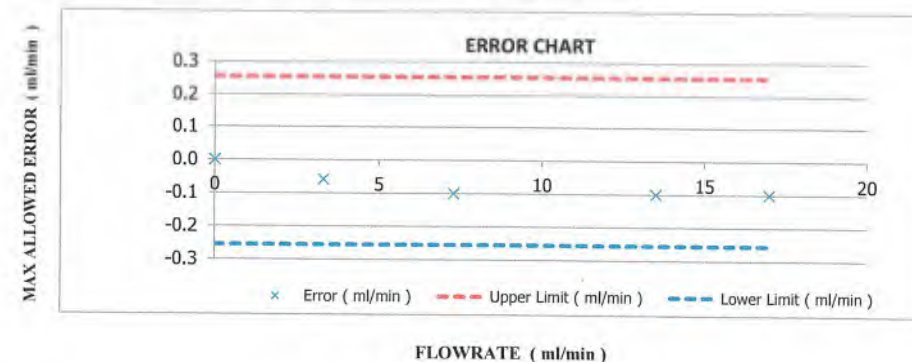
Type : Mass Flowmeter

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 (± ml/min)
24.69	101.22	0.00	0.000 *	0.000	0.063
24.44	119.03	3.30	3.358	-0.058	0.14
24.38	118.17	7.30	7.4	-0.10	0.15
24.30	156.08	13.50	13.6	-0.10	0.15
24.25	169.92	17.00	17.1	-0.10	0.18

Error = Unit Under Calibration - Standard

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



Certificate No. : L202511307-0001

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

: Q = Flow rate

: P = Absolute pressure

: T = Absolute temperature

: Subscript "Meas" = Measurement condition

: Subscript "Ref" = Reference condition

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

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-0047-24 for Gas Flow meter Serial No. M5209179B/M5209179A, Due 28-Jun-26

NIMT Calibration Certificate No. MW-0048-24 for Gas Flow meter Serial No. M5209179C/M5209179A, Due 02-Jul-26

End of Certificate

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GC/MS 05/62
Organization Name: S.P.S.Consulting Service Co.,Ltd.
Organization Location: 7 Soi Paholyothin 24 Bangok 10900

Date: December 4, 2025 1:51:07 PM
EQP Name: AgilentRecommended , AgilentRecommended

EQP Revision: GC.02.50, GCMS.02.50
Overall Qualification Status: Pass

System Inspection and Basic Safety and Operation

Name: 8890
Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Decay

Name: 8890
Back SSL

Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.2 psi /5 minutes
Agilent Recommended: >= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Date: December 4, 2025 1:51:07 PM
System ID: GC/MS 05/62

Name: 8890
Back SSL

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

Overall Inlet Pressure Accuracy Test Status

Pass

Inlet Pressure Decay

Name: 8890
Front SSL

Setpoint Status: Pass
Pressure: 25.0 psi
Pressure Change: -0.1 psi /5 minutes
Agilent Recommended: >= -2.0 and <= 0.5

Overall Inlet Pressure Decay Test Status

Pass

Inlet Pressure Accuracy

Name: 8890
Front SSL

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

Overall Inlet Pressure Accuracy Test Status

Pass

Date: December 4, 2025 1:51:07 PM
System ID: GC/MS 05/62

Detector Flow Accuracy

Name:

8890

Back

FPD+

Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

60.0

mL/min

Measured Flow:

59.6

mL/min

Accuracy:

0.4

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

6.0

ml/min

)

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

Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

60.0

mL/min

Measured Flow:

59.7

mL/min

Accuracy:

0.3

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

6.0

ml/min

)

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

Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

60.0

mL/min

Measured Flow:

75

mL/min

Purge Offset:

20

% setpoint

Adjusted Setpoint:

72.00

mL/min

Accuracy:

3.0

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

7.2

ml/min

)

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

Overall Detector Flow Accuracy Test Status

Pass

Detector Flow Accuracy

Name:

8890

Front

FID

Setpoint Status:

Pass

Flow Type:

Fuel

Setpoint:

30.0

mL/min

Measured Flow:

30.2

mL/min

Accuracy:

0.2

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

3.0

ml/min

)

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

Setpoint Status:

Pass

Flow Type:

Oxidizer

Setpoint:

400.0

mL/min

Measured Flow:

396

mL/min

Accuracy:

4.0

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

40.0

ml/min

)

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

Setpoint Status:

Pass

Flow Type:

Makeup

Setpoint:

25.0

mL/min

Measured Flow:

25.3

mL/min

Accuracy:

0.3

mL/min

Agilent Recommended:

<=

10.0

% setpoint

(

2.5

ml/min

)

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

Overall Detector Flow Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:

8890

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

230.0

229.7

°C

Accuracy:

-0.3

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

<=

1.0

% setpoint in K

(

-5.0

°C

)

(

5.0

°C

)

Setpoint Status:

Pass

Zone:

Oven

Setpoint/Actual

Temperature:

100.0

99.8

°C

Accuracy:

-0.2

°C

Agilent Recommended:

>=

-1.0

% setpoint in K

<=

1.0

% setpoint in K

(

-3.7

°C

)

(

3.7

°C

)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

8890

Setpoint Status:

Pass

Setpoint/Average

Temperature:

100.0

99.76667

°C

Stability:

0.1

°C

Agilent Recommended:

<=

0.5

Overall GC Oven Temperature Stability Test Status

Pass

Scouting Run

Tested Combination1	Back	SSL	/ Back	FPD+
	Manual Injection			
Name:	Not applicable			

Setpoint Status:

Completed

Injection Volume on Column:

1.0

uL

Mode:

S-Mode

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination1	Back	SSL	/ Back	FPD+
Name:	8890			

Setpoint Status:

Pass

Mode:

S-Mode

Base Signal:

65

150 pA

Agilent Recommended:

ASTM Noise

Response

<=

30720.00

Drift

Response/h

<=

23040.00

Status:

Pass

Pass

Overall Noise and Drift Test Status

Pass

Signal to Noise

Tested Combination1	Back	SSL	/ Back	FPD+
	Manual Injection			
Name:	8890			

Mode:

S-Mode

Setpoint Status:

Pass

Signal to Noise:

341448

Agilent Recommended:

>=

1400

Overall Signal to Noise Test Status

Pass

Scouting Run

Tested Combination2	Front	SSL	/ Front	FID
	Injection Tower			
Name:	7693A			

Setpoint Status: Completed

Injection Volume on Column: 1.0 uL

Overall Scouting Run Status

Completed

Noise and Drift

Tested Combination2	Front	SSL	/ Front	FID
Name:	8890			

Setpoint Status: Pass

Base Signal: 11.5 pA

	ASTM Noise		Drift	
	Response		Response/h	
	284.49		2764.01	
Agilent Recommended:	<=	768.00	<=	19200.00
Status:	Pass		Pass	

Overall Noise and Drift Test Status

Pass

Injection Precision

Tested Combination2	Front	SSL	/ Front	FID
Name:	7693A			

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area RSD: 0.53 % Retention Time RSD: 0.03 %

Agilent Recommended: <= 3.00 <= 1.00

Overall Injection Precision Test Status

Pass

Signal to Noise

Tested Combination2	Front	SSL	/ Front	FID
	Injection Tower			
Name:	8890			

Setpoint Status: Pass

Signal to Noise: 1101022

Agilent Recommended: >= 300000

Overall Signal to Noise Test Status

Pass

Log Amp

Tested Combination3	Front	SSL	/ External	SQ
Name:	5977B			

Setpoint Status: Pass

Overall Log Amp Test Status

Pass

RFPA

Tested Combination3	Front	SSL	/ External	SQ
Name:	5977B			

Setpoint Status:	Pass				
Amu:	1050	m/z	Drift After Five Minutes:	-9	mV
Agilent Recommended:	>=	-100	and	<=	100
				<=	1100
					534 mV

Overall RFPA Test Status

Pass

Tune EI

Tested Combination3	Front	SSL	/	External	SQ
Name:	5977B				
Setpoint Status:	Pass				
Filament:	1				
Setpoint Status:	Pass				
Filament:	2				

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination3	Front	SSL	/	External	SQ
	Injection Tower				
Name:	7693A				
Source:	EI - Inert				
Setpoint Status:	Completed				
Injection Volume on Column:	1.0 uL				

Overall Scouting Run Status

Completed

Instrument Detection Limit

Date: December 4, 2025 1:51:07 PM
System ID: GC/MS 05/62

Tested Combination3	Front	SSL	/	External	SQ
	Injection Tower				
Name:	7693A				
Source:	EI - Inert				

Setpoint Status:	Pass	
Injection Volume on Column:	1.0 uL	
Area	Retention Time	
Minimum RSD:	3.54 %	0.02 %
Agilent Recommended:	<= 5.00	<= 1.00
Status:	Pass	Pass
Instrument Detection Limit:	1.18983 fg	
Agilent Recommended:	<= 1.68250	
Status:	Pass	

Overall Instrument Detection Limit Test Status

Pass

Mass Ratio Precision

Tested Combination3	Front	SSL	/	External	SQ
	Injection Tower				
Name:	7693A				
Source:	EI - Inert				
Setpoint Status:	Pass				
Injection Volume on Column:	1.0 uL				
Area Mass 1	Mass Ratio				
Abundance*s					
RSD:	0.34 %				
Agilent Recommended:	<= 5.00				
	Pass				
	0.16 %				
	<= 5.00				
	Pass				

Date: December 4, 2025 1:51:07 PM
System ID: GC/MS 05/62

Overall Mass Ratio Precision Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System	
System ID	GC/MS 05/62
Manufacturer	Agilent Technologies
Name	8890
Tested Combination1	
Injection Technique	Manual Injection
Inlet	Back
Detector	Back
LTM Included?	No
Tested Combination2	
Injection Technique	Injection Tower
Inlet	Front
Detector	Front
LTM Included?	No
Tested Combination3	
Injection Technique	Injection Tower
Inlet	Front
Detector	External
LTM Included?	No
Sampler 1	
Manufacturer	Agilent Technologies
Type	Manual Injection
Usage	Sample Injection
Syringe Volume (µL)	10

Sampler 2

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN19360205
Firmware Revision	A.11.03
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

Sampler 3

Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN19430060
Firmware Revision	A.11.03
Vial Heater	Not installed

Mainframe 1

Manufacturer	Agilent Technologies
Name	8890
Model Number	G3542A
Serial Number	CN1944A148
Firmware Revision	2.3.3.6
Oven Type	Standard

Inlet 1

Manufacturer	Agilent Technologies
Name	8890
Type	SSL
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Inlet 2

Manufacturer	Agilent Technologies
Name	8890
Type	SSL
Location	Back
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes

Detector 1

Manufacturer	Agilent Technologies
Name	8890
Type	FID
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Front
Makeup Gas	Nitrogen

Detector 2

Manufacturer	Agilent Technologies
Name	8890
Type	FPD+
Adapter	Capillary
Control Type	Electronic Pressure Control (EPC)
Location	Back
Makeup Gas	Nitrogen
First Filter Tested	S-Mode

Detector 3

Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

Mass Spectrometer 1

Manufacturer	Agilent Technologies
Type	SQ
Name	5977B
Serial Number	US1947M001
Firmware Revision	6.00.04
High Vacuum System	Turbo Pump
Scouting Run Standard	MRP Std

MS EI Source 1

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

Electronic Signature

Purpose

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

Details

Full Name of Signer:	Adirek Rattanawijit
Logged On User Name:	adirek.rattanawijit@non.agilent.com
Signature Creation Date:	December 4, 2025
Reason for Signature:	Executed protocol and published this original version of document

ACE Self Qualification Status

The installed version of ACE used to deliver this service passed qualification; the results conform with expected values. The self qualification summary report is available in the session folder location SDS\ClearStore\AceSelfQualification.

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User Name: adirek.rattanawijit
Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 11:27:05 AM	Audit	SessionCreated	Session	Host Name: C614-QA, Drive Serial Number: 42776F5E
December 4, 2025 11:27:05 AM	start	Configuration	Session	None
December 4, 2025 11:27:05 AM	Audit	Entitlement	Licensing	User is Nonpaying and does not require an unlock code
December 4, 2025 11:39:42 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.50/Gc.02.50.eqp], EQP File Name: [Gc.02.50.eqp], EQP Name: [AgilentRecommended], Protocol Revision :[Gc.02.50] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.50/GcMs.02.50.eqp], EQP File Name: [GcMs.02.50.eqp], EQP Name: [AgilentRecommended]
December 4, 2025 11:39:46 AM	End	Configuration	Session	None
December 4, 2025 11:39:58 AM	start	Qualification	Session	OQ
December 4, 2025 11:39:58 AM	start	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	None

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Date: December 4, 2025 1:51:07 PM
System ID: GC/MS 05/62

User Name: adirek.rattanawijit
Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 11:40:47 AM	End	Execution	System Inspection and Basic Safety and Operation - 8890: - Qualitative Test - No setpoints associated	Run Count : 1
December 4, 2025 11:40:49 AM	start	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
December 4, 2025 11:41:04 AM	End	Execution	Inlet Pressure Decay - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
December 4, 2025 11:41:07 AM	start	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
December 4, 2025 11:41:20 AM	End	Execution	Inlet Pressure Accuracy - Back SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
December 4, 2025 11:41:24 AM	start	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	None
December 4, 2025 11:41:36 AM	End	Execution	Inlet Pressure Decay - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: >= -2.0 psi and <= 0.5 psi	Run Count : 1
December 4, 2025 11:41:38 AM	start	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
December 4, 2025 11:41:42 AM	End	Execution	Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1

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Date: December 4, 2025 1:51:07 PM
System ID: GC/MS 05/62

User Name: adirek.rattanawijit
Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 11:41:45 AM	start	Execution	Detector Flow Accuracy - Back FPD+/- Type : Fuel - S: 60.0 mL/min - L: <= 10.0% setpoint	None
December 4, 2025 11:42:04 AM	End	Execution	Detector Flow Accuracy - Back FPD+/- Type : Fuel - S: 60.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
December 4, 2025 11:42:07 AM	start	Execution	Detector Flow Accuracy - Back FPD+/- Type : Oxidizer - S: 60.0 mL/min - L: <= 10.0% setpoint	None
December 4, 2025 11:42:14 AM	End	Execution	Detector Flow Accuracy - Back FPD+/- Type : Oxidizer - S: 60.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
December 4, 2025 11:42:34 AM	start	Execution	Detector Flow Accuracy - Back FPD+/- Type : Makeup - S: 60.0 mL/min - L: <= 10.0% setpoint	None
December 4, 2025 11:42:40 AM	End	Execution	Detector Flow Accuracy - Back FPD+/- Type : Makeup - S: 60.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
December 4, 2025 11:42:44 AM	start	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	None
December 4, 2025 11:42:59 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Fuel - S: 30.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
December 4, 2025 11:43:06 AM	start	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	None

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User Name: adirek.rattanawijit
Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 11:43:11 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Oxidizer - S: 400.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
December 4, 2025 11:43:14 AM	start	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	None
December 4, 2025 11:43:55 AM	End	Execution	Detector Flow Accuracy - Front FID: - Type : Makeup - S: 25.0 mL/min - L: <= 10.0% setpoint	Run Count : 1
December 4, 2025 11:43:58 AM	start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
December 4, 2025 11:44:33 AM	Audit	Data	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
December 4, 2025 11:44:35 AM	End	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
December 4, 2025 11:44:38 AM	start	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
December 4, 2025 11:45:13 AM	Audit	Data	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
December 4, 2025 11:45:15 AM	End	Execution	GC Oven Temperature Accuracy - 8890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1

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System ID: GC/MS 05/62

Date: December 4, 2025 1:51:07 PM
System ID: GC/MS 05/62

User Name: adirek.rattanawijit
Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 11:45:18 AM	start	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
December 4, 2025 11:45:54 AM	start	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
December 4, 2025 11:46:34 AM	Audit	Data	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
December 4, 2025 11:46:43 AM	End	Execution	GC Oven Temperature Stability - 8890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
December 4, 2025 11:46:47 AM	start	Execution	GC Scouting Run - Manual Injection, Back SSL, Back FPD+: - Part of System Preparation - No limits associated	None
December 4, 2025 11:51:39 AM	Audit	Data	GC Scouting Run - Manual Injection, Back SSL, Back FPD+: - Part of System Preparation - No limits associated	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\SCFPD02.D
December 4, 2025 11:52:01 AM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
December 4, 2025 11:55:41 AM	Audit	Data	GC Scouting Run - Manual Injection, Back SSL, Back FPD+: - Part of System Preparation - No limits associated	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\SCFPD03.D

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System ID: GC/MS 05/62

User Name: adirek.rattanawijit
Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 11:55:53 AM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 100000;Integration: Off at 0;Integration: On at 7]
December 4, 2025 11:56:03 AM	Audit	Reporting	Reintegration	Reintegration Count: 2 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 100000;Integration: Off at 0;Integration: On at 4]
December 4, 2025 11:57:54 AM	End	Execution	GC Scouting Run - Manual Injection, Back SSL, Back FPD+: - Part of System Preparation - No limits associated	Run Count : 1
December 4, 2025 11:57:59 AM	start	Execution	Signal to Noise - Manual Injection, Back SSL, Back FPD+: - Detector FPD+ - L: >= 1400	None
December 4, 2025 11:58:18 AM	Audit	Data	Signal to Noise - Manual Injection, Back SSL, Back FPD+: - Detector FPD+ - L: >= 1400	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\SNFPD01.D

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System ID: GC/MS 05/62

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Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 11:58:55 AM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 100000;Integration: Off at 0;Integration: On at 7]
December 4, 2025 11:59:04 AM	Audit	Reporting	Reintegration	Reintegration Count: 2 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 100000;Integration: Off at 0;Integration: On at 2]
December 4, 2025 11:59:10 AM	Audit	Reporting	Reintegration	Reintegration Count: 3 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 1000000;Integration: Off at 0;Integration: On at 2]
December 4, 2025 11:59:15 AM	Audit	Reporting	Reintegration	Reintegration Count: 4 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 10000000;Integration: Off at 0;Integration: On at 2]

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Report Generated by Hostname: C614-QA

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SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 11:59:20 AM	Audit	Reporting	Reintegration	Reintegration Count: 5 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 100000000;Integration: Off at 0;Integration: On at 2]
December 4, 2025 11:59:24 AM	Audit	Reporting	Reintegration	Reintegration Count: 6 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 1000000000;Integration: Off at 0;Integration: On at 2]
December 4, 2025 12:00:40 PM	End	Execution	Signal to Noise - Manual Injection, Back SSL, Back FPD+; - Detector FPD+ - L: >= 1400	Run Count : 1
December 4, 2025 12:00:48 PM	start	Execution	Noise and Drift - Back FPD+; - Detector FPD+ S-Mode - L (Noise): <= 4.00 150 pA - L (Drift): <= 3.00 150 pA/hour	None
December 4, 2025 12:02:17 PM	Audit	Data	Noise and Drift - Back FPD+; - Detector FPD+ S-Mode - L (Noise): <= 4.00 150 pA - L (Drift): <= 3.00 150 pA/hour	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\ND003.D
December 4, 2025 12:02:24 PM	End	Execution	Noise and Drift - Back FPD+; - Detector FPD+ S-Mode - L (Noise): <= 4.00 150 pA - L (Drift): <= 3.00 150 pA/hour	Run Count : 1

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Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 12:02:33 PM	start	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	None
December 4, 2025 12:02:50 PM	Audit	Data	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\Scout_FID_00 1.D
December 4, 2025 12:03:11 PM	End	Execution	GC Scouting Run - Injection Tower, Front SSL, Front FID: - Part of System Preparation - No limits associated	Run Count : 1
December 4, 2025 12:03:14 PM	start	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	None
December 4, 2025 12:03:26 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IND002.D
December 4, 2025 12:03:31 PM	Audit	Data	DataManager	DataManager was in a data verification state but the user chose to start over
December 4, 2025 12:03:39 PM	Audit	Data	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IND001.D
December 4, 2025 12:03:52 PM	End	Execution	Noise and Drift - Front FID: - Detector FID - L (Noise): <= 0.10 pA - L (Drift): <= 2.50 pA/hour	Run Count : 1

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System Id: GC/MS 05/62
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SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 12:03:56 PM	start	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	None
December 4, 2025 12:04:15 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IP_FID_002.D
December 4, 2025 12:04:15 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IP_FID_003.D
December 4, 2025 12:04:15 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IP_FID_004.D
December 4, 2025 12:04:15 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IP_FID_005.D
December 4, 2025 12:04:15 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IP_FID_006.D
December 4, 2025 12:04:15 PM	Audit	Data	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IP_FID_007.D

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Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 12:04:31 PM	End	Execution	Injection Precision - Injection Tower, Front SSL, Front FID: - GC - L (Area): <= 3.00% - L (Ret. Time): <= 1.00%	Run Count : 1
December 4, 2025 12:04:35 PM	start	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	None
December 4, 2025 12:05:00 PM	Audit	Data	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\ISN_FID_001.D
December 4, 2025 12:05:10 PM	End	Execution	Signal to Noise - Injection Tower, Front SSL, Front FID: - Detector FID - L: >= 300000	Run Count : 1
December 4, 2025 12:05:17 PM	start	Execution	Log Amp - 5977B SQ: - Source: EI - Inert	None
December 4, 2025 12:09:24 PM	start	Execution	RFPA - 5977B SQ: - Source: EI - Inert	None
December 4, 2025 12:19:06 PM	End	Execution	RFPA - 5977B SQ: - Source: EI - Inert	Run Count : 1
December 4, 2025 12:21:23 PM	start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	None
December 4, 2025 12:21:38 PM	Audit	Data	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\SC01.D

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Report Generated by Hostname: C614-QA

System Id: GC/MS 05/62
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SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 12:21:54 PM	start	Execution	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	None
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IDL002.D
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IDL003.D
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IDL004.D
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IDL005.D
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IDL006.D
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\IDL007.D

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System Id: GC/MS 05/62
Print Date: December 4, 2025 1:51:09 PM

SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: 10 - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win Home\Desktop\OQPV_GC\IS PS OQPV_GCMS 2025\OQ2025\IDL008.D
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: 10 - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win Home\Desktop\OQPV_GC\IS PS OQPV_GCMS 2025\OQ2025\IDL009.D
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: 10 - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win Home\Desktop\OQPV_GC\IS PS OQPV_GCMS 2025\OQ2025\IDL010.D
December 4, 2025 12:22:29 PM	Audit	Data	Instrument Detection Limit - Injection Tower, Front SSL, SQ: 10 - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : C:\Users\Win Home\Desktop\OQPV_GC\IS PS OQPV_GCMS 2025\OQ2025\IDL011.D
December 4, 2025 12:22:54 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 50; Integration: Off at 0; Integration: On at 4.5]
December 4, 2025 12:23:13 PM	End	Execution	Instrument Detection Limit - Injection Tower, Front SSL, SQ: 10 - Source: - EI - Inert - RSD L (Area): <= 5.00% - RSD L (Ret. Time): <= 1.00%	Run Count : 1

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User Name: adirek.rattanawijit
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SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 12:23:20 PM	start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	None
December 4, 2025 12:23:30 PM	start	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	None
December 4, 2025 12:25:04 PM	End	Execution	Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Inert- Part of GCMS System Preparation	Run Count : 1
December 4, 2025 12:25:08 PM	start	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	None
December 4, 2025 12:25:31 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : C:\Users\Win Home\Desktop\OQPV_GC\IS PS OQPV_GCMS 2025\OQ2025\MRP002.D
December 4, 2025 12:25:31 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : C:\Users\Win Home\Desktop\OQPV_GC\IS PS OQPV_GCMS 2025\OQ2025\MRP003.D
December 4, 2025 12:25:31 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : C:\Users\Win Home\Desktop\OQPV_GC\IS PS OQPV_GCMS 2025\OQ2025\MRP004.D

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SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 12:25:31 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\MRP005.D
December 4, 2025 12:25:31 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\MRP006.D
December 4, 2025 12:25:31 PM	Audit	Data	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Data files Path : C:\Users\Win 10 Home\Desktop\OQPV_GC\S PS OQPV_GCMS 2025\OQ2025\MRP007.D
December 4, 2025 12:25:47 PM	Audit	Reporting	Reintegration	Reintegration Count: 1 -- [Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 50000; Integration: Off at 0; Integration: On at 4.6]
December 4, 2025 12:26:01 PM	End	Execution	Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00%	Run Count : 1
December 4, 2025 1:31:04 PM	start	Execution	Log Amp - 5977B SQ: - Source: EI - Inert	None
December 4, 2025 1:32:04 PM	End	Execution	Log Amp - 5977B SQ: - Source: EI - Inert	Run Count : 1
December 4, 2025 1:33:18 PM	start	Execution	Tune EI - 5977B SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated)	None

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SPS_OQGCMS_5977B_2025 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
December 4, 2025 1:33:38 PM	End	Execution	Tune EI - 5977B SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated)	Run Count : 1
December 4, 2025 1:33:41 PM	start	Execution	Tune EI - 5977B SQ: - Source: EI - Inert Filament 2 (Qualitative - No setpoints associated)	None
December 4, 2025 1:33:59 PM	End	Execution	Tune EI - 5977B SQ: - Source: EI - Inert Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
December 4, 2025 1:34:04 PM	End	Qualification	Session	OQ
December 4, 2025 1:34:04 PM	start	Reporting	Session	None
December 4, 2025 1:46:22 PM	Audit	Reporting	Session	Report Generated : Certificate
December 4, 2025 1:47:02 PM	Audit	Reporting	Session	Report Generated : Report
December 4, 2025 1:47:58 PM	Audit	AceClosed	Session	None
December 4, 2025 1:48:35 PM	Audit	AceRestarted	Session	Host Name: C614-QA, Drive Serial Number: 42776F5E
December 4, 2025 1:48:38 PM	Audit	SessionReloaded	Session	None
December 4, 2025 1:48:42 PM	start	Qualification	Session	OQ
December 4, 2025 1:49:52 PM	Audit	Reporting	Session	Report Generated : Certificate
December 4, 2025 1:50:32 PM	Audit	Reporting	Session	Report Generated : Report

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เอกสารแนบ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่อง



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

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

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

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

Console Data		Calibration Data		
No.	Serial No.	Date	y	ΔH_{g} (mmH ₂ O)
B01	1563	01/12/2025	1.003	49.79
B02	8002514	01/12/2025	1.004	49.61
B03	1503016	03/12/2025	0.999	49.84
B04	00006659	02/12/2025	0.998	50.06
B05	00007428	01/12/2025	1.005	49.40
R01	1561	01/12/2025	0.997	49.92
R02	8002513	03/12/2025	0.999	49.70
R03	1570	03/12/2025	1.002	49.82
R04	8002519	01/12/2025	1.005	49.95
R05	1503015	03/12/2025	0.998	49.86

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)



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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompru, Chulachok, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : ssp@spscs.com, www.spscs.com

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficient of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	02/02/2026	0.84	0.84
B04	S	0.99	02/02/2026	0.84	0.83
B05	S	0.99	03/02/2026	0.84	0.84
B07	S	0.99	04/02/2026	0.84	0.83
B08	S	0.99	04/02/2026	0.85	0.84
B09	S	0.99	04/02/2026	0.84	0.84
B11	S	0.99	03/02/2026	0.84	0.85
B16	S	0.99	03/02/2026	0.83	0.84
B18	S	0.99	03/02/2026	0.84	0.84
B19	S	0.99	02/02/2026	0.84	0.84
B21	S	0.99	02/02/2026	0.84	0.83
B24	S	0.99	02/02/2026	0.84	0.83
B27	S	0.99	02/02/2026	0.84	0.84
B30	S	0.99	03/02/2026	0.84	0.85
B31	S	0.99	03/02/2026	0.84	0.84
B33	S	0.99	03/02/2026	0.83	0.84
B35	S	0.99	04/02/2026	0.84	0.84

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peerat Detudom
(Mr. Peerat Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : ssp@spscs.com, www.spscs.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	04/02/2026	0.85	0.84
B37	S	0.99	02/02/2026	0.84	0.83
B38	S	0.99	03/02/2026	0.83	0.84
B39	S	0.99	03/02/2026	0.85	0.84
B40	S	0.99	02/02/2026	0.84	0.84
B41	S	0.99	02/02/2026	0.83	0.84
B44	S	0.99	04/02/2026	0.84	0.84
B45	S	0.99	04/02/2026	0.85	0.84
B46	S	0.99	04/02/2026	0.83	0.84
B47	S	0.99	04/02/2026	0.84	0.85
B48	S	0.99	03/02/2026	0.84	0.84
B49	S	0.99	03/02/2026	0.85	0.84
B54	S	0.99	02/02/2026	0.84	0.84
B56	S	0.99	02/02/2026	0.84	0.83
B57	S	0.99	03/02/2026	0.84	0.85
B58	S	0.99	03/02/2026	0.84	0.84

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peerat Detudom
(Mr. Peerat Detudom)



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

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 : 07-Mar-25

APPROVED BY : PONGSAK J.
ISSUED DATE : 13-Mar-25
RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 07-Mar-25
AIR PRESSURE : 1009mbar $\pm$ 1mbar CALIBRATION DATE : 07-Mar-25
AMBIENT TEMPERATURE : 24°C $\pm$ 1°C RELATIVE HUMIDITY : 54%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	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 120 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	0.01999	0.00001	0.000065
0.10	0.10001	-0.00001	0.000066
0.20	0.20001	-0.00001	0.000066
0.50	0.50002	-0.00002	0.000065
1.00	1.00003	-0.00003	0.000066
2.00	2.00001	-0.00001	0.000067
5.00	5.00002	-0.00002	0.000068
10.00	10.00000	0.00000	0.000070
20.00	20.00004	-0.00004	0.000078
50.00	50.00000	0.00000	0.00013
100.00	100.00001	-0.00001	0.00019
120.00	120.00002	-0.00002	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.

2110-11,14,55 Soi Prasert Manukul 29 Yaek 4, Prasert Manukul Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.ca-laboratory.com E-mail: sale@ca-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.	212301422
JOB CONTROL NO.	240720076546

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

DATE OF RECEIVED : 19 July 2025

DATE OF ISSUED: 24 July 2025

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
24 July 2025



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. Q24076546

F3-011-05/12-23

page 1 of 3



CALIBRATION LABORATORY Co., LTD.

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Tel: 02-578-0353-4 Fax: 02-578-2672 www.ca-laboratory.com E-mail: sale@ca-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	23 July 2025
DUE DATE OF CALIBRATION	23 July 2026

ENVIRONMENT CONDITIONS

Temperature : (23 $\pm$ 2) °C

Relative Humidity (55 $\pm$ 10) %RH

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPPM05 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, Floke Model 741 B, S/N: 5295020 with Pressure Module Model 700PD5 S/N: 89204505.

TRACEABILITY :

The measurement is traceable to International System of Units (SI), through National Institute of Metrology (Thailand)

Certificate No. MP-0040-24

UNCERTAINTY :

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

Certificate No. Q24076546

F3-011-05/12-23

page 2 of 3



CALIBRATION LABORATORY Co., LTD.

210 Q-11, 14-55 So-Prasert Mansuk 29 Yakh 4, Prasert-Mansuk Rd, Latphrao, Bangkok 10230

Tel. 02-078-0303/4 Fax 02-578-2872 www.cal-lab.com E-mail: sale@cal-lab.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	-15.07	-15.10	-4.5	-4.5	+0.5	+0.5
-10	-32.50	-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	-100.39	-100.39	-29.6	-29.6	+0.4	+0.4

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air

Technical Note: Conversion factor 1 kPa = 0.2953003 inHg

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 43 of 67

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

End of Certificate

Certificate No. Q24076546

F3-011-05/12-23

Cert. No. : SP25026
Pages : 1 of 4

Calibration Certificate

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

Condition As Found : GOOD

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

Location : ORGANIC LABORATORY IV

Ambient Temperature : (22.9 ± 5) °C

Relative Humidity : (53.7 ± 25) %

Received Date : 22 AUGUST 2025

Calibration Date : 22 AUGUST 2025

Date of Issue : 25 AUGUST 2025

Calibrated by : Nitinun Srihawan

Approved by : *Wichok B.*
(Wichok Ekpongpradit)

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.

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 2 of 4

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	126461	24/10/2026
Didymium liquid	RM-DL	28912	126462	24/10/2026
Neutral density filter	RM-IN2N3N	13877	126457	24/10/2026
Potassium dichromate solutions	RM-0204060810	14204	126497	25/10/2026
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)

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	278.21	0.08	0.16	2.00
	361.25	361.39	0.14	0.16	2.00
	467.82	467.71	-0.11	0.16	2.00
	536.56	536.50	-0.06	0.16	2.00
	640.50	640.36	-0.14	0.16	2.00
RM-DL	740.09	739.85	-0.24	0.16	2.00
	864.94	865.12	0.18	0.16	2.00

UUC* = Unit Under Calibration

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 3 of 4

Result of calibration : Photometric Accuracy

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	29381	0.5	0.5443	0.5413	-0.0030	0.0043	2.00
		29914	0.7	0.7484	0.7455	-0.0029	0.0054	2.00
		29360	1.0	1.0527	1.0535	0.0008	0.0032	2.00
	465.0	29381	0.5	0.4948	0.4922	-0.0026	0.0041	2.00
		29914	0.7	0.6906	0.6877	-0.0029	0.0050	2.00
		29360	1.0	0.9695	0.9709	0.0014	0.0031	2.00
	546.1	29381	0.5	0.5090	0.5068	-0.0022	0.0036	2.00
		29914	0.7	0.6985	0.6960	-0.0025	0.0041	2.00
		29360	1.0	0.9814	0.9825	0.0011	0.0031	2.00
	590.0	29381	0.5	0.5375	0.5353	-0.0022	0.0034	2.00
		29914	0.7	0.7256	0.7231	-0.0025	0.0037	2.00
		29360	1.0	1.0213	1.0219	0.0006	0.0032	2.00
	635.0	29381	0.5	0.5223	0.5202	-0.0021	0.0033	2.00
		29914	0.7	0.6927	0.6901	-0.0026	0.0036	2.00
		29360	1.0	0.9744	0.9750	0.0006	0.0032	2.00

UUC* = Unit Under Calibration

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 4 of 4

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Potassium dichromate solutions	235.0	20	0.2415	0.2443	0.0028	0.0101	2.00
		40	0.4866	0.4871	0.0005	0.0115	2.00
		60	0.7415	0.7295	-0.0120	0.0067	2.00
		80	0.9854	0.9844	-0.0010	0.0071	2.00
		100	1.2444	1.2425	-0.0019	0.0073	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 0.001 A
Parameter Setting
Measurement Mode Wavelength, Absorbance
Wavelength Scan 190 nm - 1100 nm
Scanning Speed 7.5 nm/min
Band width(Wavelength) 1.0
Band width(Vis) 1.0
Band width(Uv) 1.0

Stray Light** UUC* Reading at 220.0 nm	
Transimission T(%)	Absorbance(A)
0.020	3.7032

**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



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยเทศบาลอิน 24 ถนนเทศบาลอิน แขวงจตุจักร กรุงเทพฯ 10000
Tel : (662) 638-070-72 Fax : (662) 631-4327 E-mail : sales@sps.co.th, www.sps.co.th

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 310-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	
801	SKC	224-PC104	262101	05/01/2026	1.000	1.500	2.000	1.000	1.500	2.000	1.010x - 18.941		0.999	
802	SKC	224-PC104	628166	05/01/2026	1.000	1.500	2.000	1.000	1.500	2.000	1.012x - 23.432		0.999	
803	SKC	224-PC104	612988	05/01/2026	1.000	1.500	2.000	999	1.500	2.000	1.008x - 15.587		1.000	
804	SKC	224-PC104	602001	06/01/2026	1.000	1.500	2.000	1.001	1.499	1.999	0.997x + 2.672		1.000	
805	SKC	224-PC104	612693	07/01/2026	1.000	1.500	2.000	999	1.494	1.995	0.996x + 1.505		1.000	
806	SKC	224-PC104	262106	06/01/2026	1.000	1.500	2.000	1.002	1.501	2.004	1.007x - 12.528		1.000	
807	SKC	224-PC104	626262	06/01/2026	1.000	1.500	2.000	1.003	1.501	2.005	1.010x - 19.021		0.999	
808	SKC	224-PC104	606100	06/01/2026	1.000	1.500	2.000	1.003	1.500	2.004	1.006x - 8.619		1.000	
809	SKC	224-PC104	636479	06/01/2026	1.000	1.500	2.000	1.001	1.500	2.000	1.007x - 16.658		1.000	
810	SKC	224-PC104	041950	06/01/2026	1.000	1.500	2.000	998	1.503	2.005	1.002x + 1.965		1.000	
811	SKC	224-PC104	516313	06/01/2026	1.000	1.500	2.000	999	1.494	1.993	1.010x - 25.765		0.999	
812	SKC	224-PC104	034636	06/01/2026	1.000	1.500	2.000	995	1.497	1.998	0.996x - 6.796		0.999	
813	SKC	224-PC104	602073	05/01/2026	1.000	1.500	2.000	994	1.499	1.995	0.996x + 8.575		0.999	
814	SKC	224-PC104	606113	05/01/2026	1.000	1.500	2.000	993	1.499	1.994	1.001x - 7.291		1.000	
815	SKC	224-PC104	626476	05/01/2026	1.000	1.500	2.000	992	1.505	2.002	1.012x - 25.443		1.000	
816	SKC	224-PC104	626477	06/01/2026	1.000	1.500	2.000	992	1.496	1.991	0.996x + 0.960		1.000	
817	SKC	224-PC104	626480	06/01/2026	1.000	1.500	2.000	1.000	1.500	2.001	1.007x - 14.814		1.000	
818	SKC	224-PC104	191484	05/01/2026	1.000	1.500	2.000	994	1.500	2.002	1.013x - 30.783		0.999	
819	SKC	224-PC104	691249	05/01/2026	1.000	1.500	2.000	993	1.490	1.999	1.006x - 18.713		1.000	
820	SKC	224-PC104	691287	05/01/2026	1.000	1.500	2.000	991	1.500	1.997	1.005x - 23.565		1.000	
821	SKC	224-PC104	691331	05/01/2026	1.000	1.500	2.000	1.000	1.500	2.000	1.002x - 6.050		1.000	
822	SKC	224-PC104	691604	06/01/2026	1.000	1.500	2.000	1.000	1.499	1.994	1.000x - 6.158		0.999	
823	SKC	224-PC104	053693	06/01/2026	1.000	1.500	2.000	992	1.498	1.992	0.990x + 3.813		0.999	
824	SKC	224-PC104	606361	06/01/2026	1.000	1.500	2.000	1.000	1.499	2.000	1.001x - 5.201		1.000	
825	SKC	224-PC104	798489	06/01/2026	1.000	1.500	2.000	993	1.495	1.995	1.002x - 10.857		1.000	
826	SKC	224-PC104	798479	06/01/2026	1.000	1.500	2.000	994	1.500	2.000	1.010x - 25.253		1.000	
827	SKC	224-PC104	691673	06/01/2026	1.000	1.500	2.000	996	1.500	1.999	0.996x + 5.799		1.000	
828	SKC	224-PC104	691570	06/01/2026	1.000	1.500	2.000	995	1.502	1.998	0.995x - 5.193		1.000	
829	SKC	224-PC104	626472	06/01/2026	1.000	1.500	2.000	995	1.491	1.993	0.999x - 4.660		1.000	
830	SKC	224-PC104	691489	06/01/2026	1.000	1.500	2.000	1.000	1.500	1.998	1.002x - 6.804		1.000	
831	SKC	224-PC104	691509	05/01/2026	1.000	1.500	2.000	999	1.500	1.997	0.992x + 6.256		1.000	
832	SKC	224-PC104	091167	05/01/2026	1.000	1.500	2.000	994	1.491	1.992	0.990x - 2.389		0.999	
833	SKC	224-PC104	091756	05/01/2026	1.000	1.500	2.000	993	1.496	1.998	1.013x - 28.814		0.999	
834	SKC	224-PC104	612962	05/01/2026	1.000	1.500	2.000	994	1.502	2.003	1.011x - 21.717		1.000	
835	SKC	224-PC104	603680	06/01/2026	1.000	1.500	2.000	998	1.499	2.000	1.001x - 2.561		1.000	
836	SKC	224-PC104	626164	06/01/2026	1.000	1.500	2.000	993	1.497	1.994	1.003x - 6.758		1.000	
837	SKC	224-PC104	626158	06/01/2026	1.000	1.500	2.000	993	1.506	2.007	1.009x - 10.995		1.000	
838	SKC	224-PC104	626167	06/01/2026	1.000	1.500	2.000	993	1.502	2.000	1.013x - 26.362		0.999	
839	SKC	224-PC104	036037	06/01/2026	1.000	1.500	2.000	1.000	1.497	1.993	0.991x + 9.546		1.000	
840	SKC	224-PC104	798069	06/01/2026	1.000	1.500	2.000	1.000	1.499	1.994	0.999x - 0.180		1.000	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peeru Detucom
(Mr. Peeru Detucom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 310-H

S/N : 136164

Environmental Conditions

Temperature : 23 ± 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	
841	SKC	224-PC104	612099	05/01/2026	1.000	1.500	2.000	995	1.496	1.997	1.004x - 11.346		1.000	
842	SKC	224-PC104	626081	05/01/2026	1.000	1.500	2.000	996	1.510	1.999	0.999x - 0.850		1.000	
843	SKC	224-PC104	036456	05/01/2026	1.000	1.500	2.000	1.000	1.493	2.004	1.006x - 6.760		1.000	
844	SKC	224-PC104	529361	05/01/2026	1.000	1.500	2.000	995	1.512	1.995	1.000x - 4.571		0.999	
845	SKC	224-PC104	529559	05/01/2026	1.000	1.500	2.000	997	1.503	2.001	1.009x - 10.178		1.000	
846	SKC	224-PC104	566783	05/01/2026	1.000	1.500	2.000	997	1.491	2.007	1.015x - 21.797		1.000	
847	SKC	224-PC104	566787	06/01/2026	1.000	1.500	2.000	995	1.508	1.999	1.007x - 15.240		0.999	
848	SKC	224-PC104	566753	06/01/2026	1.000	1.500	2.000	998	1.493	1.992	0.997x - 0.766		1.000	
849	SKC	224-PC104	566780	06/01/2026	1.000	1.500	2.000	994	1.475	1.991	1.002x - 13.903		0.999	
850	SKC	224-PC104	500600	06/01/2026	1.000	1.500	2.000	996	1.498	1.993	0.991x - 4.730		0.999	
851	SKC	224-PC104	500563	06/01/2026	1.000	1.500	2.000	995	1.498	1.994	1.008x - 21.051		0.999	
852	SKC	224-PC104	036186	06/01/2026	1.000	1.500	2.000	1.001	1.499	1.995	0.995x + 4.562		1.000	
853	SKC	224-PC104	707470	06/01/2026	1.000	1.500	2.000	992	1.502	2.007	1.016x - 28.087		1.000	
854	SKC	224-PC104	036471	06/01/2026	1.000	1.500	2.000	1.000	1.497	2.000	1.009x - 10.056		1.000	
855	SKC	224-PC104	510710	05/01/2026	1.000	1.500	2.000	999	1.497	2.001	1.008x - 15.999		1.000	
856	SKC	224-PC104	511436	05/01/2026	1.000	1.500	2.000	996	1.510	2.001	1.005x - 11.880		0.999	
857	SKC	224-PC104	010798	05/01/2026	1.000	1.500	2.000	1.000	1.493	2.007	1.000x - 1.575		1.000	
858	SKC	224-PC104	509852	05/01/2026	1.000	1.500	2.000	997	1.473	1.995	1.000x - 11.032		0.999	
859	SKC	224-PC104	509862	05/01/2026	1.000	1.500	2.000	991	1.461	1.999	1.001x - 71.371		0.999	
860	SKC	224-PC104	512655	06/01/2026	1.000	1.500	2.000	971	1.489	2.002	1.021x - 56.285		0.999	
861	SKC	224-PC104	609915	06/01/2026	1.000	1.500	2.000	1.000	1.476	2.001	1.006x - 16.896		0.999	
862	SKC	224-PC104	509779	06/01/2026	1.000	1.500	2.000	997	1.509	2.001	1.004x - 10.186		1.000	
863	SKC	224-PC104	511432	06/01/2026	1.000	1.500	2.000	1.000	1.496	1.994	0.996x - 0.374		1.000	
864	SKC	224-PC104	508302	06/01/2026	1.000	1.500	2.000	1.000	1.500	1.997	1.000x - 4.850		1.000	
865	SKC	224-PC104	508310	05/01/2026	1.000	1.500	2.000	998	1.505	1.999	1.001x - 5.999		1.000	</



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	r ²
880	SKC	224-PC003	304589	06/01/2026	1,000	1,500	2,000	995	1,499	1,996	$0.991x + 5.980$	0.999
881	SKC	224-PC003	303586	06/01/2026	1,000	1,500	2,000	1,000	1,474	1,999	$1.001x - 10.358$	0.999
882	SKC	224-PC003	305473	06/01/2026	1,000	1,500	2,000	1,000	1,474	1,999	$0.998x + 6.617$	0.999
883	SKC	224-PC003	310785	06/01/2026	1,000	1,500	2,000	1,002	1,505	1,992	$0.993x + 10.233$	1.000
884	SKC	224-PC003	308553	03/01/2026	1,000	1,500	2,000	994	1,501	1,989	$0.991x - 2.939$	1.000
885	SKC	224-PC003	305757	03/01/2026	1,000	1,500	2,000	995	1,494	1,996	$1.012x - 22.072$	0.999
886	SKC	224-PC003	312625	03/01/2026	1,000	1,500	2,000	997	1,507	1,992	$0.998x + 11.080$	0.999
887	SKC	224-PC003	308554	03/01/2026	1,000	1,500	2,000	994	1,475	1,996	$1.000x - 10.329$	0.999
888	SKC	224-PC003	308507	03/01/2026	1,000	1,500	2,000	995	1,475	1,989	$0.993x + 3.749$	0.999
889	SKC	224-PC003	309860	03/01/2026	1,000	1,500	2,000	1,001	1,499	2,005	$1.005x - 12.041$	1.000
890	SKC	224-PC003	308566	06/01/2026	1,000	1,500	2,000	997	1,494	1,996	$1.003x + 5.172$	1.000
891	SKC	224-PC003	310919	06/01/2026	1,000	1,500	2,000	995	1,491	1,997	$1.004x - 14.630$	1.000
892	SKC	224-PC003	310887	06/01/2026	1,000	1,500	2,000	976	1,495	1,995	$1.017x - 80.810$	0.999
893	SKC	224-PC003	309845	06/01/2026	1,000	1,500	2,000	995	1,497	1,997	$0.992x + 3.614$	0.999

Calibrated by :

Adul Dungkorn
(Mr. Adul Dungkorn)

Approved by :

Peera Deesorn
(Ms. Peera Deesorn)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender S10-H

S/N : 136833

Environmental Conditions

Temperature

25

± 5

°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		
891	SKC	224-PCXRB	602467	25/01/2026	1.000	1.500	2.000	999	1.505	2.009	1.010x + 15.906	1.000
892	SKC	224-PCXRB	624450	05/01/2026	1.000	2.000	3.000	1.001	1.505	2.005	1.005x + 3.625	1.000
893	SKC	224-PCXRB	691592	05/01/2026	1.000	1.500	2.000	998	1.499	2.010	1.009x + 11.382	1.000
894	SKC	224-PCXRB	691473	05/01/2026	1.000	1.500	2.000	999	1.496	2.000	0.992x + 5.045	0.999
895	SKC	224-PCXRB	796470	06/01/2026	1.000	1.500	2.000	997	1.486	1.993	0.995x + 8.467	0.999
896	SKC	224-PCXRB	796856	06/01/2026	1.000	1.500	2.000	1.000	1.502	1.992	0.995x + 2.876	0.999
897	SKC	224-PCXRB	796862	06/01/2026	1.000	1.500	2.000	1.000	1.508	2.000	1.000x + 1.559	1.000
898	SKC	224-PCXRB	883215	07/01/2026	1.000	1.500	2.000	1.001	1.500	2.000	1.006x + 8.215	1.000
899	SKC	224-PCXRB	034460	08/01/2026	1.000	1.500	2.000	999	1.509	2.005	1.005x + 6.625	1.000
900	SKC	224-PCXRB	081463	09/01/2026	1.000	1.500	2.000	1.001	1.509	2.006	1.007x + 8.511	1.000
901	SKC	224-PCXRB	081783	09/01/2026	1.000	1.500	2.000	999	1.502	1.995	1.002x + 10.946	0.999
902	SKC	224-PCXRB	081366	09/01/2026	1.000	1.500	2.000	999	1.495	1.994	0.996x + 1.463	0.999
903	SKC	224-PCXRB	091658	09/01/2026	1.000	1.500	2.000	999	1.499	1.994	0.996x + 1.136	0.999
904	SKC	224-PCXRB	091784	09/01/2026	1.000	1.500	2.000	1.004	1.509	2.006	1.007x + 8.975	1.000
905	SKC	224-PCXRB	092457	09/01/2026	1.000	1.500	2.000	1.004	1.502	2.000	0.999x + 1.751	1.000
906	SKC	224-PCXRB	092943	09/01/2026	1.000	1.500	2.000	1.001	1.511	2.000	1.010x + 15.433	1.000
907	SKC	224-PCXRB	092461	09/01/2026	1.000	1.500	2.000	1.004	1.504	2.003	0.998x + 4.258	1.000
908	SKC	224-PCXRB	166156	05/01/2026	1.000	1.500	2.000	1.003	1.504	2.006	1.004x + 3.776	1.000
909	SKC	224-PCXRB	566802	09/01/2026	1.000	1.500	2.000	1.002	1.498	1.995	1.001x + 6.224	0.999
910	SKC	224-PCXRB	092969	09/01/2026	1.000	1.500	2.000	997	1.509	1.996	0.994x + 5.259	0.999
911	SKC	224-PCXRB	666728	06/01/2026	1.000	1.500	2.000	1.000	1.510	1.993	0.998x + 1.136	0.999
912	SKC	224-PCXRB	707664	05/01/2026	1.000	1.500	2.000	1.004	1.501	2.006	1.004x + 5.706	1.000
913	SKC	224-PCXRB	761067	05/01/2026	1.000	1.500	2.000	1.009	1.504	2.006	1.009x + 3.179	1.000
914	SKC	224-PCXRB	707893	05/01/2026	1.000	1.500	2.000	999	1.497	1.992	0.996x + 8.363	0.999
915	SKC	224-PCXRB	761052	06/01/2026	1.000	1.500	2.000	998	1.503	1.975	0.994x + 17.071	0.999
916	SKC	224-PCXRB	707936	05/01/2026	1.000	1.500	2.000	997	1.492	1.945	0.991x + 6.368	1.000
917	SKC	224-PCXRB	707596	05/01/2026	1.000	1.500	2.000	1.002	1.495	2.002	1.002x + 3.696	1.000
918	SKC	224-PCXRB	787481	06/01/2026	1.000	1.500	2.000	1.008	1.503	2.006	0.996x + 6.459	1.000
919	SKC	224-PCXRB	707902	01/01/2026	1.000	1.500	2.000	1.006	1.513	2.009	1.002x + 1.216	0.999
920	SKC	224-PCXRB	895811	07/01/2026	1.000	1.500	2.000	1.001	1.513	2.008	1.006x + 9.239	1.000
921	SKC	224-PCXRB	083183	06/01/2026	1.000	1.500	2.000	1.010	1.510	2.013	1.013x + 0.780	1.000
922	SKC	224-PCXRB	673950	06/01/2026	1.000	1.500	2.000	999	1.498	1.999	1.000x + 0.668	1.000
923	SKC	224-PCXRB	626254	06/01/2026	1.000	1.500	2.000	1.000	1.508	2.007	1.004x + 5.199	1.000
924	SKC	224-PCXRB	676131	05/01/2026	1.000	1.500	2.000	996	1.496	2.003	1.010x + 18.176	1.000
925	SKC	224-PCXRB	707940	06/01/2026	1.000	1.500	2.000	1.009	1.496	2.006	0.999x + 0.386	1.000
926	SKC	224-PCXRB	707946	05/01/2026	1.000	1.500	2.000	1.006	1.504	2.006	1.005x + 6.281	1.000
927	SKC	224-PCXRB	707932	06/01/2026	1.000	1.500	2.000	1.003	1.505	2.004	1.004x + 5.006	1.000
928	SKC	224-PCXRB	707349	06/01/2026	1.000	1.500	2.000	998	1.496	1.997	0.995x + 1.635	1.000
929	SKC	224-PCXRB	761095	06/01/2026	1.000	1.500	2.000	1.000	1.497	2.003	1.005x + 8.068	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Mr. Peera Detudom
(Mr. Peera Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender S10-H

S/N : 136833

Environmental Conditions

Temperature

25

± 5

°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		
930	SKC	224-PCXRB	612753	05/01/2026	1.000	1.500	2.000	997	1.506	1.998	1.006x + 0.356	1.000
931	SKC	224-PCXRB	628160	05/01/2026	1.000	1.500	2.000	995	1.504	1.992	0.996x + 2.374	0.999
932	SKC	224-PCXRB	629403	05/01/2026	1.000	1.500	2.000	1.006	1.505	1.994	0.988x + 15.108	0.999
933	SKC	224-PCXRB	626129	05/01/2026	1.000	1.500	2.000	993	1.504	1.972	0.982x + 17.902	0.999
934	SKC	224-PCXRB	602753	06/01/2026	1.000	1.500	2.000	1.001	1.493	2.000	1.001x + 3.434	1.000
935	SKC	224-PCXRB	626137	06/01/2026	1.000	1.500	2.000	998	1.499	1.997	0.996x + 1.827	1.000

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Mr. Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 10000
7 Soi Phaholyothin 24, Phaholyothin Rd., Jantok, Chaitrak, Bangkok 10000
Tel : (662) 639-4370-72 Fax : (662) 513-4321 E-mail : sales@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 : 136833

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	VP8-65	03/01/2026	500	1,000	2,000	503.6	992.9	1981.9	0.9996 ± 3.140	0.999
H-R02	Dwyer	VP8-65	05/01/2026	500	1,000	2,000	509.8	995.8	1986.2	1.0000 ± 1.345	1.000
H-R03	Dwyer	VP8-65	05/01/2026	500	1,000	2,000	491.3	992.1	1982.9	1.0000 ± 17.510	0.999
H-R04	Dwyer	VP8-65	05/01/2026	500	1,000	2,000	496.4	996.6	2019.5	1.0017 ± 11.585	1.000
H-R05	Dwyer	VP8-65	06/01/2026	500	1,000	2,000	497.2	991.5	1987.3	1.0030 ± 7.563	1.000
H-R06	Dwyer	VP8-65	06/01/2026	500	1,000	2,000	501.1	992.4	1982.9	1.0010 ± 6.139	0.999

Calibrated by :

Adul Dangklom
(Mr Adul Dangklom)

Approved by :

Porn Detudom
(Mr Porn Detudom)



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Tel : (662) 639-4370-72 Fax : (662) 513-4321 E-mail : sales@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 : 136833

Calibration Data

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R ²
L-R01	Dwyer	VFA-21	05/01/2026	50	100	200	50.2	102.0	208.9	0.9916 ± 2.329	1.000
L-R02	Dwyer	VFA-21	05/01/2026	50	100	200	50.8	101.3	200.5	0.9980 ± 0.623	0.999
L-R03	Dwyer	VFA-21	06/01/2026	50	100	200	50.1	99.4	202.9	1.0170 ± 1.340	1.000
L-R04	Dwyer	VFA-21	06/01/2026	50	100	200	49.8	100.3	201.0	1.0100 ± 1.341	0.999
L-R05	Dwyer	VFA-21	05/01/2026	50	100	200	50.2	101.4	203.6	0.9900 ± 2.394	1.000
L-R06	Dwyer	VFA-21	06/01/2026	50	100	200	50.8	99.1	201.3	0.9800 ± 0.191	1.000

Calibrated by :

Adul Dangklom
(Mr Adul Dangklom)

Approved by :

Porn Detudom
(Mr Porn 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 : thuwatt@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0825/23032

Instrument Type : Gas Chromatography

Model : 3800

Serial Number : 00734

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

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

Date : 02/08/2025

ELECTRONIC TEST

CPU	☒ PASS	☐ FAIL
DISPLAY & LED TEST	☒ PASS	☐ FAIL
VENT TEST	☒ PASS	☐ FAIL
KEY ECHO TEST	☒ PASS	☐ FAIL
DESTRUCTION RAM TEST	☒ PASS	☐ FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detectors (FID Channel-Front)

INJECTOR : 1079 Injector

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 0.218g/L C14,C15,C16 in hexane (diluted to 30ppm)

SENSITIVITY TEST: C15. (Area count) = 515,940 Counts.



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

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.40	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	19,716	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (°C)	80	79	± 5
Injector (°C)	220	218	± 5
Detector (°C)	300	298	± 5
Incubator (°C)	60	N/A	± 5

Relative Standard Deviation % (%RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.48	≤ 5
Retention Time C15 (%)	0.08	≤ 0.5

APPROVAL:

Signature: 

Engineer : Somchai Pohtongkam

Date : 02/08/2025



VARIAN

1/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



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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 : thawat@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	506,043
C15 Area 2	520,497
C15 Area 3	522,154
C15 Area 4	521,664
C15 Area 5	509,340
C15 Area Average	515,940
* % RSD (< 5 %)	1.48

* 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	☒ Pass	☐ Fail
Performance by	Sondul P.	
Date	02/08/2025	



Comments			
Reviewed by	Wanay	Date	02/08/2025



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

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	3.874
C15 RT 2	3.880
C15 RT 3	3.875
C15 RT 4	3.872
C15 RT 5	3.878
C15 RT Average	3.876
* % RSD (< 0.5 %)	0.08

* 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	☒ Pass	☐ Fail
Performance by	Sondul P.	
Date	02/08/2025	



Comments			
Reviewed by	Wanay	Date	02/08/2025



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

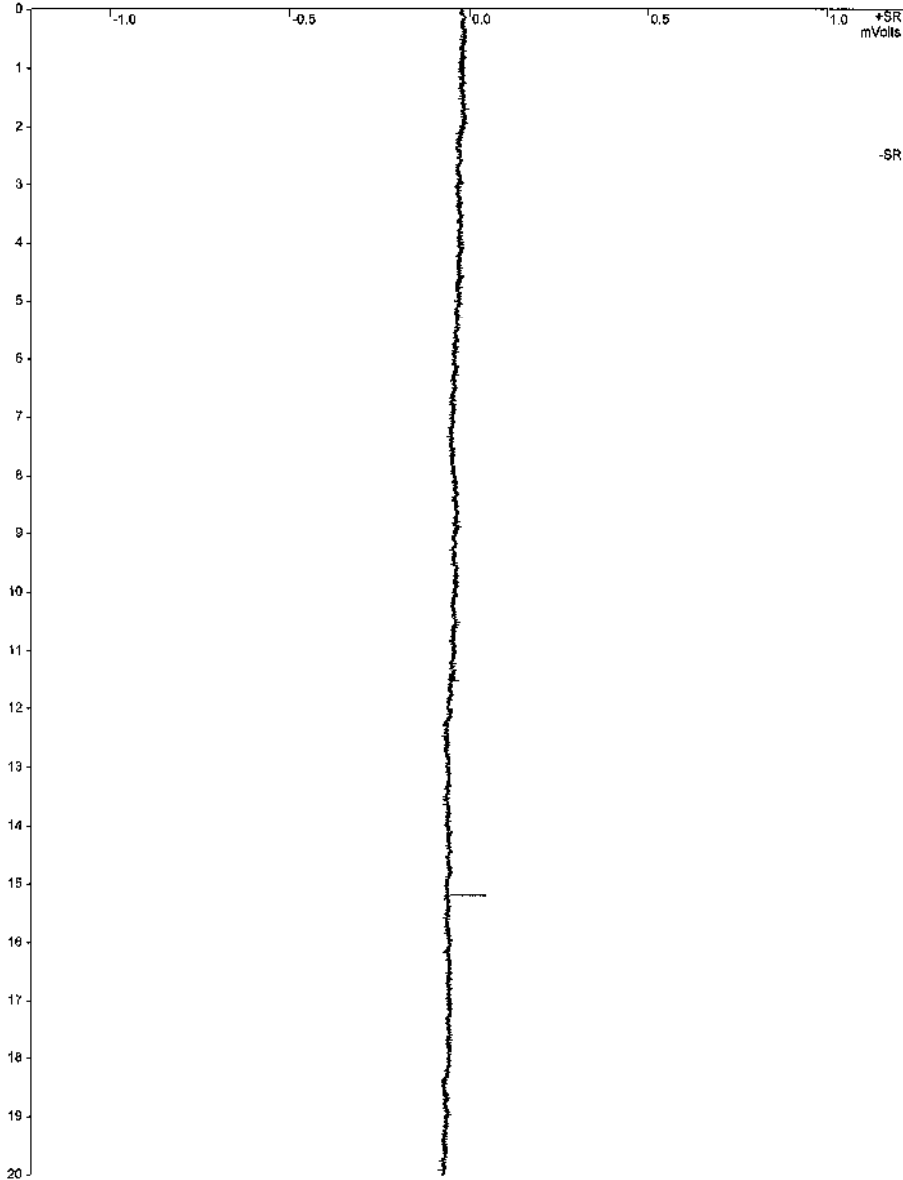
Title :
Run File : e:\sps2025\blk001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : blk

Injection Date: 2/8/2568 12:01 Calculation Date: 2/8/2568 12:33

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 20.005 min

** LC Workstation Version 6.20 ** 02511-7390-ac7-0265 **

Chart Speed = 1.13 cm/min Attenuation = 1 Zero Offset = 50%
Start Time = 0.000 min End Time = 20.005 min Min / Tick = 1.00



Title :
Run File : e:\sps2025\blk001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : blk

Injection Date: 2/8/2568 12:01 Calculation Date: 2/8/2568 12:33

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 20.005 min

** LC Workstation Version 6.20 ** 02511-7390-ac7-0265 **

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: -14 microVolts LSB: 1 microVolts

Noise (used): 24 microVolts ~ monitored before this run

Manual injection

Data Handling: No peaks

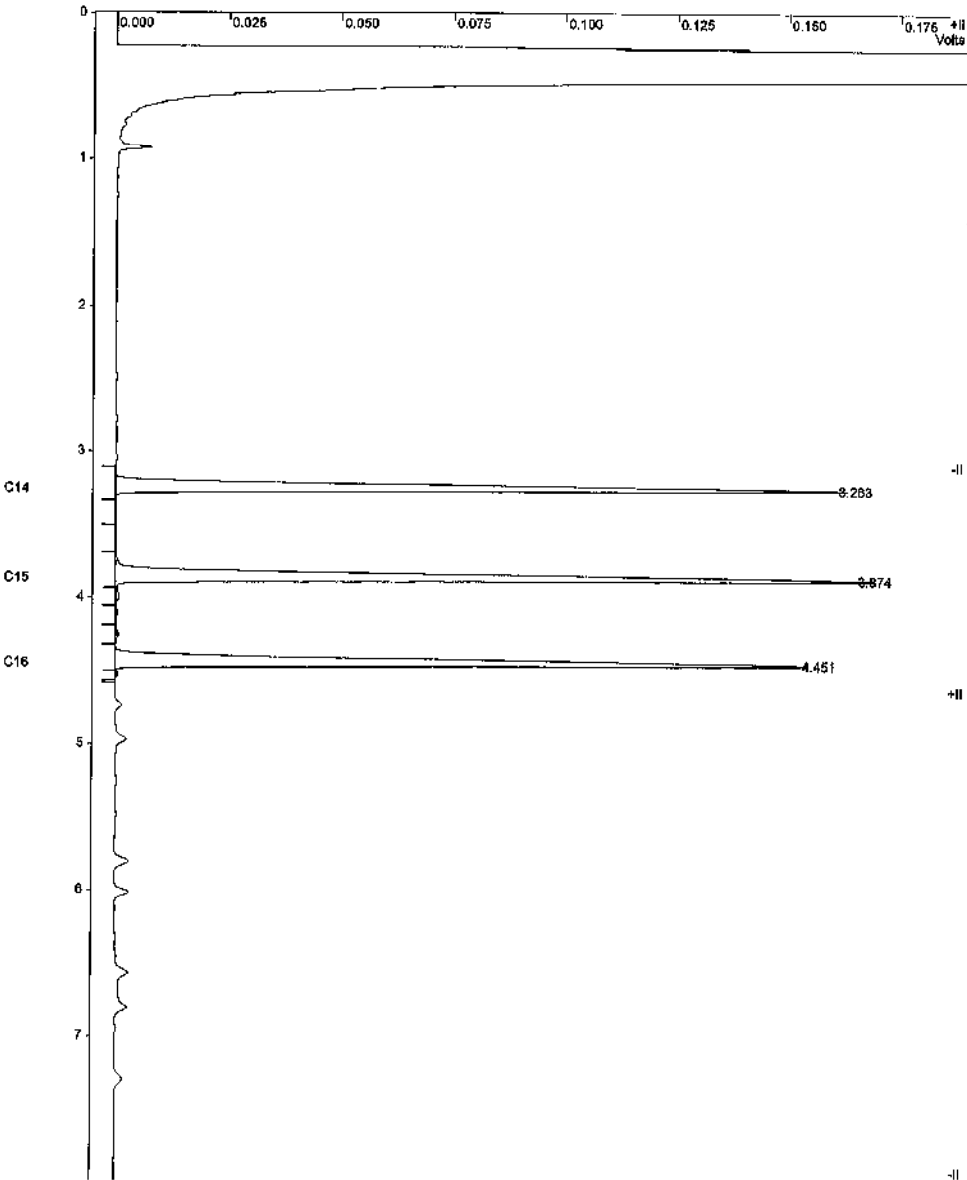
Title :
Run File : e:\sps2025\fidstd001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : fidstd

Injection Date: 2/8/2568 12:34 Calculation Date: 2/8/2568 13:26

Operator : watsamon 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 = 79 Zero Offset = 2%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Print Date: Sat Aug 02 15:10:09 2025 Page 1 of 1

Title :
Run File : e:\sps2025\fidstd001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : fidstd

Injection Date: 2/8/2568 12:34 Calculation Date: 2/8/2568 13:26

Operator : watsamon 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 : Calibration
Peak Measurement: Peak Area
Calculation Type: External Standard
Level : 1

Peak No.	Peak Name	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	3.263	0.002	458627	BB	2.7	
2	C15	3.874	0.002	506043	VV	2.8	
3	C16	4.451	0.001	460610	VB	2.8	
Totals:			0.005	1425280			

Total Unidentified Counts : 0 counts

Detected Peaks: 8 Rejected Peaks: 5 Identified Peaks: 3

Multiplier: N/A Divisor: N/A Unidentified Peak Factor: 0

Baseline Offset: 6 microVolts LSB: 1 microVolts

Noise (used): 2 microVolts - monitored before this run

Manual injection

Sample ID: **fid std**

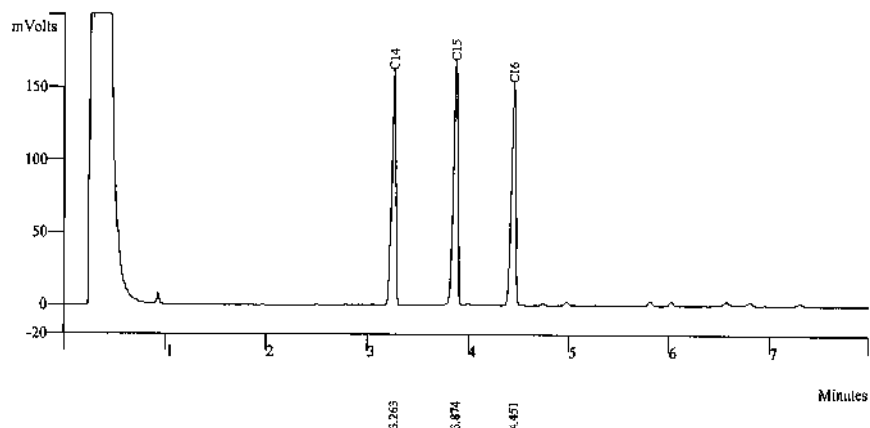
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd001.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	0.0000	3.263	458627	BB	2.7
2	C15	0.0000	3.874	506043	VV	2.8
3	C16	0.0000	4.451	460610	VB	2.8
Totals		0.0000		1425280		

Sample ID: **fid std**

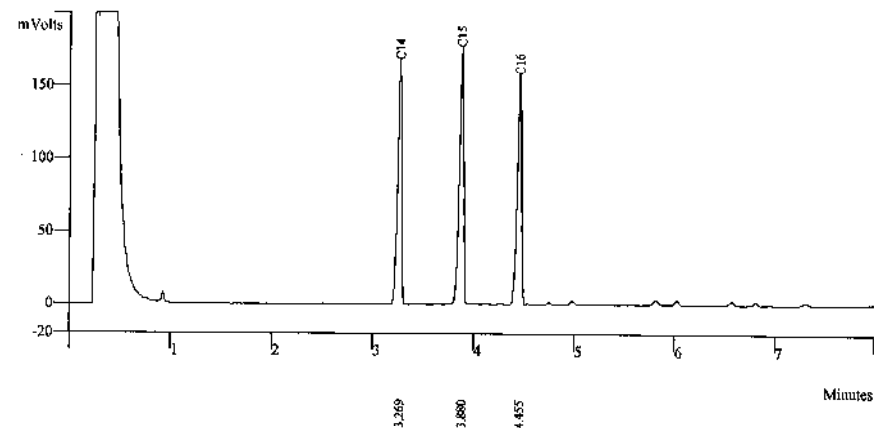
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd002.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	0.0000	3.269	472338	BB	2.6
2	C15	0.0000	3.880	520497	VV	2.7
3	C16	0.0000	4.455	471916	VB	2.8
Totals		0.0000		1464751		



Sample ID: fid std

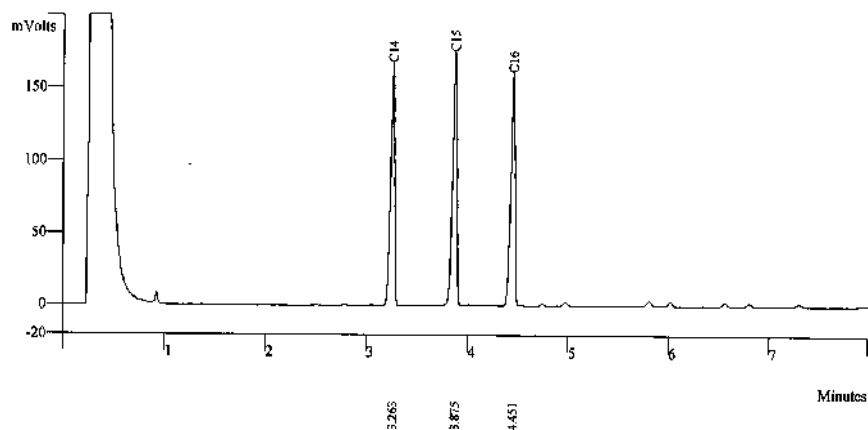
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd003.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	0.0000	3.263	469265	BB	2.6
2	C15	0.0000	3.875	522154	VV	2.8
3	C16	0.0000	4.451	478526	VB	2.8
Totals		0.0000		1469945		



Sample ID: fid std

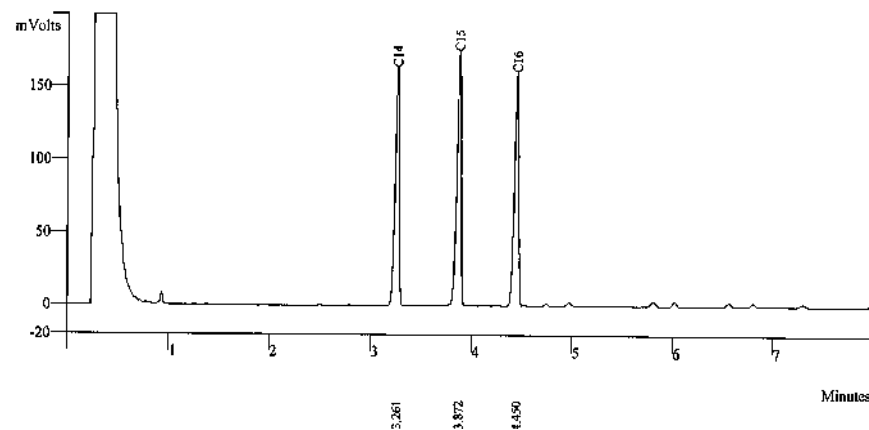
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd004.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	0.0000	3.261	468907	BB	2.7
2	C15	0.0000	3.872	521664	VV	2.8
3	C16	0.0000	4.450	478772	VB	2.8
Totals		0.0000		1469343		



Sample ID: fid std

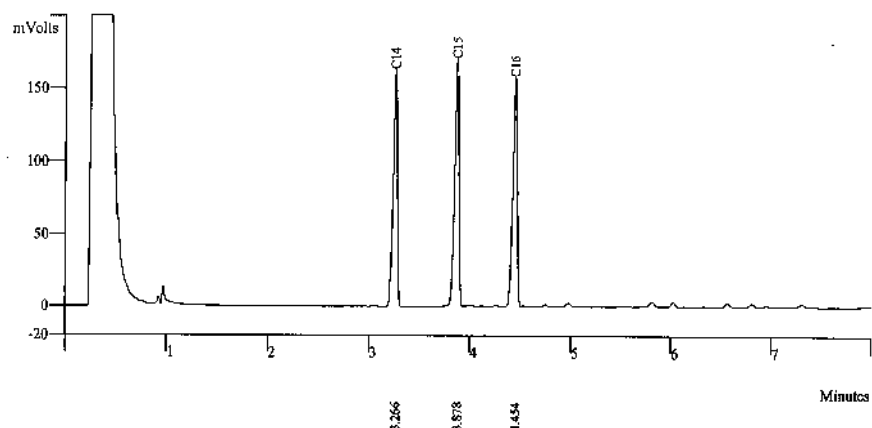
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd005.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	0.0000	3.266	459351	BB	2.6
2	C15	0.0000	3.878	509340	VV	2.8
3	C16	0.0000	4.454	468353	VB	2.8
Totals		0.0000		1437044		



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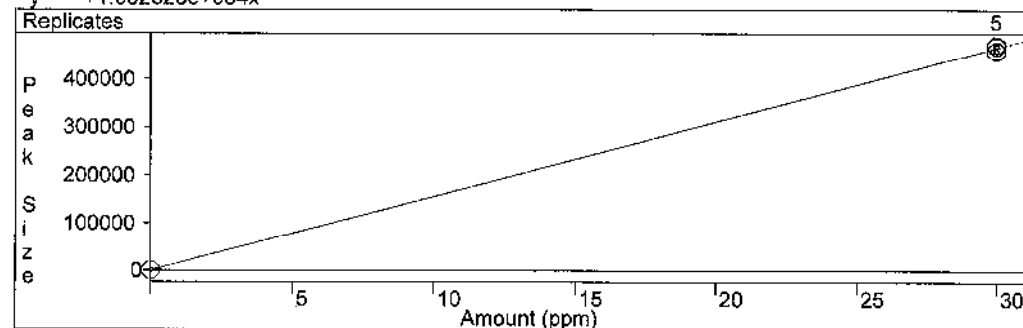
1 of 1

Print Date: 02 Aug 2025 15:12:58
 Calibration Curves Report
 File: e:\sps2025\cal fid.mth
 Detector: 3800 GC, Address: 44, Channel ID: Front

C14

External Standard Analysis
 Curve Type: Linear
 Origin: Force
 $y = +1.552325e+004x$

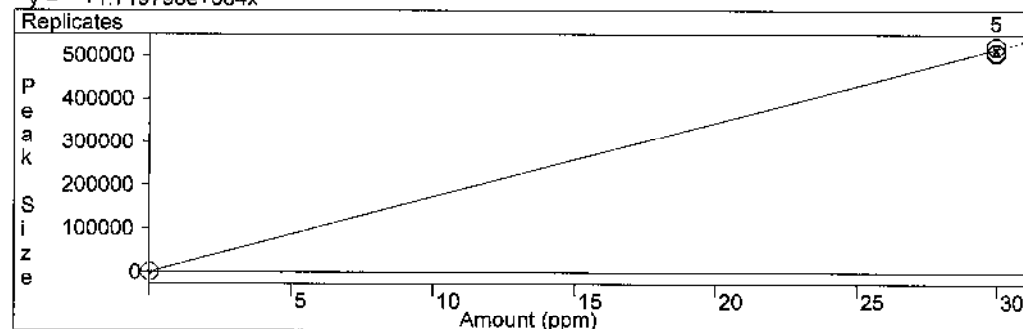
Resp. Fact. RSD: 1.347%
 Coeff. Det.(r²): 0.999130



C15

External Standard Analysis
 Curve Type: Linear
 Origin: Force
 $y = +1.719798e+004x$

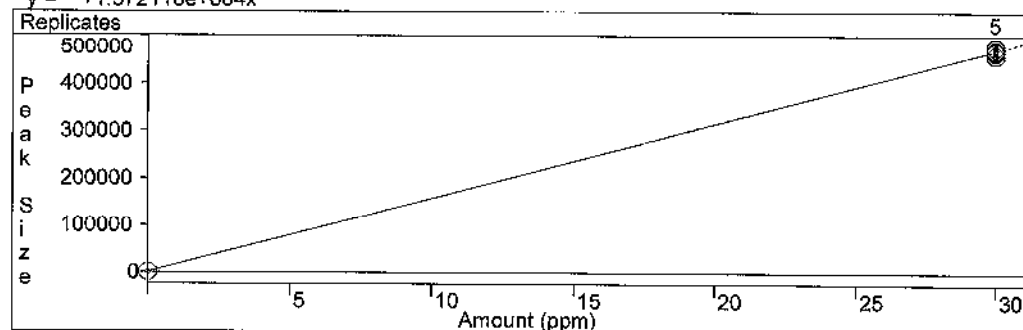
Resp. Fact. RSD: 1.481%
 Coeff. Det.(r²): 0.998948



C16

External Standard Analysis
 Curve Type: Linear
 Origin: Force
 $y = +1.572118e+004x$

Resp. Fact. RSD: 1.611%
 Coeff. Det.(r²): 0.998756



CERTIFICATE

This is to certify, that

Somchai Pohthongkham

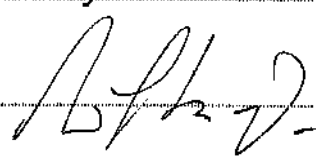
has participated the course

Basic GC and Sampler training

Date: **24 – 27 May 2004**

Location: **Middelburg**

Instructor: **W.J. Buys**

Signature instructor: 



Varian Analytical Instruments
Varian Chrompack International BV
Herculesweg 11
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4330 BA Middelburg
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Tel.: +31 118 621000
Fax: +31 118 621118
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WK Electric Co., Ltd.

68/242 Moo 5, Sawaipracharaj Rd., Tambol Ladsawal, Amphur Lamiukka, Pathumthani 12150

Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com



Certificate of Calibration

Certificate No.: WK2412-053-1

Page 1 of 2

Customer : THAI UNIQUE CO., LTD.
80-82 Prachathipatal Rd., Bangkokphrom,
Pranakorn, Bangkok 10200

Instrument	: AMD Flow Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Agilent Technologies	Humidity	: (50 ± 15) %RH
Model	: G6691A	Received Date	: 4-Dec-24
Serial No.	: MY16470347	Calibrated Date	: 11-Dec-24
Identity No.	: SV-DF-001	Issued Date	: 18-Dec-24
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	WK2405-049-5	22-May-25	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.Thippatani Mungpuangklang

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.



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 : LF25-0305
Equipment : Thermometer
Manufacturer : Fluke
Model : 51
Serial Number : 5910857
Asset Number : 5910857
Customer : Thal Unique Co., Ltd.
80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200
Date of Calibrate : 6-Jun-2025
Date of Issue : 6-Jun-2025

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 approval 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

Samak

Mr. Samak Uaonkaonoi
Metrology Technician

Approved by

Miss Juthamas Sukthainirun

Miss Juthamas Sukthainirun
Cal-Lab Manager



Agilent Technologies

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 %

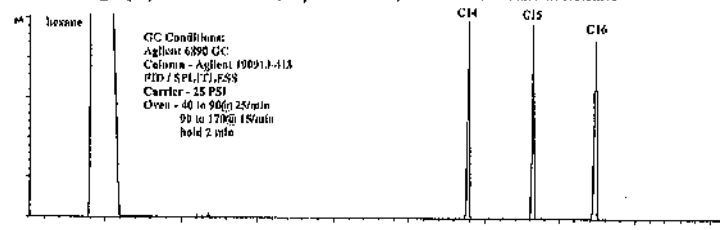
Solvent: hexane

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/NCCL Z-540-1 and ISO 9001.

Purities:	
n-tetradecane	99.6%
n-pentadecane	99%
n-hexadecane	99.5%
hexane	90%

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



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. Jomplu Chatuchak Bangkok 10900
Tel. (662) 939-4370-72 Fax (662) 513-4221 E-mail sales@spscon.com www.spscon.com

FLUE GAS ANALYZER CALIBRATION REPORT

ANALYZER DATA

NUMBER	R05	BRAND	ANTON
MODEL	SPRINT Pro 2	S/N	3330230127D21

CALIBRATION DATA

DATE	16 February 2026	LOCATION	S.P.S.
TEMPERATURE(°C)	24.5	PRESSURE(mmHg)	758.31
% RH	49.0		

ZERO AIR MODULE

BRAND	API	MODEL	701
S/N	1225		

REFERENCE STANDARD GAS (OXYGEN)

STANDARD GAS	Oxygen (O ₂)	CYLINDER No.	S569784
EXPIRATION DATE	03 September 2030	CYLINDER CONC.	8.01%

TEST NO.	O ₂ CALIBRATION RESULT		
	SPAN(%)	READING(%)	CORRECTION VALUE(%)
1	0.0	0.0	0.0
2	8.0	8.1	-0.1
3	20.9	20.9	0.0

REFERENCE STANDARD GAS (CARBON MONOXIDE)

STANDARD GAS	Carbon monoxide (CO)	CYLINDER No.	D824586
EXPIRATION DATE	05 April 2030	CYLINDER CONC.	101 ppm

TEST NO.	CO CALIBRATION RESULT		
	SPAN(ppm)	READING(ppm)	CORRECTION VALUE(ppm)
1	0.0	0.0	0.0
2	101.0	102.0	-1.0

Calibrated by: Herson L.
(Mr. Heeson Lormae)

Approved by: Yutthana S.
(Mr. Yutthana Tanathananit)



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 Jompor Chatuchak, Bangkok 10900
Tel : (662) 939 4370-72 Fax : (662) 563-4221 E-mail : sales@spscon.com, www.spscon.com

CO Analyzer (High Conc.) Calibration

CO₂ Standard Gas Data

Cylinder Number : 18K1149150

Certification Date : 15-Aug-2023

Certified Concentration : 16.4%

Expiration Date : 15-Aug-2031

CO₂ Analyzer Calibration Data

Calibration Date : 16 February 2026

Calibration Time : 16:00-17:00

Analyzer Type : CO Analyzer (Optional Internal CO₂ Sensor)

Analyzer Model : T300M

Serial No. : 250

Calibration Span (%) : 16.4 %

	Certified Cylinder Value (%)	Analyzer Calibration Response (%)	Absolute Difference (%)	Calibration Error (% of Calibration Span)
Zero Gas	0.00	0.02	0.02	0.12
Mid-Level Calibration Gas	16.4	16.25	0.15	0.91
High-Level Calibration Gas	16.4	16.28	0.12	0.73
Analyzer Calibration Error Average (< 2% of Calibration Span)			(Pass)	0.82

Calibrated by :

Heeson L.
(Heeson Lormae)

Approved by :

Yutthana S.
(Yutthana Tanatharanit)

เอกสารแนบ 5-3

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในบรรยากาศ

Request No. 21-69/0204

MTC No. EEL, BP. 152/0169

CALIBRATION CERTIFICATE

Submitted by : S.P.S. CONSULTING SERVICE CO., LTD.

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level 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 : 29 Jan. 2026

Date of Calibration : 11 Feb. 2026

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.

FMJL/MTC.002 Rev.5

Request No. 21-69/0204

MTC No. EEL, BP. 152/0169

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.89	-0.11	± 0.10	± 0.40 dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.90	± 0.50	± 3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Kluaaya)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 11 Feb. 2026

Date of Issue : 12 Feb. 2026

Ref : 2011269012900497001

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.

FMJL/MTC.002 Rev.5



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10500
7 Soi Phaholyothin 24 Phaholyothin Rd. Joopeet, Chatuchak Bangkok 10500
Tel 1662 938-4370-72 Fax 1662 513-4321 E-mail info@spscon.com www.spscon.com

Noise R_090/26

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	11 February 2026
		Due Date	11 February 2027

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-R21	ACO	6236	00182004	15 February 2026	93.9	93.9
ACO-R22	ACO	6236	00182010	15 February 2026	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB	

Calibrated by .

Heeson L.

(Mr. Heeson Lormae)

Approved by

Yutthana S.

(Mr. Yutthana Tanatharanit)

เอกสารแนบ 5-4

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำทิ้ง



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 : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
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 : 17 June 2025

DATE OF ISSUED : 20 June 2025

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

Calibrated By : Sukgasem Seehanart
Wenick Inchainri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
20 June 2025



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. Q25070523

F3-011-05/12-23

page 1 of 4



CALIBRATION LABORATORY Co.,LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
DATE OF CALIBRATION : 18 June 2025

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2.5) ^\circ\text{C}$ Relative Humidity : $(50 \pm 15) \% \text{ RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPCH-01 [pH Meter]. The calibration was performed by direct measurement with Certified Reference Material (CRM).

This instrument was calibrated under procedure No. CLC-CPTH-04 [Temperature] based on ASTM E 644-04 as calibration guidelines. The calibration was performed by using Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664260,11754256, Lot Number CC787362.
3. Calibration Bath, Kamble Model OB-22/2 ULT S/N. 17115653.
4. Precision Thermometer, ASL Model F250 S/N. 1334023800.
5. IPRT, Wika Model CTP5000-250-D S/N. PQ00043543-1-10-1.

Certificate No. Q25070523

F3-011-05/12-23

page 2 of 4





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



TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Lot Number. 080124, 120124. Due Date 23 January 2026.
2. The measurements are traceable to International System of Units (SI), through Control Company.
Certificate No. 4281-14495731, Due Date 27 September 2025.
3. The measurements are traceable to International System of Units (SI), through Calibration Laboratory Co., Ltd.
Certificate No. Q24120999, Due Date 26 November 2025.
4. The measurements are traceable to International System of Units (SI), through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 1042/67, Due Date 16 October 2025.
5. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand).
Certificate No. TT-0146-24, Due Date 28 October 2025.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor complies with the table which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

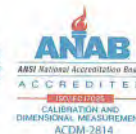
Certificate No. Q25070523
F3-011-05/12-23

page 3 of 4



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 table in the following gives the calibration results and associated measurement uncertainties of pH meter.

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

Standard pH Buffer Solution (pH)	pH Meter Reading (pH)	pH Meter Reading (mV)	Correction (pH)	Uncertainty of pH Measurement ($\pm$ pH)	k Factor
4.003	4.005	168.2	-0.002	0.010	2.00
7.005	7.010	-8.1	-0.005	0.013	2.00
10.015	10.010	-177.7	+0.005	0.014	2.00

Technical Note. Setting function CAL 3 point (4,7,10).

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 4 of 68

2. TEMPERATURE RESULT

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty $\pm$ (°C)
100	25.00	25.0	0.00	0.07

Technical Note. Type of sensor : Thermistor

Probe $\varnothing$ 3 mm

Materials : Metal Sheath.

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2.00$.

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 015 Page 56 of 68

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

End of Certificate

Certificate No. Q25070523
F3-011-05/12-23

page 4 of 4



CERT.No.: HS-X014C

Harikul Science Co.,Ltd.

694 Soi Ratchadanivet 24, Pracharatbamphen,

Samsaennok, Huaikhwang, Bangkok 10310

Tel: 0-2274-2456 Fax: 0-2274-2443

Email: info@harikul.com www.harikul.com

Certificate of Calibration

Calibration Date : 16 March 2026

Submitted by : S.P.S CONSULTING SERVICE CO.,LTD

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,

Chatuchak, Bangkok, Thailand 10900

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 760.00 mmHg

Salinity : 0 ppt

Model : YSI 5000

S/N : 15B100751

Probe : YSI 5010

S/N : 22D100097

ID NO. :

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : -

ID NO. HS001

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(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	9.09	mg/l	-
Inaccuracy	0.00	mg/l	-
Overall Status	(PASS)		

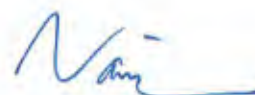
Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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



Technician Signature
(Kittipong Maekwong)



Laboratory Manager
(Natenapha Pisatkunchon)

CERTIFICATE No : 26T0464
REFERENCE No : 79659-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
MODEL : DRB 200
SERIAL No : 15110C0497
ID No : DRB 04/59
SUBMITTED BY : S.P.S. CONSULTING SERVICE CO., LTD.
7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD.,
JOMPOL, CHATUCHAK, BANGKOK 10900

CALIBRATED BY : SOMCHAI S.
CALIBRATION DATE : 30-Jan-26

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 30-Jan-26

RECEIVED DATE : 30-Jan-26



CERTIFICATE No : 26T0464

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 04/59
RECEIVED DATE : 30-Jan-26
AMBIENT TEMPERATURE : 23°C ± 1°C
MODEL : DRB 200
SERIAL NUMBER : 15110C0497
CALIBRATION DATE : 30-Jan-26
RELATIVE HUMIDITY : 54 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON POINTS AND LOCATED AS THE PICTURE.
2. REFERENCE STANDARD INSTRUMENTS :-

- | INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|-------------------------------|-------------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH TC TYPE K | HYDRA 2635A | 6849323 | 25T5342 | 18-Jun-26 |
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 QUALITY CALIBRATION CO., LTD.

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.	1	2
Controller temperature (°C)	144	145
Indicating Temperature	144	145
Measured Temperature (°C) at Spread Locations	1	149.3
	2	149.1
	3	149.9
	4	149.9
	5	150.0
	6	149.8
	7	149.9
	8	149.7
	9	149.5
	10	149.9
	11	148.5
	12	149.1
	13	149.2
	14	149.0
	15	149.1
Uncertainty of Measurement(± °C)	0.89	0.89

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER
NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.

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

END OF CALIBRATION REPORT





CERTIFICATE No : 26M2268
REFERENCE No : 80204-3

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 : SUCHAT S.
CALIBRATION DATE : 05-Mar-26

APPROVED BY : PONGSAK J.

ISSUED DATE : 06-Mar-26

RECEIVED DATE : 05-Mar-26



CERTIFICATE No : 26M2268

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : BSA224S-CW
MANUFACTURER : SARTORIUS S/N : 36591843
ID No : BA 09/61 RECEIVED DATE : 05-Mar-26
AIR PRESSURE : 1004mbar ± 1mbar CALIBRATION DATE : 05-Mar-26
AMBIENT TEMPERATURE : 25° C ± 1° C RELATIVE HUMIDITY : 50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-151	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27

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)

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 (± g)
0.0	0.0000	0.0000	0.00010
0.1	0.1000	0.0000	0.00011
0.2	0.2000	0.0000	0.00010
0.5	0.5000	0.0000	0.00011
1.0	1.0000	0.0000	0.00011
2.0	2.0000	0.0000	0.00011
5.0	5.0000	0.0000	0.00011
10.0	10.0000	0.0000	0.00011
20.0	20.0001	-0.0001	0.00011
50.0	50.0000	0.0000	0.00013
100.0	100.0001	-0.0001	0.00019
200.0	200.0001	-0.0001	0.00032

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT





บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

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

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

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0825/23032

Instrument Type : Gas Chromatography

Model : 3800

Serial Number : 00734

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

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

Date : 02/08/2025

ELECTRONIC TEST

CPU	☒ PASS	☐ FAIL
DISPLAY & LED TEST	☒ PASS	☐ FAIL
VENT TEST	☒ PASS	☐ FAIL
KEY ECHO TEST	☒ PASS	☐ FAIL
DESTRUCTION RAM TEST	☒ PASS	☐ FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detectors (FID Channel-Front)

INJECTOR : 1079 Injector

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 0.218g/L C14,C15,C16 in hexane (diluted to 30ppm)

SENSITIVITY TEST: C15. (Area count) = 515,940 Counts.



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

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.40	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	19,716	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (°C)	80	79	± 5
Injector (°C)	220	218	± 5
Detector (°C)	300	298	± 5
Incubator (°C)	60	N/A	± 5

Relative Standard Deviation % (%RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.48	≤ 5
Retention Time C15 (%)	0.08	≤ 0.5

APPROVAL:

Signature: 

Engineer : Somchai Pohtongkam

Date : 02/08/2025



VARIAN

1/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



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

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

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	506,043
C15 Area 2	520,497
C15 Area 3	522,154
C15 Area 4	521,664
C15 Area 5	509,340
C15 Area Average	515,940
* % RSD (< 5 %)	1.48

* 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	☒ Pass	☐ Fail
Performance by	Sondul P.	
Date	02/08/2025	



Comments			
Reviewed by	Wanay	Date	02/08/2025



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

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

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

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	3.874
C15 RT 2	3.880
C15 RT 3	3.875
C15 RT 4	3.872
C15 RT 5	3.878
C15 RT Average	3.876
* % RSD (< 0.5 %)	0.08

* 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	☒ Pass	☐ Fail
Performance by	Sondul P.	
Date	02/08/2025	



Comments			
Reviewed by	Wanay	Date	02/08/2025



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

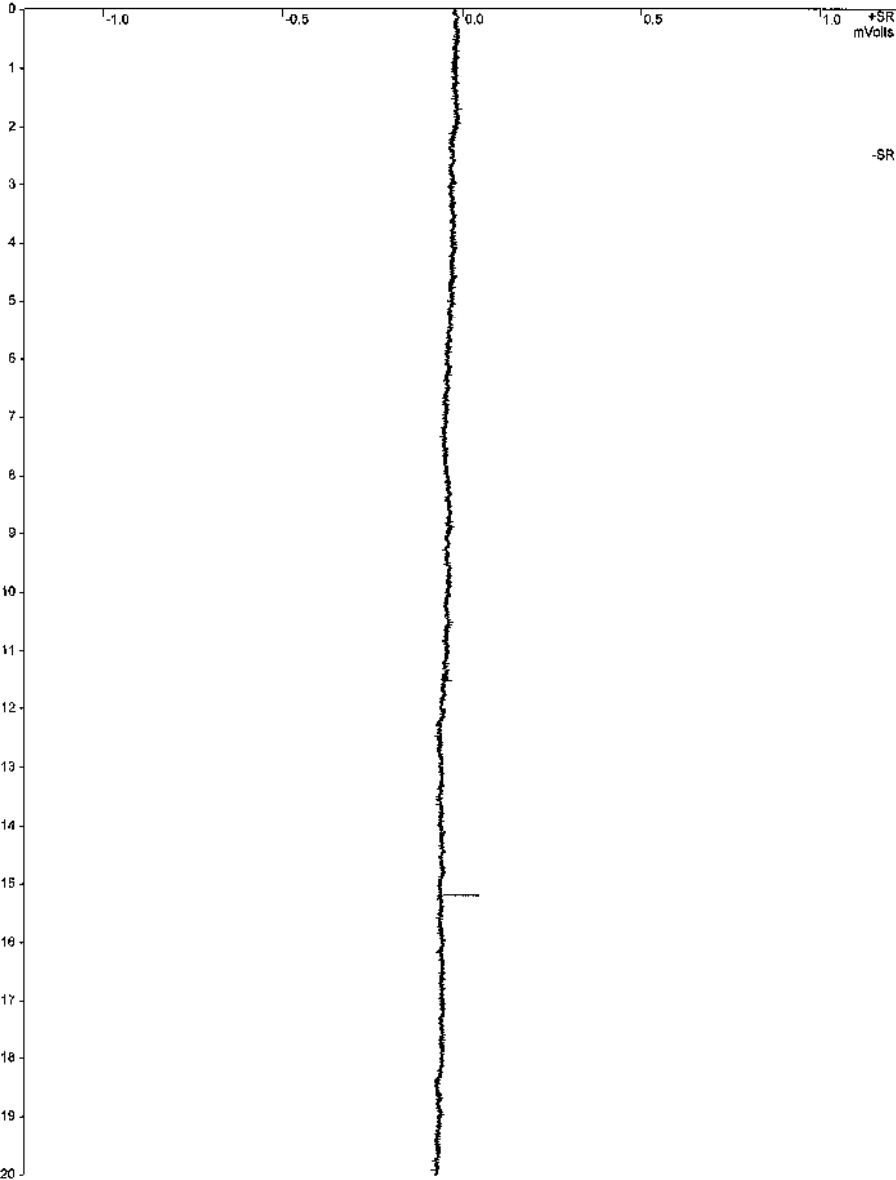
Title :
Run File : e:\sps2025\blk001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : blk

Injection Date: 2/8/2568 12:01 Calculation Date: 2/8/2568 12:33

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 20.005 min

** LC Workstation Version 6.20 ** 02511-7390-ac7-0265 **

Chart Speed = 1.13 cm/min Attenuation = 1 Zero Offset = 50%
Start Time = 0.000 min End Time = 20.005 min Min / Tick = 1.00



Title :
Run File : e:\sps2025\blk001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : blk

Injection Date: 2/8/2568 12:01 Calculation Date: 2/8/2568 12:33

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 20.005 min

** LC Workstation Version 6.20 ** 02511-7390-ac7-0265 **

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: -14 microVolts LSB: 1 microVolts

Noise (used): 24 microVolts ~ monitored before this run

Manual injection

Data Handling: No peaks

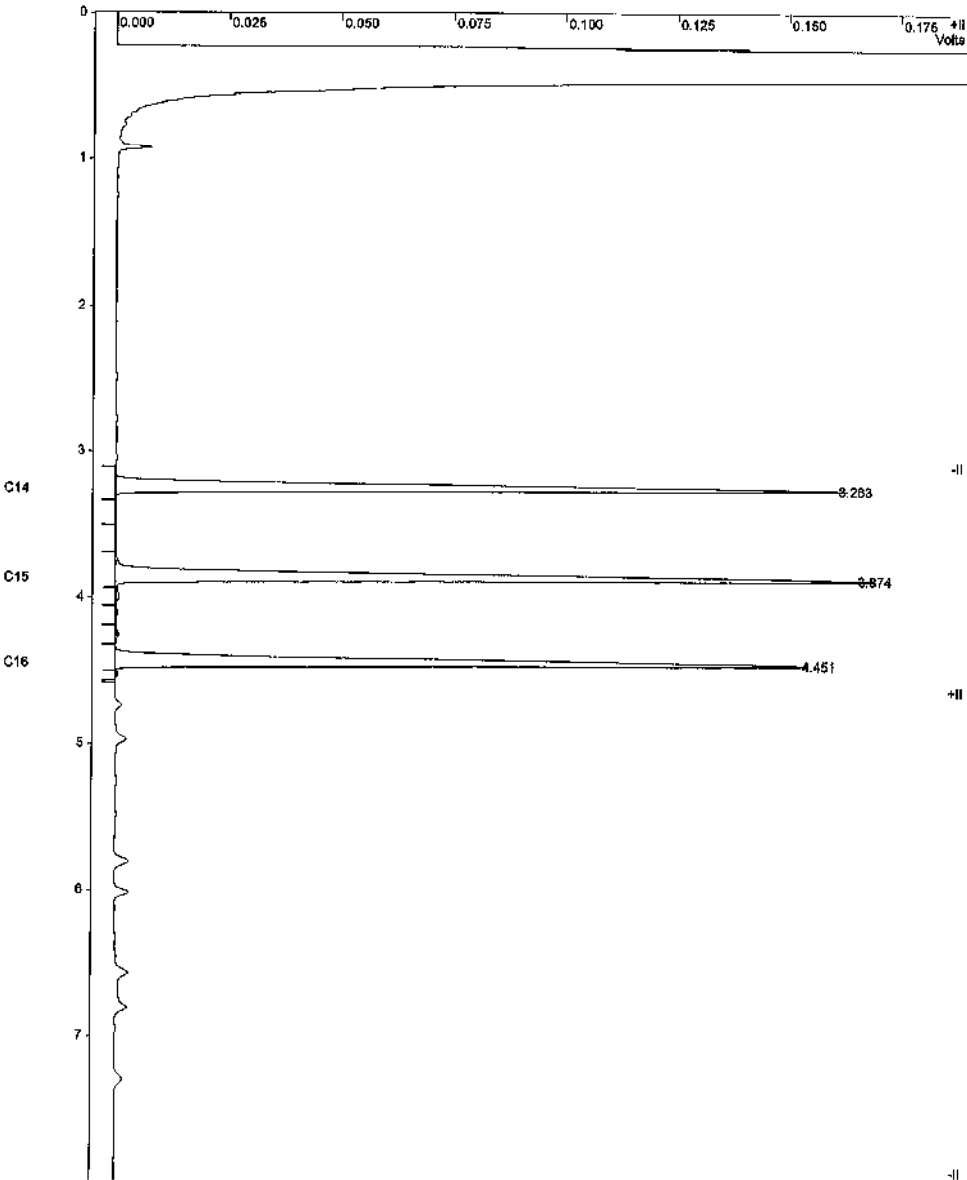
Title :
Run File : e:\sps2025\fidstd001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : fidstd

Injection Date: 2/8/2568 12:34 Calculation Date: 2/8/2568 13:26

Operator : watsamon 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 = 79 Zero Offset = 2%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Print Date: Sat Aug 02 15:10:09 2025 Page 1 of 1

Title :
Run File : e:\sps2025\fidstd001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : fidstd

Injection Date: 2/8/2568 12:34 Calculation Date: 2/8/2568 13:26

Operator : watsamon 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 : Calibration
Peak Measurement: Peak Area
Calculation Type: External Standard
Level : 1

Peak No.	Peak Name	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	3.263	0.002	458627	BB	2.7	
2	C15	3.874	0.002	506043	VV	2.8	
3	C16	4.451	0.001	460610	VB	2.8	
Totals:			0.005	1425280			

Total Unidentified Counts : 0 counts

Detected Peaks: 8 Rejected Peaks: 5 Identified Peaks: 3

Multiplier: N/A Divisor: N/A Unidentified Peak Factor: 0

Baseline Offset: 6 microVolts LSB: 1 microVolts

Noise (used): 2 microVolts - monitored before this run

Manual injection

Sample ID: **fid std**

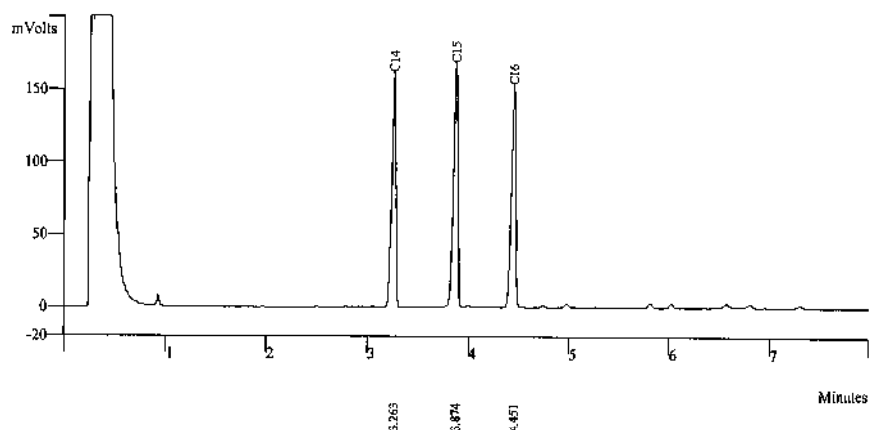
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd001.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	0.0000	3.263	458627	BB	2.7
2	C15	0.0000	3.874	506043	VV	2.8
3	C16	0.0000	4.451	460610	VB	2.8
Totals		0.0000		1425280		

Sample ID: **fid std**

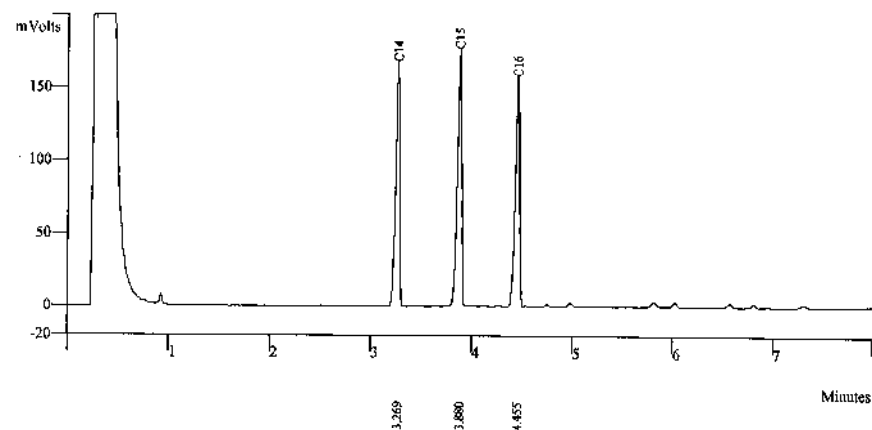
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd002.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	0.0000	3.269	472338	BB	2.6
2	C15	0.0000	3.880	520497	VV	2.7
3	C16	0.0000	4.455	471916	VB	2.8
Totals		0.0000		1464751		



Sample ID: fid std

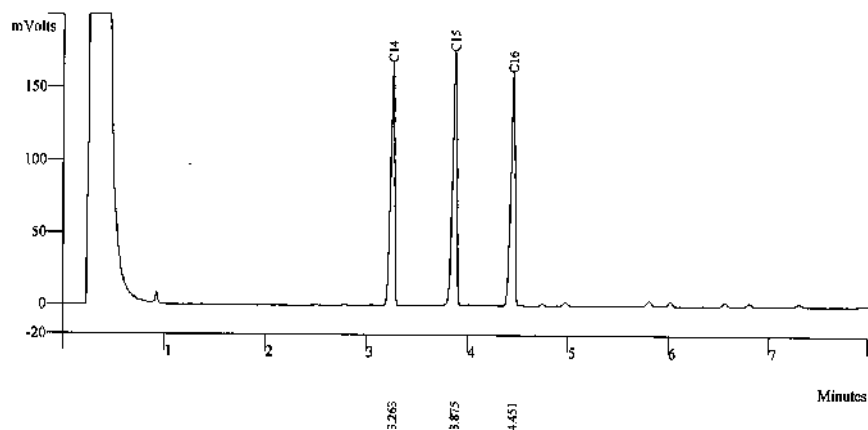
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd003.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	0.0000	3.263	469265	BB	2.6
2	C15	0.0000	3.875	522154	VV	2.8
3	C16	0.0000	4.451	478526	VB	2.8
Totals		0.0000		1469945		



Sample ID: fid std

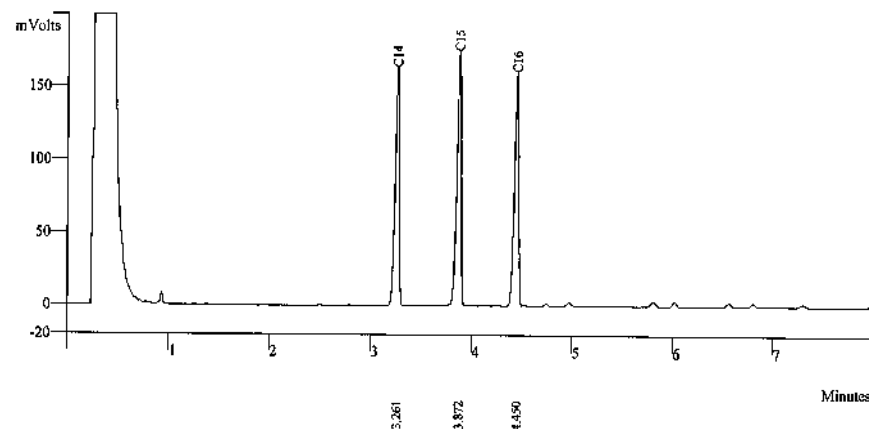
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd004.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	0.0000	3.261	468907	BB	2.7
2	C15	0.0000	3.872	521664	VV	2.8
3	C16	0.0000	4.450	478772	VB	2.8
Totals		0.0000		1469343		



Sample ID: fid std

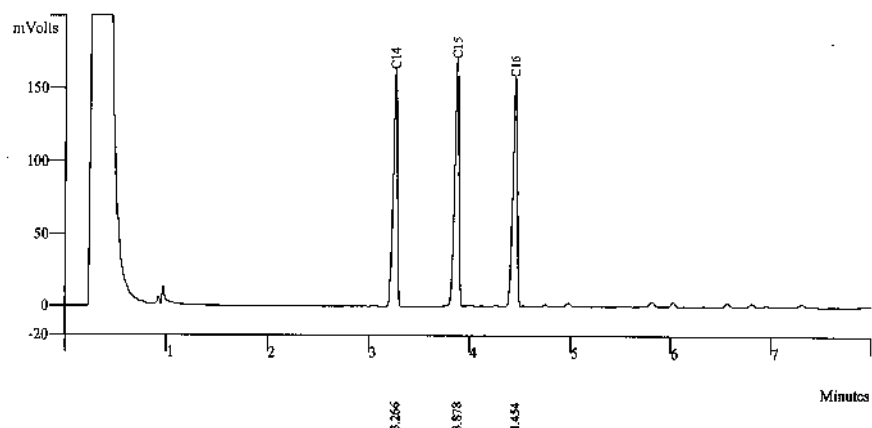
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd005.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	0.0000	3.266	459351	BB	2.6
2	C15	0.0000	3.878	509340	VV	2.8
3	C16	0.0000	4.454	468353	VB	2.8
Totals		0.0000		1437044		



THAI UNIQUE CO.,LTD.

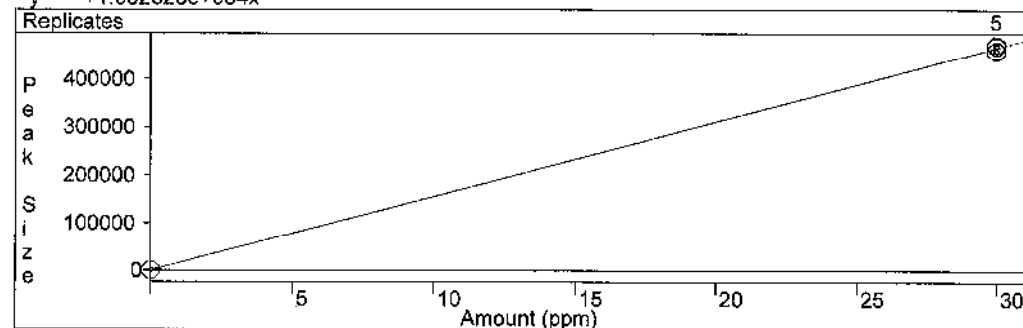
1 of 1

Print Date: 02 Aug 2025 15:12:58
 Calibration Curves Report
 File: e:\sps2025\cal fid.mth
 Detector: 3800 GC, Address: 44, Channel ID: Front

C14

External Standard Analysis
 Curve Type: Linear
 Origin: Force
 $y = +1.552325e+004x$

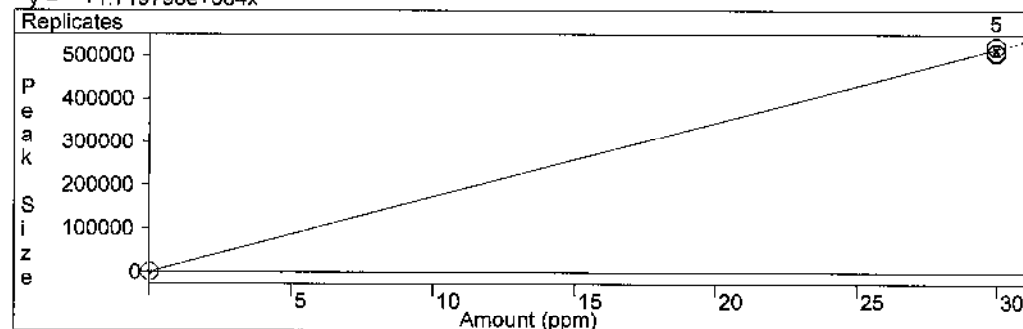
Resp. Fact. RSD: 1.347%
 Coeff. Det.(r²): 0.999130



C15

External Standard Analysis
 Curve Type: Linear
 Origin: Force
 $y = +1.719798e+004x$

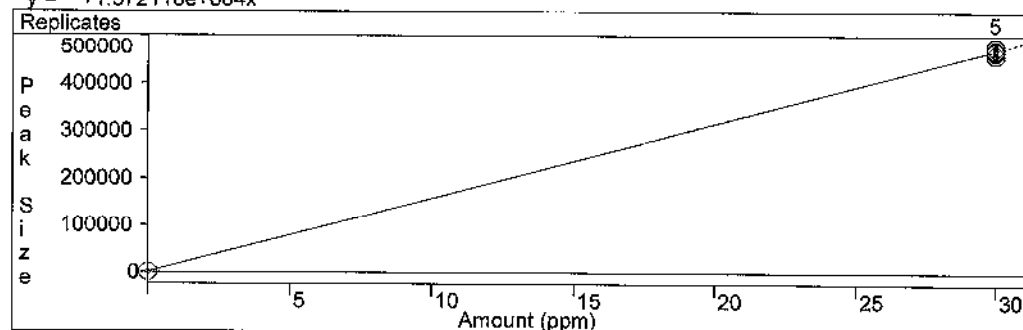
Resp. Fact. RSD: 1.481%
 Coeff. Det.(r²): 0.998948



C16

External Standard Analysis
 Curve Type: Linear
 Origin: Force
 $y = +1.572118e+004x$

Resp. Fact. RSD: 1.611%
 Coeff. Det.(r²): 0.998756



CERTIFICATE

This is to certify, that

Somchai Pohthongkham

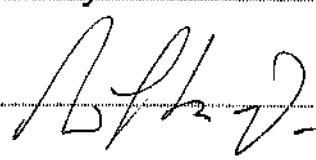
has participated the course

Basic GC and Sampler training

Date: **24 – 27 May 2004**

Location: **Middelburg**

Instructor: **W.J. Buys**

Signature instructor: 



Varian Analytical Instruments
Varian Chrompack International BV
Herculesweg 11
P.O. Box 8033
4330 BA Middelburg
The Netherlands
Tel.: +31 118 621000
Fax: +31 118 621118
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WK Electric Co., Ltd.

68/242 Moo 5, Sawaipracharaj Rd., Tambol Ladsawal, Amphur Lamiukka, Pathumthani 12150

Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com



Certificate of Calibration

Certificate No.: WK2412-053-1

Page 1 of 2

Customer : THAI UNIQUE CO., LTD.
80-82 Prachathipatal Rd., Bangkokphrom,
Pranakorn, Bangkok 10200

Instrument	: AMD Flow Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Agilent Technologies	Humidity	: (50 ± 15) %RH
Model	: G6691A	Received Date	: 4-Dec-24
Serial No.	: MY16470347	Calibrated Date	: 11-Dec-24
Identity No.	: SV-DF-001	Issued Date	: 18-Dec-24
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	WK2405-049-5	22-May-25	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.Thippatani Mungpuangklang

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.



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 : LF25-0305
Equipment : Thermometer
Manufacturer : Fluke
Model : 51
Serial Number : 5910857
Asset Number : 5910857
Customer : Thal Unique Co., Ltd.
80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200
Date of Calibrate : 6-Jun-2025
Date of Issue : 6-Jun-2025

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 approval 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

Samak

Mr. Samak Uaonkaonoi
Metrology Technician

Approved by

Miss Juthamas Sukthainirun

Miss Juthamas Sukthainirun
Cal-Lab Manager



Agilent Technologies

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 %

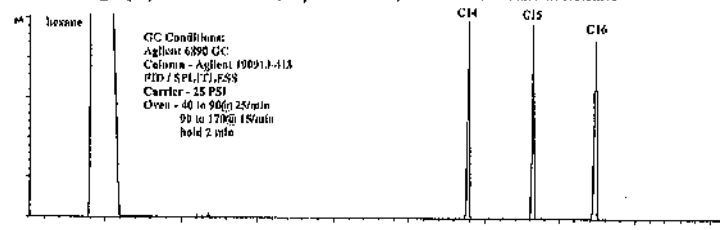
Solvent: hexane

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	90%

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

GC Clarus 600/680 Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	680S14042502	Service Tag:	N68APSSFxMP
Customer Name (if applicable):	Ms.Naruecha	PM number :	1 of 2
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-11858723
Date PM Performed: (DD-MMM-YYYY)	13-Feb-2026	Next PM Due Date: (DD-MMM-YYYY)	13-Aug-2026

Part Number	Release	Publication Date	
TH09370070	C	August 2016	

Scope

The purpose of this PM is to ensure the continued functionality of the Clarus 600 and Clarus 680 GC by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3.2	PSS, PSS, FID,
Clarus SQ8T	648N4050804	Turbomass 6.4	
AtomX	US14113002	Tekma AtomX	

Parts Lists

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
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 (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Check incoming AC line voltage for proper levels and grounding.

L-N	220	Volt
L-G	220	Volt
N-G	0.46	Volt

**Neutral to ground not more than 0.5 volts peak to peak*
- ☒ Inspect all gas line filters and traps; Replace if necessary with customer supplied spares.

Carrier gas	☒ Helium	☐ Nitrogen	☐ Hydrogen
Moisture level	☒ Good	☐ Need to replace	☐ Other _____
Detector gas	☒ Air Zero	☒ Hydrogen	☐ Nitrogen
Moisture level	☒ Good	☐ Need to replace	☐ Other _____
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Leak check all fittings from the gas source to instrument.

Gas leakage	☒ Pass	☐ Fail	Comment _____
-------------	--	-------------------------------	---------------
- ☒ Perform general inspection of system for cleanliness.
- ☒ Inspect for functional and clean electronic cooling and oven vent fans

Electronic cooling fan	☒ Yes	☐ No
Oven cooling fan	☒ Yes	☐ No

2. Electronic :

- ☒ Check oven temperature. Calibrate if necessary.

Oven temperature set point	150 °C	☒ Pass	☐ Fail
----------------------------	--------	--	-------------------------------
- ☐ Check sub-ambient option. (If installed).

Oven temperature set point	5 °C	☐ Pass	☐ Fail
----------------------------	------	-------------------------------	-------------------------------
- ☒ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.

- ☒ Check flows, including split flows if applicable. Calibrate if necessary.

Carrier flow	Pass
Split flow	Pass
- ☒ Check detector gas flows and adjust if necessary.

Detector flow	Pass
---------------	------
- ☒ Autosampler installed ☒ Yes ☐ No

Check autosampler sensor for wear and replace if necessary.	
Vial sensor	Pass
Door sensor	Pass
Tower sensor	Pass
Plunger sensor	Pass
Elevator sensor	Pass
- ☒ Remove syringe, manually flush. Replace with customer supplied spare if necessary.
- ☒ Check firmware version. Upgrade to current levels if necessary.

Firmware version	6.5
------------------	-----
- ☒ Measure all accessible power supply voltages.

5 Volt	Pass
+15 Volt	Pass
-15 Volt	Pass
24 Volt	Pass
- ☒ Record all detector voltage signal.

Detector Channel A	0.87	mV.
Detector Channel B	NA	mV.

3. Diagnostics Tests:

- ☒ Run instrument diagnostics.

BRAM	Pass
EPROM	Pass
- ☒ Run Autosampler diagnostics.

BRAM	Pass
EPROM	Pass

4. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed.</i>	
<i>This Clarus600/680 GC Pass the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Monchai Kitcharoenkeat	Date: 13-Feb-2026 (DD-MMM-YYYY)
Authorized Customer Representative: Ms.Naruecha	Date: 13-Feb-2026 (DD-MMM-YYYY)

Cert. No. : SP25026
Pages : 1 of 4

Calibration Certificate

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

Condition As Found : GOOD

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

Location : ORGANIC LABORATORY IV

Ambient Temperature : (22.9 ± 5) °C

Relative Humidity : (53.7 ± 25) %

Received Date : 22 AUGUST 2025

Calibration Date : 22 AUGUST 2025

Date of Issue : 25 AUGUST 2025

Calibrated by : Nitinun Srihawan

Approved by : *Wichok B.*
(Wichok Ekpongpradit)

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.

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 2 of 4

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	126461	24/10/2026
Didymium liquid	RM-DL	28912	126462	24/10/2026
Neutral density filter	RM-IN2N3N	13877	126457	24/10/2026
Potassium dichromate solutions	RM-0204060810	14204	126497	25/10/2026
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)

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	278.21	0.08	0.16	2.00
	361.25	361.39	0.14	0.16	2.00
	467.82	467.71	-0.11	0.16	2.00
	536.56	536.50	-0.06	0.16	2.00
	640.50	640.36	-0.14	0.16	2.00
RM-DL	740.09	739.85	-0.24	0.16	2.00
	864.94	865.12	0.18	0.16	2.00

UUC* = Unit Under Calibration

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 3 of 4

Result of calibration : Photometric Accuracy

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	29381	0.5	0.5443	0.5413	-0.0030	0.0043	2.00
		29914	0.7	0.7484	0.7455	-0.0029	0.0054	2.00
		29360	1.0	1.0527	1.0535	0.0008	0.0032	2.00
	465.0	29381	0.5	0.4948	0.4922	-0.0026	0.0041	2.00
		29914	0.7	0.6906	0.6877	-0.0029	0.0050	2.00
		29360	1.0	0.9695	0.9709	0.0014	0.0031	2.00
	546.1	29381	0.5	0.5090	0.5068	-0.0022	0.0036	2.00
		29914	0.7	0.6985	0.6960	-0.0025	0.0041	2.00
		29360	1.0	0.9814	0.9825	0.0011	0.0031	2.00
	590.0	29381	0.5	0.5375	0.5353	-0.0022	0.0034	2.00
		29914	0.7	0.7256	0.7231	-0.0025	0.0037	2.00
		29360	1.0	1.0213	1.0219	0.0006	0.0032	2.00
	635.0	29381	0.5	0.5223	0.5202	-0.0021	0.0033	2.00
		29914	0.7	0.6927	0.6901	-0.0026	0.0036	2.00
		29360	1.0	0.9744	0.9750	0.0006	0.0032	2.00

UUC* = Unit Under Calibration

Cert. No. : SP25026
Job No. : VC68SP0019
Pages : 4 of 4

Result of calibration : Photometric Accuracy

(Without adjustment)

Material	Wavelength (nm)	Solution (mg/l)	Certified Absorbance (A)	UUC* Reading Absorbance (A)	Error (A)	Uncertainty ± (A)	k Factor
Potassium dichromate solutions	235.0	20	0.2415	0.2443	0.0028	0.0101	2.00
		40	0.4866	0.4871	0.0005	0.0115	2.00
		60	0.7415	0.7295	-0.0120	0.0067	2.00
		80	0.9854	0.9844	-0.0010	0.0071	2.00
		100	1.2444	1.2425	-0.0019	0.0073	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 0.001 A
Parameter Setting
Measurement Mode Wavelength, Absorbance
Wavelength Scan 190 nm - 1100 nm
Scanning Speed 7.5 nm/min
Band width(Wavelength) 1.0
Band width(Vis) 1.0
Band width(Uv) 1.0

Stray Light** UUC* Reading at 220.0 nm	
Transimission T(%)	Absorbance(A)
0.020	3.7032

**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



WO-11540201/2025

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	<u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested:	<u>December 18, 2025</u>
Address :	<u>7 Soi Phaholyothin 24</u>	Recommendation Recertification	
	<u>Paholyothin Road</u>	Period	<u>6 Months</u>
	<u>Jompol Chatuchak, Bangkok 1090</u>	Recertification Due:	<u>June 28, 2026</u>
User Name:	<u>K.Phenpha Vipasthawatt</u>	Date Last Certified:	<u>July 1, 2025</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>November 30, 2026</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>July 30, 2026</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>August 30, 2026</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2026</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



WO-11540201/2025

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER	<u>077C7042401</u>	DATE TESTED	<u>December 18, 2025</u>
1. MECHANICAL CHECKS			
A. Inspect and clean all fans and filters.			☐
B. Inspect and replace as necessary, all torch components including the RF coil.			☐
C. Inspect all tubing for sign of clacking or leaking.			☐
D. Adjust water and gas pressure regulator settings.			☐
E. Inspect and leak check pneumatics drawers.			☐
F. Clean the exterior of the instrument.			☐
2. OPTICAL CHECKS			
A. Inspect and clean all optical components.			☐
B. As required, check and replace all purgefilters.			☐
C. Recheck optical alignment.			☐
3. COOLING SYSTEM CHECKS			
A. Perform preventive maintenance on chiller.			☐
B. Flush out the chiller every year.			☐
4. PERFORMANCE CHECKS			
A. Torch View Alignment.			☐
B. Wavelength Calibration.			☐



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401		DATE TESTED : December 18, 2025	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00530
	Ni 231.604 nm	≤ 0.008	0.00708
	Ni 341.476 nm	≤ 0.012	0.00776
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01614
	Ba 455.403 nm	≤ 0.025	0.02377
Precision	As 193.656 nm	% RSD < 1.0	0.67 %
	Zn 213.856 nm	% RSD < 1.0	0.62 %
	Mn 257.610 nm	% RSD < 1.0	0.88 %
	La 379.478 nm	% RSD < 1.0	0.63 %
	Ba 455.403 nm	% RSD < 1.0	0.65 %
	Ba 493.408 nm	% RSD < 1.0	0.45 %
	Detection Limits : Axial	Tl 190.080 nm	3(sd)
	As 193.696 nm	3(sd)	6.06 ppb
	Pb 220.353 nm	3(sd)	0.92 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	17.35 ppb
	Zn 213.856 nm	3(sd)	1.79 ppb
	Mn 257.610 nm	3(sd)	0.18 ppb
	La 379.478 nm	3(sd)	0.76 ppb
	Ba 455.403 nm	3(sd)	0.11 ppb
	Ba 493.408 nm	3(sd)	0.56 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	40.52
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	42.33



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER	077C7042401	DATE TESTED	December 18, 2025
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 5-5

เอกสารสอบเทียบเครื่องมือการตรวจวิเคราะห์คุณภาพน้ำใต้ดิน

GC Clarus 600/680 Preventive Maintenance (PM)

Company Name:	S.P.S. Consulting Service Co.,Ltd		
Address (Instrument Location):	7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900.		
Serial Number:	680S14042502	Service Tag:	N68APSSFEMP
Customer Name (if applicable):	Ms.Naruecha	PM number :	1 of 2
Service Engineer Name:	Monchai Kitcharoenkeat	Service Order Number:	WO-11858723
Date PM Performed: (DD-MMM-YYYY)	13-Feb-2026	Next PM Due Date: (DD-MMM-YYYY)	13-Aug-2026

Part Number	Release	Publication Date	
TH09370070	C	August 2016	

Scope

The purpose of this PM is to ensure the continued functionality of the Clarus 600 and Clarus 680 GC by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer. The customer should save their method before the PM begins.

General Instructions:

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3.2	PSS, PSS, FID,
Clarus SQ8T	648N4050804	Turbomass 6.4	
AtomX	US14113002	Tekma AtomX	

Parts Lists

Additional Tools Required for PM				
Part Number (if applicable)	Description	Quantity	Serial #	Calibration Due Date (MM/YY)
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 (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Check incoming AC line voltage for proper levels and grounding.

L-N	220	Volt
L-G	220	Volt
N-G	0.46	Volt

**Neutral to ground not more than 0.5 volts peak to peak*
- ☒ Inspect all gas line filters and traps; Replace if necessary with customer supplied spares.

Carrier gas	☒ Helium	☐ Nitrogen	☐ Hydrogen
Moisture level	☒ Good	☐ Need to replace	☐ Other _____
Detector gas	☒ Air Zero	☒ Hydrogen	☐ Nitrogen
Moisture level	☒ Good	☐ Need to replace	☐ Other _____
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Leak check all fittings from the gas source to instrument.

Gas leakage	☒ Pass	☐ Fail	Comment _____
-------------	--	-------------------------------	---------------
- ☒ Perform general inspection of system for cleanliness.
- ☒ Inspect for functional and clean electronic cooling and oven vent fans

Electronic cooling fan	☒ Yes	☐ No
Oven cooling fan	☒ Yes	☐ No

2. Electronic :

- ☒ Check oven temperature. Calibrate if necessary.

Oven temperature set point	150 °C	☒ Pass	☐ Fail
----------------------------	--------	--	-------------------------------
- ☐ Check sub-ambient option. (If installed).

Oven temperature set point	5 °C	☐ Pass	☐ Fail
----------------------------	------	-------------------------------	-------------------------------
- ☒ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.

- ☒ Check flows, including split flows if applicable. Calibrate if necessary.

Carrier flow	Pass
Split flow	Pass
- ☒ Check detector gas flows and adjust if necessary.

Detector flow	Pass
---------------	------
- ☒ Autosampler installed ☒ Yes ☐ No

Check autosampler sensor for wear and replace if necessary.	
Vial sensor	Pass
Door sensor	Pass
Tower sensor	Pass
Plunger sensor	Pass
Elevator sensor	Pass
- ☒ Remove syringe, manually flush. Replace with customer supplied spare if necessary.
- ☒ Check firmware version. Upgrade to current levels if necessary.

Firmware version	6.5
------------------	-----
- ☒ Measure all accessible power supply voltages.

5 Volt	Pass
+15 Volt	Pass
-15 Volt	Pass
24 Volt	Pass
- ☒ Record all detector voltage signal.

Detector Channel A	0.87	mV.
Detector Channel B	NA	mV.

3. Diagnostics Tests:

- ☒ Run instrument diagnostics.

BRAM	Pass
EPROM	Pass
- ☒ Run Autosampler diagnostics.

BRAM	Pass
EPROM	Pass

4. Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

<i>The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed.</i>	
<i>This Clarus600/680 GC Pass the preventive maintenance.</i>	
Review of Preventive Maintenance:	
Authorized PerkinElmer Representative: Monchai Kitcharoenkeat	Date: 13-Feb-2026 (DD-MMM-YYYY)
Authorized Customer Representative: Ms.Naruecha	Date: 13-Feb-2026 (DD-MMM-YYYY)

เอกสารแนบ 5-6

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในสถานประกอบการ



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพลาโยธิน 24 ถนนพลาโยธิน แขวงจตุจักร กรุงเทพฯ 10900
7 Soi Phayathin 24, Phayathin Rd., Jompru, Chulachak, Bangkok 10900
Tel : (662) 919-470-72, Fax : (662) 513-4271, E-mail : ssp@spson.com, www.spson.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender S10-H

S/N : 136853

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	y		R ²	
R01	SAC	224-PC104	62081	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	1.000 ± 1.123		1.000	
R02	SAC	224-PC104	62082	01/10/2025	1.000	2.000	2.500	999	1.511	1.999	1.000 ± 2.213		1.000	
R03	SAC	224-PC104	69130	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	1.000 ± 3.030		1.000	
R04	SAC	224-PC104	69162	01/10/2025	1.000	1.500	2.000	1.013	1.500	2.000	2.999 ± 7.790		0.999	
R05	SAC	224-PC104	70970	01/10/2025	1.000	1.500	2.000	1.070	1.504	2.000	1.001 ± 2.757		1.000	
R06	SAC	224-PC104	70980	01/10/2025	1.000	1.500	2.000	999	1.502	1.999	1.000 ± 1.913		1.000	
R07	SAC	224-PC104	70982	01/10/2025	1.000	1.500	2.000	999	1.502	1.999	1.000 ± 4.973		0.999	
R08	SAC	224-PC104	88303	01/10/2025	1.000	1.500	2.000	1.000	1.500	1.999	0.999 ± 0.908		1.000	
R09	SAC	224-PC104	10460	01/10/2025	1.000	1.500	2.000	999	1.500	1.998	1.000 ± 11.809		1.000	
R10	SAC	224-PC104	091185	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	1.000 ± 11.730		0.999	
R11	SAC	224-PC104	091704	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	0.999 ± 5.380		1.000	
R12	SAC	224-PC104	091708	01/10/2025	1.000	1.500	2.000	999	1.499	1.999	1.000 ± 5.717		1.000	
R13	SAC	224-PC104	091830	01/10/2025	1.000	1.500	2.000	1.010	1.500	2.000	1.000 ± 2.996		0.999	
R14	SAC	224-PC104	091704	01/10/2025	1.000	1.500	2.000	999	1.499	2.000	1.000 ± 15.600		1.000	
R15	SAC	224-PC104	029457	01/10/2025	1.000	1.500	2.000	999	1.501	2.001	1.000 ± 12.917		0.999	
R16	SAC	224-PC104	029803	01/10/2025	1.000	1.500	2.000	999	1.499	1.999	0.999 ± 1.307		1.000	
R17	SAC	224-PC104	029805	01/10/2025	1.000	1.500	2.000	1.000	1.500	1.999	1.000 ± 10.886		0.999	
R18	SAC	224-PC104	566758	01/10/2025	1.000	1.500	2.000	999	1.500	1.999	1.000 ± 3.450		1.000	
R19	SAC	224-PC104	566800	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.001	1.000 ± 6.752		1.000	
R20	SAC	224-PC104	525084	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.001	1.000 ± 9.023		0.999	
R21	SAC	224-PC104	663728	01/10/2025	1.000	1.500	2.000	999	1.500	2.000	1.000 ± 24.973		0.999	
R22	SAC	224-PC104	709800	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	0.999 ± 6.300		1.000	
R23	SAC	224-PC104	709801	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	0.999 ± 15.020		1.000	
R24	SAC	224-PC104	709802	01/10/2025	1.000	1.500	2.000	1.000	1.500	1.999	1.000 ± 6.142		0.999	
R25	SAC	224-PC104	709803	01/10/2025	1.000	1.500	2.000	1.000	1.500	1.999	1.000 ± 0.150		0.999	
R26	SAC	224-PC104	709804	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	0.999 ± 10.714		1.000	
R27	SAC	224-PC104	709805	01/10/2025	1.000	1.500	2.000	1.011	1.512	2.012	1.000 ± 2.847		0.999	
R28	SAC	224-PC104	070401	01/10/2025	1.000	1.500	2.000	999	1.499	2.000	1.000 ± 0.144		1.000	
R29	SAC	224-PC104	109140	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	1.000 ± 3.500		1.000	
R30	SAC	224-PC104	050811	01/10/2025	1.000	1.500	2.000	999	1.510	2.000	1.000 ± 10.022		1.000	
R31	SAC	224-PC104	050805	01/10/2025	1.000	1.500	2.000	999	1.500	2.000	1.000 ± 9.587		1.000	
R32	SAC	224-PC104	071050	01/10/2025	1.000	1.500	2.000	1.000	1.499	1.999	0.999 ± 5.157		1.000	
R33	SAC	224-PC104	020854	01/10/2025	1.000	1.500	2.000	1.000	1.499	2.000	1.000 ± 15.151		0.999	
R34	SAC	224-PC104	020855	01/10/2025	1.000	1.500	2.000	999	1.500	1.999	0.999 ± 0.786		1.000	
R35	SAC	224-PC104	709401	01/10/2025	1.000	1.500	2.000	1.000	1.500	1.999	0.999 ± 0.112		1.000	
R36	SAC	224-PC104	709402	01/10/2025	1.000	1.500	2.000	999	1.510	1.999	1.000 ± 0.090		1.000	
R37	SAC	224-PC104	709403	01/10/2025	1.000	1.500	2.000	1.000	1.510	2.000	0.999 ± 7.570		0.999	
R38	SAC	224-PC104	709404	01/10/2025	1.000	1.500	2.000	999	1.511	1.999	1.000 ± 2.918		1.000	
R39	SAC	224-PC104	100303	01/10/2025	1.000	1.500	2.000	1.000	1.510	1.999	0.999 ± 11.250		0.999	

Calibrated by :

Adul Dangkum
(Mr. Adul Dangkum)

Approved by :

Ms. Pansa Detudom
(Ms. Pansa Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender S10-H

S/N : 136853

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	y		R ²	
R40	SAC	224-PC104	612711	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	1.000 ± 2.699		1.000	
R41	SAC	224-PC104	620180	01/10/2025	1.000	1.500	2.000	999	1.499	2.000	1.000 ± 1.670		1.000	
R42	SAC	224-PC104	630413	01/10/2025	1.000	1.500	2.000	1.000	1.499	1.999	0.999 ± 9.615		0.999	
R43	SAC	224-PC104	620129	01/10/2025	1.000	1.500	2.000	1.000	1.500	2.000	1.000 ± 12.740		0.999	
R44	SAC	224-PC104	620754	01/10/2025	1.000	1.500	2.000	1.000	1.500	1.999	1.000 ± 9.411		0.999	
R45	SAC	224-PC104	620157	01/10/2025	1.000	1.500	2.000	999	1.500	1.999	1.000 ± 3.942		1.000	

Calibrated by :

Adul Dangkum
(Mr. Adul Dangkum)

Approved by :

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(Ms. Pansa Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender S10-H

S/N : 13683

Environmental Conditions

Temperature 25 ± 5 °C
Pressure 1010 ± 15 mmHg

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve				
					Setting		Actual (Q std.)			y		R ²		
					1	2	3	1	2	3	y	R ²		
801	SAC	224-PC09A	60367	01/04/2026	1.000	1.300	2.000	1.000	1.302	2.007	1.00% ± 0.003	1.000		
802	SAC	224-PC09A	60490	05/04/2026	1.000	1.300	2.000	1.000	1.301	2.006	1.00% ± 0.003	1.000		
803	SAC	224-PC09A	60192	05/04/2026	1.000	1.300	2.000	1.000	1.301	2.006	1.00% ± 0.003	0.999		
804	SAC	224-PC09A	60102	05/04/2026	1.000	1.300	2.000	1.000	1.313	1.999	0.99% ± 0.003	0.999		
805	SAC	224-PC09A	59870	05/04/2026	1.000	1.300	2.000	1.000	1.299	1.997	0.99% ± 0.003	1.000		
806	SAC	224-PC09A	60486	05/04/2026	1.000	1.300	2.000	998	1.297	1.998	0.99% ± 0.003	1.000		
807	SAC	224-PC09A	60485	05/04/2026	1.000	1.300	2.000	1.002	1.308	2.001	0.99% ± 0.003	1.000		
808	SAC	224-PC09A	60323	05/04/2026	1.000	1.300	2.000	1.000	1.301	1.992	1.00% ± 0.003	0.999		
809	SAC	224-PC09A	60400	05/04/2026	1.000	1.300	2.000	999	1.306	2.005	1.00% ± 0.003	1.000		
810	SAC	224-PC09A	60160	05/04/2026	1.000	1.300	2.000	999	1.301	1.996	1.00% ± 0.003	0.999		
811	SAC	224-PC09A	60169	05/04/2026	1.000	1.300	2.000	1.001	1.304	2.001	1.00% ± 0.003	1.000		
812	SAC	224-PC09A	60168	05/04/2026	1.000	1.300	2.000	999	1.305	1.998	0.99% ± 0.003	1.000		
813	SAC	224-PC09A	60159	05/04/2026	1.000	1.300	2.000	1.000	1.304	2.000	0.99% ± 0.003	1.000		
814	SAC	224-PC09A	60164	05/04/2026	1.000	1.300	2.000	1.001	1.306	2.001	1.00% ± 0.003	0.999		
815	SAC	224-PC09A	62507	05/04/2026	1.000	1.300	2.000	998	1.292	1.999	1.00% ± 0.003	1.000		
816	SAC	224-PC09A	60593	05/04/2026	1.000	1.300	2.000	1.004	1.306	2.008	1.00% ± 0.003	0.999		
817	SAC	224-PC09A	62602	05/04/2026	1.000	1.300	2.000	998	1.303	1.998	1.00% ± 0.003	1.000		
818	SAC	224-PC09A	60576	05/04/2026	1.000	1.300	2.000	999	1.308	1.995	1.00% ± 0.003	0.999		
819	SAC	224-PC09A	60602	05/04/2026	1.000	1.300	2.000	998	1.302	1.998	1.00% ± 0.003	1.000		
820	SAC	224-PC09A	60598	05/04/2026	1.000	1.300	2.000	999	1.302	1.998	0.99% ± 0.003	1.000		
821	SAC	224-PC09A	66738	05/04/2026	1.000	1.300	2.000	998	1.305	1.999	1.00% ± 0.003	1.000		
822	SAC	224-PC09A	60594	05/04/2026	1.000	1.300	2.000	1.000	1.299	2.000	1.00% ± 0.003	0.999		
823	SAC	224-PC09A	71107	05/04/2026	1.000	1.300	2.000	1.000	1.302	2.004	1.00% ± 0.003	1.000		
824	SAC	224-PC09A	70503	05/04/2026	1.000	1.300	2.000	1.002	1.303	2.001	0.99% ± 0.003	1.000		
825	SAC	224-PC09A	70502	05/04/2026	1.000	1.300	2.000	1.000	1.304	2.000	0.99% ± 0.003	0.999		
826	SAC	224-PC09A	70196	05/04/2026	1.000	1.300	2.000	1.002	1.301	2.000	0.99% ± 0.003	1.000		
827	SAC	224-PC09A	70598	05/04/2026	1.000	1.300	2.000	1.001	1.306	2.004	1.00% ± 0.003	1.000		
828	SAC	224-PC09A	70740	05/04/2026	1.000	1.300	2.000	1.010	1.313	2.006	0.99% ± 0.003	0.999		
829	SAC	224-PC09A	70740	05/04/2026	1.000	1.300	2.000	1.000	1.300	1.990	1.00% ± 0.003	0.999		
830	SAC	224-PC09A	60381	05/04/2026	1.000	1.300	2.000	999	1.312	2.000	1.00% ± 0.003	1.000		
831	SAC	224-PC09A	60583	05/04/2026	1.000	1.300	2.000	1.011	1.310	2.011	1.00% ± 0.003	0.999		
832	SAC	224-PC09A	67130	05/04/2026	1.000	1.300	2.000	1.000	1.300	2.001	0.99% ± 0.003	1.000		
833	SAC	224-PC09A	62524	05/04/2026	1.000	1.300	2.000	998	1.307	2.000	1.00% ± 0.003	1.000		
834	SAC	224-PC09A	62610	05/04/2026	1.000	1.300	2.000	999	1.306	2.000	1.00% ± 0.003	1.000		
835	SAC	224-PC09A	70740	05/04/2026	1.000	1.300	2.000	998	1.308	1.999	1.00% ± 0.003	1.000		
836	SAC	224-PC09A	70796	05/04/2026	1.000	1.300	2.000	1.001	1.302	2.000	1.00% ± 0.003	0.999		
837	SAC	224-PC09A	70742	05/04/2026	1.000	1.300	2.000	999	1.307	2.000	1.00% ± 0.003	1.000		
838	SAC	224-PC09A	60740	05/04/2026	1.000	1.300	2.000	1.000	1.300	1.999	0.99% ± 0.003	1.000		
839	SAC	224-PC09A	71095	05/04/2026	1.000	1.300	2.000	1.000	1.308	2.004	1.00% ± 0.003	0.999		

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Mr. Pansa Detudom
(Mr. Pansa Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender S10-H

S/N : 13683

Environmental Conditions

Temperature 25 ± 5 °C
Pressure 1010 ± 15 mmHg

Personal Pump Data					Calibration Data									
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)					Value From Calibration Curve				
					Setting		Actual (Q std.)			y		R ²		
					1	2	3	1	2	3	y	R ²		
840	SAC	224-PC09A	61273	05/04/2026	1.000	1.300	2.000	1.000	1.301	2.000	0.99% ± 0.003	1.000		
841	SAC	224-PC09A	62614	05/04/2026	1.000	1.300	2.000	998	1.300	1.997	0.99% ± 0.003	1.000		
842	SAC	224-PC09A	62600	05/04/2026	1.000	1.300	2.000	1.000	1.315	1.998	0.99% ± 0.003	0.999		
843	SAC	224-PC09A	62612	05/04/2026	1.000	1.300	2.000	1.000	1.308	2.000	0.99% ± 0.003	1.000		
844	SAC	224-PC09A	62673	05/04/2026	1.000	1.300	2.000	999	1.309	1.997	1.00% ± 0.003	1.000		
845	SAC	224-PC09A	62617	05/04/2026	1.000	1.300	2.000	1.011	1.314	2.000	0.99% ± 0.003	0.999		

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Mr. Pansa 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 : 136833

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-45	05/10/2025	500	1,000	2,000	501.3	997.7	1995.7	1.0004 + 2.398	0.999
H-R02	Dwyer	VFB-45	07/10/2025	300	1,000	2,000	300.5	999.2	1997.2	1.0014 + 2.181	1.000
H-R03	Dwyer	VFB-45	02/12/2025	300	1,000	2,000	300.9	1001.1	1995.3	0.9994 + 0.702	0.999
H-R04	Dwyer	VFB-45	02/10/2025	500	1,000	2,000	500.4	999.6	1998.9	0.9974 + 5.139	1.000
H-R05	Dwyer	VFB-45	01/10/2025	500	1,000	2,000	500.5	1000.7	1999.2	0.9986 + 3.480	1.000
H-R06	Dwyer	VFB-45	05/10/2025	500	1,000	2,000	500.0	998.5	1994.8	1.0000 + 1.358	0.999

Calibrated by :

Adul Dangkham
(Mr. Adul Dangkham)

Approved by :

Mr. Pansa Defudom
(Mr. Pansa Defudom)



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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal. Primary Flowmeter

Model : Defender 510-H

S/N : 136833

Calibration Data

Rotameter Data			Calibration Data									
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve		
				Flow Rate (Reading)			Actual (Q std.)					
				1	2	3	1	2	3	y	R ²	
L-R01	Dwyer	VFA-21	01/10/2025	50	100	200	50.1	101.0	200.7	0.9974 + 0.833	1.000	
L-R02	Dwyer	VFA-21	01/10/2025	50	100	200	50.1	101.2	200.1	1.0014 + 0.303	0.998	
L-R03	Dwyer	VFA-21	02/10/2025	50	100	200	49.7	99.8	199.9	1.0004 + 0.371	1.000	
L-R04	Dwyer	VFA-21	03/10/2025	50	100	200	50.2	100.9	200.6	1.0004 + 0.145	0.999	
L-R05	Dwyer	VFA-21	06/10/2025	50	100	200	50.7	100.6	200.3	0.9994 + 0.033	1.000	
L-R06	Dwyer	VFA-21	09/10/2025	50	100	200	50.2	99.7	200.1	0.9984 + 0.075	1.000	

Calibrated by :

Adul Dangkham
(Mr. Adul Dangkham)

Approved by :

Mr. Pansa Defudom
(Mr. Pansa Defudom)



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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 : 135833

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-861	Oxyen	VFB-63	01/04/2026	500	1,000	2,000	993.7	1,000.6	1,998.7	$1.000x - 0.544$	1.000	
H-862	Oxyen	VFB-65	01/04/2026	500	1,000	2,000	992.2	992.8	1,992.0	$1.000x - 5.567$	0.999	
H-863	Oxyen	VFB-65	05/04/2026	500	1,000	2,000	997.4	997.5	1,997.5	$0.999x + 2.806$	1.000	
H-868	Oxyen	VFB-65	05/04/2026	500	1,000	2,000	992.5	993.6	1,995.2	$0.999x + 2.025$	0.999	
H-869	Oxyen	VFB-63	05/04/2026	500	1,000	2,000	990.4	990.3	1,989.8	$1.000x + 1.247$	1.000	
H-868	Oxyen	VFB-63	03/04/2026	500	1,000	2,000	990.6	997.2	1,994.6	$0.999x - 0.348$	1.000	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jomjol, Chaitumak, Bangkok 10900
Tel : (662) 979-4370-72 Fax : (662) 513-4221 E-mail : sale@spscn.com, www.spscn.com

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 135833

Calibration Data

Rotameter Data			Calibration Data									
No.	Brand	Model	Date	Flow Rate (mL/min)						Value From Calibration Curve		
				Flow Rate (Reading)			Actual (Q std.)					
				1	2	3	1	2	3	y	R ²	
L-R01	Oxyen	VFA-21	01/04/2026	50	100	200	50.3	100.1	201.9	$0.999x + 0.955$	1.000	
L-R02	Oxyen	VFA-21	01/04/2026	50	100	200	49.2	100.7	201.0	$0.999x + 0.567$	0.999	
L-R03	Oxyen	VFA-22	03/04/2026	50	100	200	50.4	100.2	201.0	$1.000x + 0.625$	1.000	
L-R04	Oxyen	VFA-23	05/04/2026	50	100	200	50.7	100.8	200.3	$1.000x + 0.719$	1.000	
L-R05	Oxyen	VFA-21	03/04/2026	50	100	200	50.1	100.2	200.5	$1.000x - 0.215$	0.999	
L-R06	Oxyen	VFA-21	03/04/2026	50	100	200	50.5	100.6	200.5	$0.999x + 0.639$	1.000	

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :


(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. 0-2629-0191-5, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0825/23032

Instrument Type : Gas Chromatography

Model : 3800

Serial Number : 00734

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

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

Date : 02/08/2025

ELECTRONIC TEST

CPU	☒ PASS	☐ FAIL
DISPLAY & LED TEST	☒ PASS	☐ FAIL
VENT TEST	☒ PASS	☐ FAIL
KEY ECHO TEST	☒ PASS	☐ FAIL
DESTRUCTION RAM TEST	☒ PASS	☐ FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detectors (FID Channel-Front)

INJECTOR : 1079 Injector

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 0.218g/L C14,C15,C16 in hexane (diluted to 30ppm)

SENSITIVITY TEST: C15. (Area count) = 515,940 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)	2.40	≤ 50
Baseline Drift (%)	0.18	≤ 1
Sensitivity (S/N for C15)	19,716	≥ 1,024

Temperature Specification

Temperature	Set	Result	Specification
Column Oven (°C)	80	79	± 5
Injector (°C)	220	218	± 5
Detector (°C)	300	298	± 5
Incubator (°C)	60	N/A	± 5

Relative Standard Deviation % (%RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.48	≤ 5
Retention Time C15 (%)	0.08	≤ 0.5

APPROVAL:

Signature:

Engineer : Somchai Polhtongkam

Date : 02/08/2025



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



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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 : thawati@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 Area 1	506,043
C15 Area 2	520,497
C15 Area 3	522,154
C15 Area 4	521,664
C15 Area 5	509,340
C15 Area Average	515,940
* % RSD (< 5 %)	1.48

* 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	☒ Pass	☐ Fail
Performance by	Sant P.	
Date	02/08/2025	



Comments			
Reviewed by	Watt	Date	02/08/2025



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
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Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawati@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

Checkout Procedure	FID
Detector Position	Front
Inlet Type	1079 Injector
C15 RT 1	3.874
C15 RT 2	3.880
C15 RT 3	3.875
C15 RT 4	3.872
C15 RT 5	3.878
C15 RT Average	3.876
* % RSD (< 0.5 %)	0.08

* 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	☒ Pass	☐ Fail
Performance by	Sant P.	
Date	02/08/2025	



Comments			
Reviewed by	Watt	Date	02/08/2025



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

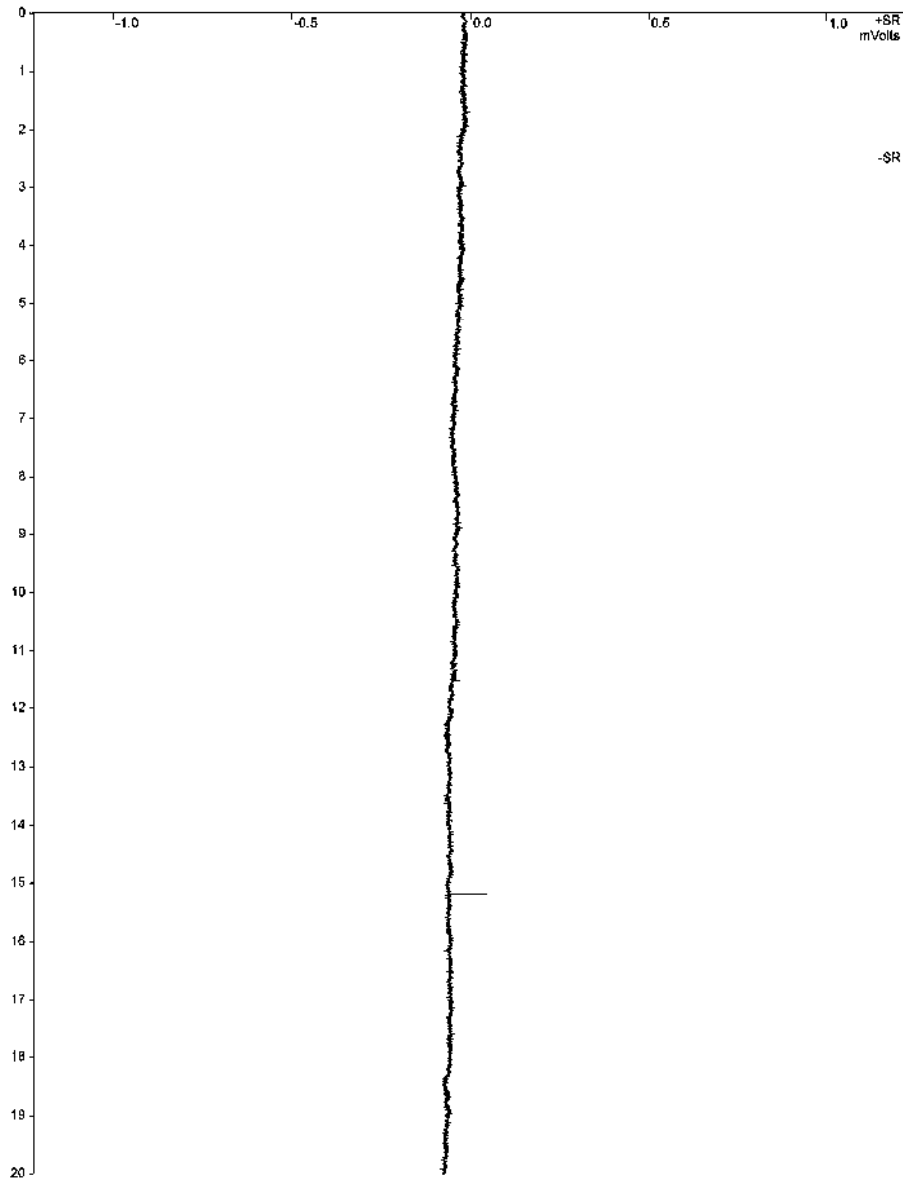
Title :
Run File : e:\sps2025\blk001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : blk

Injection Date: 2/8/2568 12:01 Calculation Date: 2/8/2568 12:33

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 20.005 min

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

Chart Speed = 1.13 cm/min Attenuation = 1 Zero Offset = 50%
Start Time = 0.000 min End Time = 20.005 min Min / Tick = 1.00



Title :
Run File : e:\sps2025\blk001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : blk

Injection Date: 2/8/2568 12:01 Calculation Date: 2/8/2568 12:33

Operator : watsamon Detector Type: 3800 (10 Volts)
Workstation: GC-LAB Bus Address : 44
Instrument : Sample Rate : 10.00 Hz
Channel : Front = FID Run Time : 20.005 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: -14 microVolts LSB: 1 microVolts

Noise (used): 24 microVolts - monitored before this run

Manual injection

Data Handling: No peaks

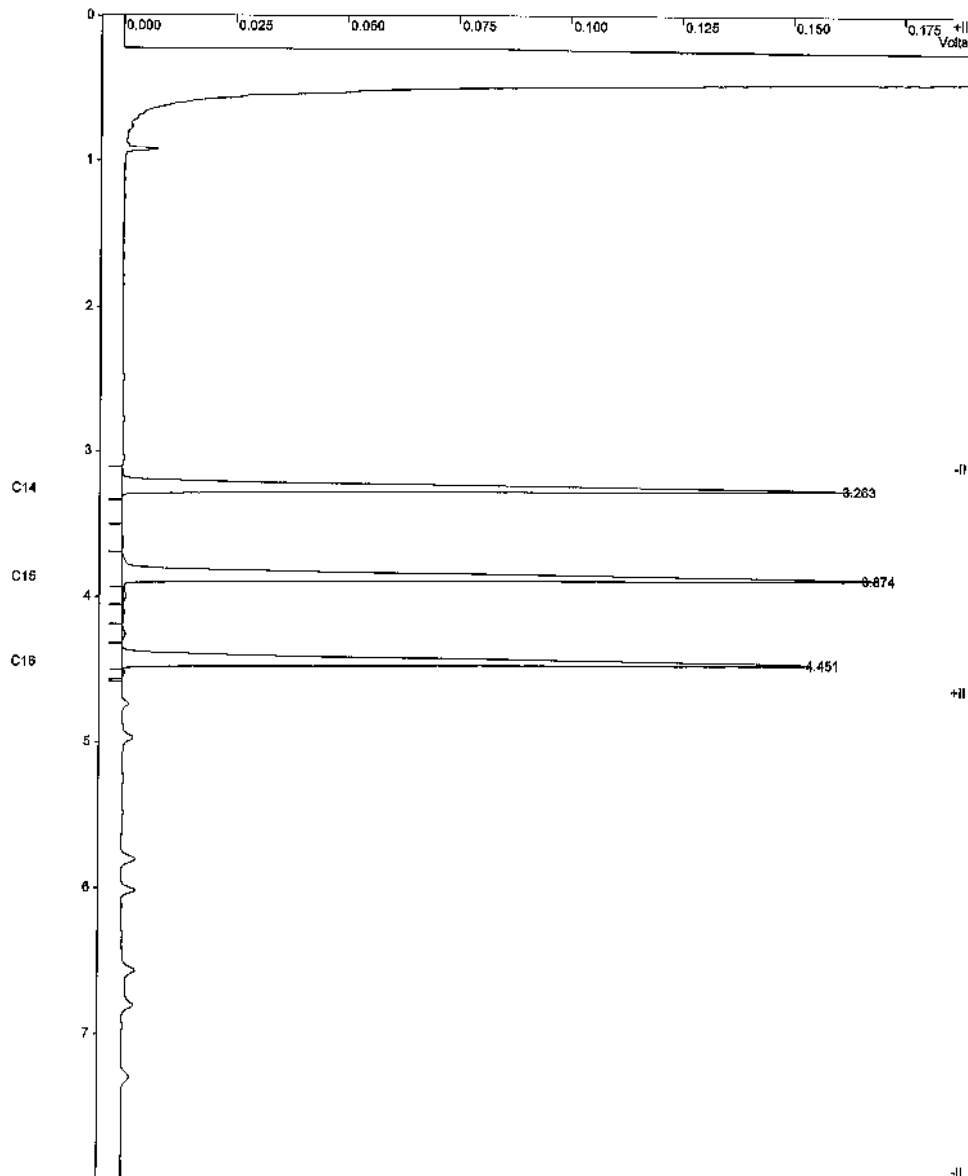
Title :
Run File : e:\sps2025\fidstd001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : fidstd

Injection Date: 2/8/2568 12:34 Calculation Date: 2/8/2568 13:26

Operator : watsamon 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 = 79 Zero Offset = 2%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



Print Date: Sat Aug 02 15:10:09 2025 Page 1 of 1

Title :
Run File : e:\sps2025\fidstd001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : fidstd

Injection Date: 2/8/2568 12:34 Calculation Date: 2/8/2568 13:26

Operator : watsamon 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 : Calibration
Peak Measurement: Peak Area
Calculation Type: External Standard
Level : 1

Peak No.	Peak Name	Ret. Time (min)	Time Offset (min)	Area (counts)	Sep. Code	Width 1/2 (sec)	Status Codes
1	C14	3.263	0.002	458627	BB	2.7	
2	C15	3.874	0.002	506043	VV	2.8	
3	C16	4.451	0.001	460610	VB	2.8	
Totals:			0.005	1425280			

Total Unidentified Counts : 0 counts

Detected Peaks: 8 Rejected Peaks: 5 Identified Peaks: 3

Multiplier: N/A Divisor: N/A Unidentified Peak Factor: 0

Baseline Offset: 6 microVolts LSB: 1 microVolts

Noise (used): 2 microVolts - monitored before this run

Manual injection

Sample ID: fid std

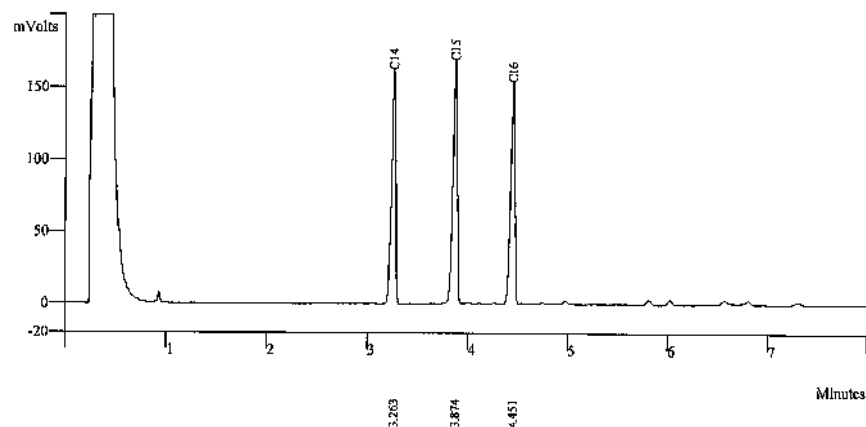
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

c:\sps2025\fidstd001.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	0.0000	3.263	458627	BB	2.7
2	C15	0.0000	3.874	506043	VV	2.8
3	C16	0.0000	4.451	460610	VB	2.8
Totals		0.0000		1425280		



Sample ID: fid std

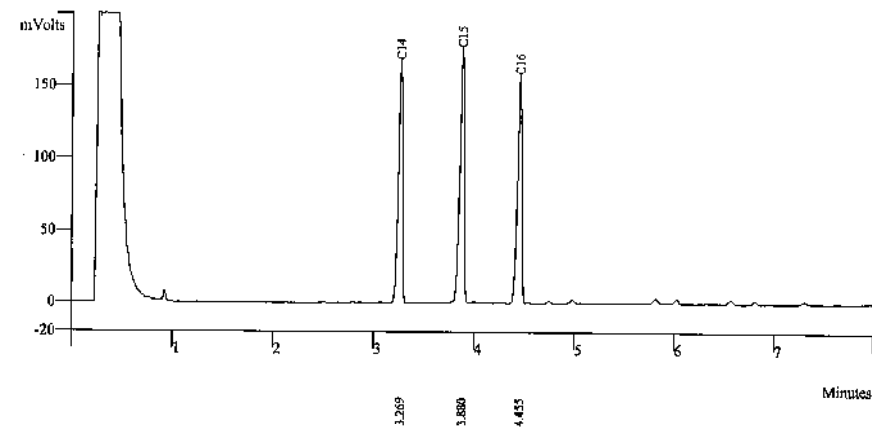
Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

c:\sps2025\fidstd002.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	0.0000	3.269	472338	BB	2.6
2	C15	0.0000	3.880	520497	VV	2.7
3	C16	0.0000	4.455	471916	VB	2.8
Totals		0.0000		1464751		



Sample ID: fid std

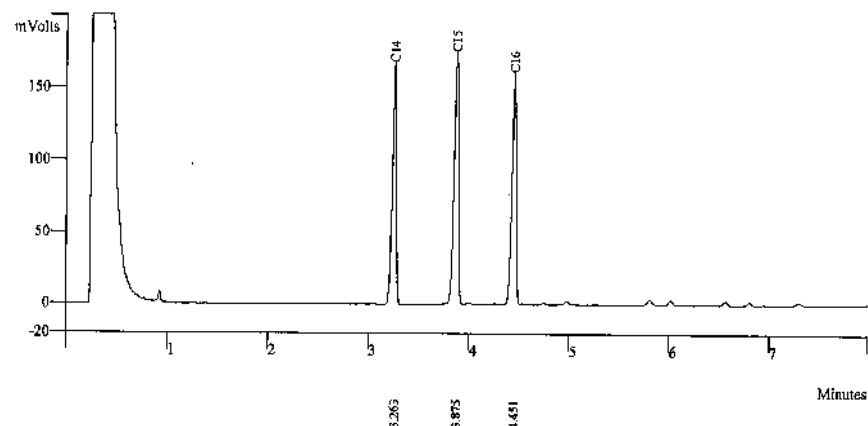
**VARIAN**

Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

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

e:\sps2025\fidstd003.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	0.0000	3.263	469265	BB	2.6
2	C15	0.0000	3.875	522154	VV	2.8
3	C16	0.0000	4.451	478526	VB	2.8
Totals		0.0000		1469945		



Sample ID: fid std

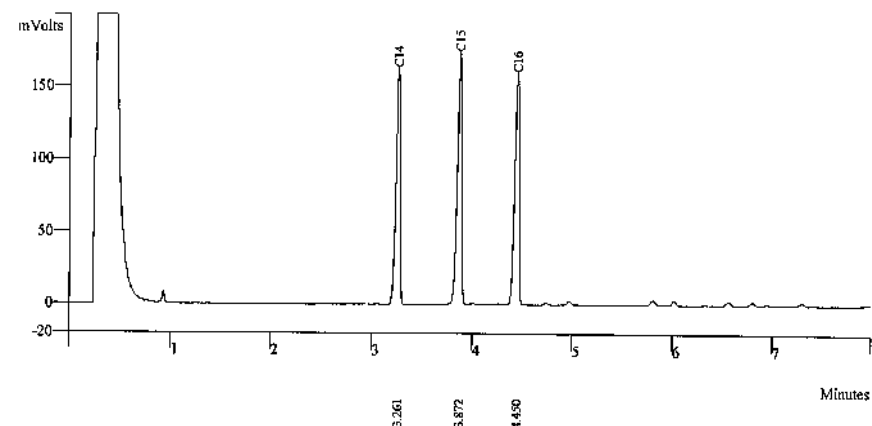
**VARIAN**

Operator (Inj): watsamon
 Injection Date: 02/08/2025
 Calc Date: 02/08/2025
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

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

e:\sps2025\fidstd004.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	0.0000	3.261	468907	BB	2.7
2	C15	0.0000	3.872	521664	VV	2.8
3	C16	0.0000	4.450	478772	VB	2.8
Totals		0.0000		1469343		



Sample ID: fid std

**VARIAN**

Operator (Inj): watsamon

Injection Date: 02/08/2025

Calc Date: 02/08/2025

Run Time (min): 7.993

Workstation: GC-LAB

Instrument (Inj):

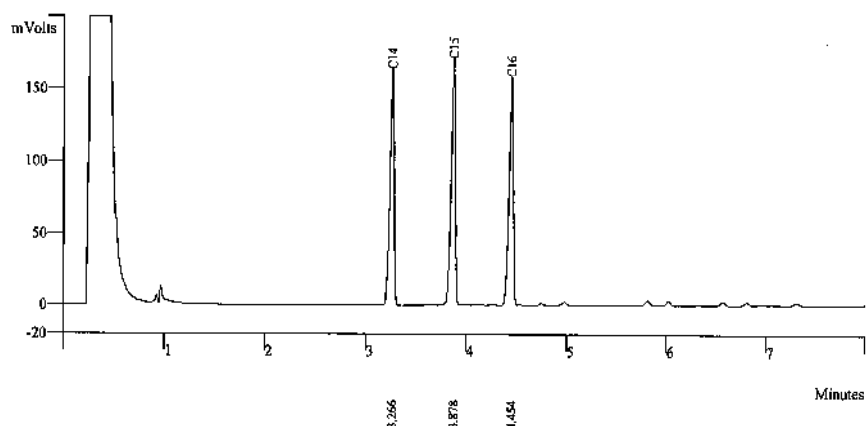
Run Mode: Calibration

Peak Measurement: Peak Area

Calculation Type: External Std.

e:\sps2025\fidstd005.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	0.0000	3.266	459351	BB	2.6
2	C15	0.0000	3.878	509340	VV	2.8
3	C16	0.0000	4.454	468353	VB	2.8
Totals		0.0000		1437044		



THAI UNIQUE CO.,LTD.

1 of 1

C14

External Standard Analysis

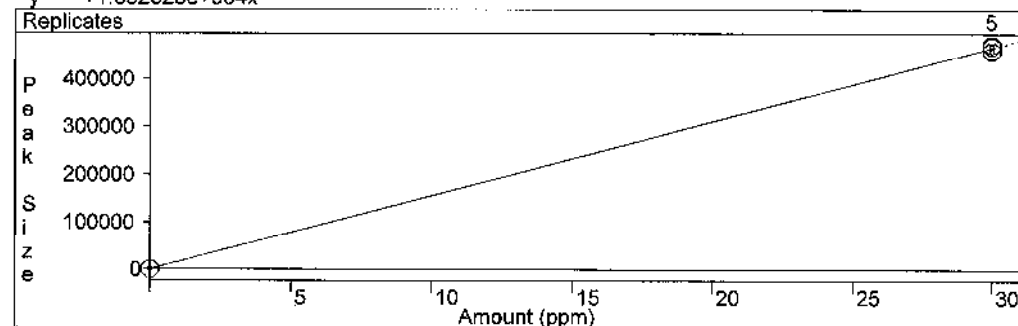
Curve Type: Linear

Origin: Force

 $y = +1.552325e+004x$

Resp. Fact. RSD: 1.347%

Coeff. Det.(r²): 0.999130



C15

External Standard Analysis

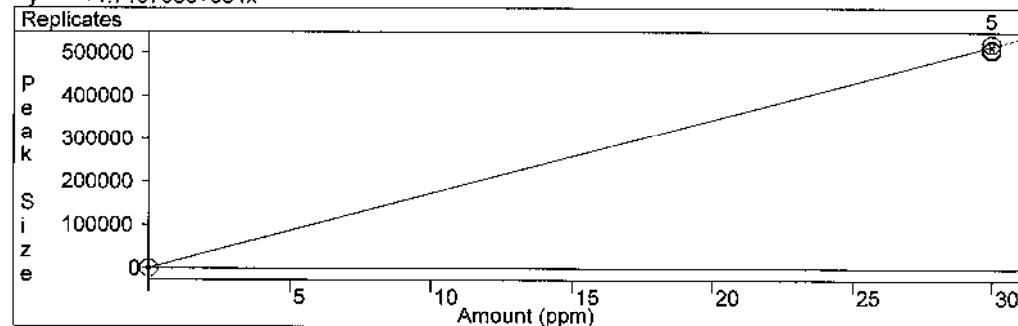
Curve Type: Linear

Origin: Force

 $y = +1.719798e+004x$

Resp. Fact. RSD: 1.481%

Coeff. Det.(r²): 0.998948



C16

External Standard Analysis

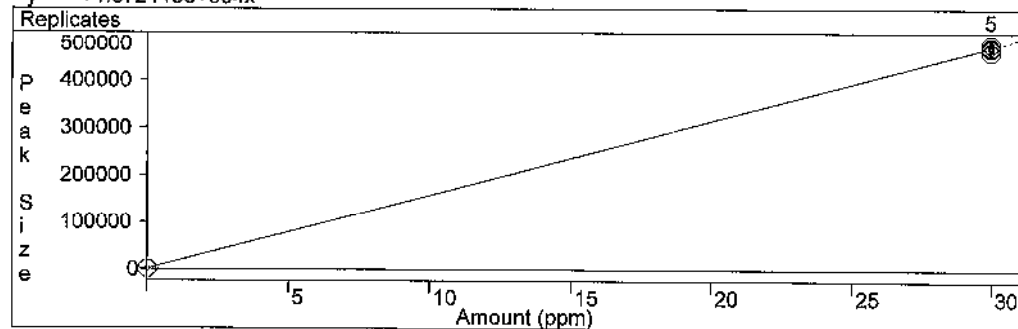
Curve Type: Linear

Origin: Force

 $y = +1.572118e+004x$

Resp. Fact. RSD: 1.611%

Coeff. Det.(r²): 0.998756



CERTIFICATE

This is to certify, that

Somchai Pohthongkham

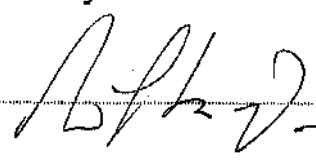
has participated the course

Basic GC and Sampler training

Date: **24 – 27 May 2004**

Location: **Middelburg**

Instructor: **W.J. Buys**

Signature instructor: 



Varian Analytical Instruments
Varian Chrompack International BV
Herculesweg 6
P.O. Box 8033
4330 EA Middelburg
The Netherlands
Tel: +31 118 671000
Fax: +31 118 631114
www.varianinc.com



WK Electric Co., Ltd.

88/242 Moo 5, Sawalprachara Rd., Tambol Ladsawai, Amphur Lamukha, Pathumthani 12150

Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com



Certificate of Calibration

Certificate No.: WK2412-053-1

Page 1 of 2

Customer : THAI UNIQUE CO., LTD.
80-82 Prachathipatai Rd., Bangkokphrom,
Pranakorn, Bangkok 10200

Instrument	: AMD Flow Meter	Ambient Temperature	: (23 ± 2) °C
Manufacturer	: Agilent Technologies	Humidity	: (50 ± 15) %RH
Model	: G6691A	Received Date	: 4-Dec-24
Serial No.	: MY16470347	Calibrated Date	: 11-Dec-24
Identity No.	: SV-DF-001	Issued Date	: 13-Dec-24
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	WK2405-049-5	22-May-25	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. Thippatai Mungpungklang

Approved by : 

Ms. Budeagorn 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.



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 : LF25-0305
Equipment : Thermometer
Manufacturer : Fluke
Model : 51
Serial Number : 5910857
Asset Number : 5910857
Customer : Thal Unique Co., Ltd.
80-82 Prachathipatal Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200
Date of Calibrate : 6-Jun-2025
Date of Issue : 6-Jun-2025

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 approval 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

Samak
Mr. Samak Uaonkaonoi
Metrology Technician

Approved by

Miss Juthamas Sukhathainirun
Miss Juthamas Sukhathainirun
Cal-Lab Manager

Certificate No. : LF25-0305

Model : 51

Serial No. : 5910857

Page 1 of 3



Agilent Technologies

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.

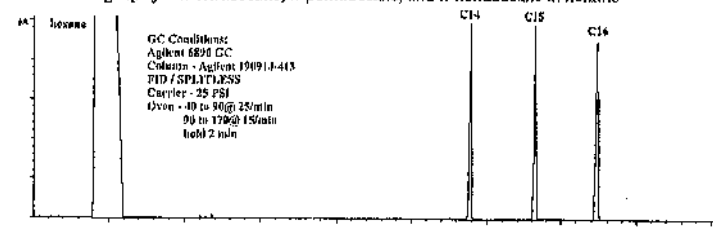
Concentrations:		
n-tetradecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-pentadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %
n-hexadecane	0.218 g/L ($\pm 0.5\%$)	0.033 w/w %

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 No : 26M2266
REFERENCE No : 80204-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : SUCHAT S.
CALIBRATION DATE : 05-Mar-26

APPROVED BY : PONGSAK J.
ISSUED DATE : 06-Mar-26
RECEIVED DATE : 05-Mar-26



CERTIFICATE No : 26M2266

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE
MANUFACTURER : METTLER TOLEDO
ID No : BA 05/50
AIR PRESSURE : 100mmbar ± 1mmbar
AMBIENT TEMPERATURE : 25° C ± 1° C
MODEL : XS105DU
S/N : 1126422905
RECEIVED DATE : 05-Mar-26
CALIBRATION DATE : 05-Mar-26
RELATIVE HUMIDITY : 50 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) STANDARD WEIGHT SET	E2	QK-1-131	C02250116	28-Jan-27
2) STANDARD WEIGHT	E2	15843	C02250117	29-Jan-27
- THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
- THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
- THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 120 g WAS 0.000055 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.00	0.00000	0.00000	0.000063
0.02	0.02000	0.00000	0.000065
0.10	0.10000	0.00000	0.000066
0.20	0.20000	0.00000	0.000066
0.50	0.50001	-0.00001	0.000065
1.00	1.00001	-0.00001	0.000066
2.00	2.00000	0.00000	0.000067
5.00	5.00001	-0.00001	0.000068
10.00	10.00004	-0.00004	0.000070
20.00	20.00006	-0.00006	0.000078
50.00	50.00000	0.00000	0.00012
100.00	100.00002	-0.00002	0.00019
120.00	120.00002	-0.00002	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 : Teerapat B

Date : Jun 6, 2025

(Mr. Teerapat Boonla)

Application Chemist



WO-11540201/2025

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	<u>S.P.S.Consulting Service Co.,Ltd</u>	Date Tested:	<u>December 18, 2025</u>
Address :	<u>7 Soi Phaholyothin 24</u>	Recommendation Recertification	
	<u>Paholyothin Road</u>	Period	<u>6 Months</u>
	<u>Jompol Chatuchak, Bangkok 1090</u>	Recertification Due:	<u>June 28, 2026</u>
User Name:	<u>K.Phenpha Vipasthawatt</u>	Date Last Certified:	<u>July 1, 2025</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>November 30, 2026</u>
<u>Wavecal Solution</u>	<u>N058-2152</u>	<u>July 30, 2026</u>
<u>VIS Wavecal solution</u>	<u>N930-2946</u>	<u>August 30, 2026</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>November 30, 2026</u>
CUSTOMER SUPPLIED	COMMENTS	CUSTOMER INITIALS
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		

Page 1 of 4



WO-11540201/2025

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER	<u>077C7042401</u>	DATE TESTED	<u>December 18, 2025</u>
1. MECHANICAL CHECKS			
A. Inspect and clean all fans and filters.			☐
B. Inspect and replace as necessary, all torch components including the RF coil.			☐
C. Inspect all tubing for sign of clacking or leaking.			☐
D. Adjust water and gas pressure regulator settings.			☐
E. Inspect and leak check pneumatics drawers.			☐
F. Clean the exterior of the instrument.			☐
2. OPTICAL CHECKS			
A. Inspect and clean all optical components.			☐
B. As required, check and replace all purgefilters.			☐
C. Recheck optical alignment.			☐
3. COOLING SYSTEM CHECKS			
A. Perform preventive maintenance on chiller.			☐
B. Flush out the chiller every year.			☐
4. PERFORMANCE CHECKS			
A. Torch View Alignment.			☐
B. Wavelength Calibration.			☐

Page 2 of 4



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401		DATE TESTED : December 18, 2025	
PARAMETER	SPECIFICATION	FINAL VALUE	
Spectral Resolution : UV	As 193.696 nm	≤ 0.007	0.00530
	Ni 231.604 nm	≤ 0.008	0.00708
	Ni 341.476 nm	≤ 0.012	0.00776
Spectral Resolution : VIS	La 408.672 nm	≤ 0.020	0.01614
	Ba 455.403 nm	≤ 0.025	0.02377
Precision	As 193.656 nm	% RSD < 1.0	0.67 %
	Zn 213.856 nm	% RSD < 1.0	0.62 %
	Mn 257.610 nm	% RSD < 1.0	0.88 %
	La 379.478 nm	% RSD < 1.0	0.63 %
	Ba 455.403 nm	% RSD < 1.0	0.65 %
	Ba 493.408 nm	% RSD < 1.0	0.45 %
	Detection Limits : Axial	Tl 190.080 nm	3(sd)
	As 193.696 nm	3(sd)	6.06 ppb
	Pb 220.353 nm	3(sd)	0.92 ppb
Detection Limits : Radial	As 193.696 nm	3(sd)	17.35 ppb
	Zn 213.856 nm	3(sd)	1.79 ppb
	Mn 257.610 nm	3(sd)	0.18 ppb
	La 379.478 nm	3(sd)	0.76 ppb
	Ba 455.403 nm	3(sd)	0.11 ppb
	Ba 493.408 nm	3(sd)	0.56 ppb
BEC : Axial (IB X 500)/(IS-IB)	Cd 226.502 nm	≤ 150 ppb	40.52
BEC : Radial (IB X 1000)/(IS-IB)	Mn 257.610 nm	≤ 45 ppb	42.33



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER	077C7042401	DATE TESTED	December 18, 2025
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: <u>Wiphan Promlumda</u>			
(Wiphan Promlumda)			
Service Engineer			

เอกสารแนบ 5-7

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานประกอบการ

Request No. 21-69/0204

MTC No. EEL, BP. 152/0169

CALIBRATION CERTIFICATE

Submitted by : S.P.S. CONSULTING SERVICE CO., LTD.

Address : 7 Soi Phaholyothin 34, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003; The sound pressure level 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 : 29 Jan. 2026

Date of Calibration : 11 Feb. 2026

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

FMJL/MTC.002 Rev.5

Request No. 21-69/0204

MTC No. EEL, BP. 152/0169

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	93.89	-0.11	± 0.10	± 0.40 dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.90	± 0.50	± 3.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr. Weerachai Deechaiyae)

Approved by :

(Mr. Prawate Klunaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 11 Feb. 2026

Date of Issue : 12 Feb. 2026

Ref : 2011269012900497001

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

FMJL/MTC.002 Rev.5



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24 Phaholyothin Rd. Jompet Chatuchak, Bangkok 10900
Tel 1662-939-43/12-32 Fax 1662-513-4221, E mail : sale@spscl.com, www.spscl.com

Noise R_168/26

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	11 February 2026
		Due Date	11 February 2027

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B36	ACO	6236	00192027	08 April 2026	93.9	93.9
ACO-R41	ACO	6236	00192053	08 April 2026	93.9	93.9
ACO-R50	ACO	6236	00192062	08 April 2026	94.0	93.9
ACO-R51	ACO	6236	00192063	08 April 2026	93.9	93.9
ACO-R52	ACO	6236	00192064	08 April 2026	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.89 ± 0.10 dB	

Calibrated by :

Heeson

(Mr. Heeson Lormae)

Approved by :

Yutthana S.

(Mr. Yutthana Tanatharanit)



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, Chatsuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sales@specon.com, www.specon.com

Noise R_271/26

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	11 February 2026
		Due Date	11 February 2027

Calibration Data

Sound Level Meter Data

Calibration Data

Actual Reading [dB]

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B43	ACO	6236	00192034	11 May 2026	93.9	93.9

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

93.81 ± 0.10 dB

Calibrated by :

Heeson L.
(Mr. Heeson Lormae)

Approved by :

Yutthana J.
(Mr. Yutthana Tanatharanit)

เอกสารแนบ 5-8

เอกสารสอบเทียบเครื่องมือการตรวจวัดปริมาณเสียงสะสมติดตัวพนักงาน

Request No. 21-68/0514

MTC No. EEL. BP. 34/0868

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 : SVANTEK

Model : SV34

Serial No. : 83820

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.

7. Condenser Microphone B&K 4180 S/N 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 : 14 Aug. 2025

Date of Calibration : 22 Aug. 2025

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/LMTC.002 Rev.5

Request No. 21-68/0514

MTC No. EEL. BP. 34/0868

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	114.02	0.02	± 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	0.21	± 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 Klunaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Aug. 2025

Date of Issue : 25 Aug. 2025

Ref : 2011268081403169011

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/LMTC.002 Rev.5



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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 : (062) 909-1370-72 Fax : (062) 513-4221 E-mail : sale@spscon.com, www.spscon.com

Noise Dose R_176/26

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 03/60
Model	SV34	Serial No.	83820
Calibration Range	114 dB, 1000 Hz	Last Calibration	25 August 2025
		Due Date	25 August 2026

Calibration Data

Sound Level Meter Data

Calibration Data

SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B12	SVANTEK	SV-104IS	80832	08 April 2026	114.0	114.0
NMD-B13	SVANTEK	SV-104IS	80834	08 April 2026	114.0	114.0
NMD-B14	SVANTEK	SV-104IS	80875	08 April 2026	114.1	114.0
NMD-B15	SVANTEK	SV-104IS	80880	08 April 2026	114.0	114.0
NMD-B16	SVANTEK	SV-104IS	106120	08 April 2026	114.0	114.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					114.02± 0.10 dB	

Calibrated by :

Heeson L
(Mr. Heeson Lormae)

Approved by :

Yutthana S.
(Mr. Yutthana Tanatharanit)



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 : sales@spscon.com, www.spscon.com

Noise Dose R_272/26

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

Brand	SVANTEK	Number	SV 03/60
Model	SV34	Serial No.	83820
Calibration Range	114 dB, 1000 Hz	Last Calibration	25 August 2025
		Due Date	25 August 2026

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-R35	SVANTEK	SV-104IS	80873	11 May 2026	114.0	114.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					114.02± 0.10 dB	

Calibrated by :

Heeson L.
(Mr. Heeson Lormae)

Approved by :

Yutthana J.
(Mr. Yutthana Tanatharanit)

เอกสารแนบ 5-9

เอกสารสอบเทียบเครื่องมือการตรวจวัดแสงสว่างในสถานประกอบการ



Certificate of Calibration

Certificate Number : SPR25120318-1 Page : 1 of 3
 Customer : S.P.S. CONSULTING SERVICE CO., LTD.
 7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,
 Bangkok 10900

Equipment Name : Light Meter
 Manufacturer : Extech
 Model : 407026
 Serial Number : A.055623
 ID. Number : LUX-R09

Environmental Conditions

Ambient Temperature : 23 °C ± 3 °C Received Date : 26 Dec 2025
 Relative Humidity : 50 % ± 15 % Calibration Date : 27 Dec 2025
 Location of Calibration : In-Lab Recommend Due Date : 27 Dec 2026
 Calibration Procedure : SP-CPE-04-32 Date of Issue : 28 Dec 2025

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.Nanthawat Wanasit

Calibration Officer

Approved by



(Signature)

(Mr.Pootthipong A.)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR25120318-1 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due Date
Illuminance Meter	T-10A /T-10MA	20023158/3102317	25PH505	21 Oct 2026

Traceability

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

SP-FM-04-15 rev.0

Result of Calibration

Certificate Number : SPR25120318-1

Page : 3 of 3

Function/ Illumination Measurement

Unit : Lux

Calibration Point	Standard Reading	UUC Reading	Error	Uncertainty (±)
100	100.0	97	-3	1.3
200	200.0	196	-2	6.6
300	300	298	-2	6.6
1000	1000	1000	0	13
2000	2000	1982	-18	26
3000	3000	2970	-30	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 5-10

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับความร้อนในสถานประกอบการ



Certificate of Calibration

Certificate Number : SPR25100063-6 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 : Quest Technologies
Model : QUESTemp 32
Serial Number : TPK120034
ID. Number : B33

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 06 Oct 2025
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 21 Oct 2025
Location of Calibration : In-Lab Recommend Due Date : 21 Oct 2026
Calibration Procedure : SP-CPT-04-13 Date of Issue : 22 Oct 2025

Method of Calibration

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

Calibrated by : Mr.Jirasak. Pumbut

Calibration Officer

Approved by

(Mr.Pootthipong A.)

Authorized Signatory



SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR25100063-6 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due Date
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2026
Temp & Humidity Test Chamber	TEMI1500-01/SD/N/N	S7110ZL742-1014	SPR25040010-13	20 Apr 2026

Traceability

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

NA - NA Caltechnologies Co., Ltd.

SP Metrology - SP Metrology system (Thailand) Co.Ltd.

SP-FM-04-15 rev.0



Result of Calibration

Certificate Number : SPR25100063-6

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.007	30.0	-0.007	0.20
35.0	35.009	35.1	0.091	0.20
40.0	40.005	40.1	0.095	0.21

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.007	30.1	0.093	0.20
35.0	35.009	35.1	0.091	0.20
40.0	40.005	40.1	0.095	0.21

Temperature Accuracy in the Measurement. (GLOVE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.007	29.9	-0.107	0.20
35.0	35.009	34.9	-0.109	0.20
40.0	40.005	39.9	-0.105	0.21

Note :

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25100063-4 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 34

Serial Number : TEN040005

ID. Number : R04

Environmental Conditions

Ambient Temperature : 23 °C ± 2 °C Received Date : 06 Oct 2025

Relative Humidity : 50 % ± 15 % Calibration Date : 08 Oct 2025

Location of Calibration : In-Lab Recommend Due Date : 08 Oct 2026

Calibration Procedure : SP-CPT-04-13 Date of Issue : 09 Oct 2025

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 Uengsang

Calibration Officer

Approved by



(Mr.Pootthipong A.)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR25100063-4 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2026
Temp & Humidity Test Chamber	TEMI1500-01/SD/N/N/	S7110ZL742 1014	SPR25040010-13	20 Apr 2026

Traceability

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

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SP-FM-04-15 rev.0

Result of Calibration

Certificate Number : SPF25100063-4

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.8	-0.214	0.20
35.0	35.012	34.8	-0.212	0.20
40.0	40.018	39.8	-0.218	0.20

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.7	-0.314	0.20
35.0	35.012	34.7	-0.312	0.20
40.0	40.018	39.7	-0.318	0.20

Temperature Accuracy in the Measurement. (GLOVE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.8	-0.214	0.20
35.0	35.012	34.8	-0.212	0.20
40.0	40.018	39.8	-0.218	0.20

Note :

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR26010387-2 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 : MCD070035
 ID. Number : R05

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 30 Jan 2026
 Relative Humidity : $50\% \pm 15\%$ Calibration Date : 03 Feb 2026
 Location of Calibration : In-Lab Recommend Due Date : 03 Feb 2027
 Calibration Procedure : SP-CPT-04-13 Date of Issue : 04 Feb 2026

Method of Calibration

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

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

Calibrated by : Mr.Jirasak Pumbut

Calibration Officer

Approved by



(Mr.Worapong Sinthusopa)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR26010387-2 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due Date
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2027
Temp & Humidity Test Chamber	TEMI1500-01/SD/N/N/	ST110ZL742 1014	SPR25040010-13	20 Apr 2026

Traceability

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

SP-FM-04-15 rev.0



Result of Calibration

Certificate Number : SPR26010387-2

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.009	29.7	-0.309	0.20
35.0	35.012	34.7	-0.312	0.20
40.0	40.017	39.7	-0.317	0.21

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.009	29.7	-0.309	0.20
35.0	35.012	34.7	-0.312	0.20
40.0	40.017	39.7	-0.317	0.21

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.009	29.7	-0.309	0.20
35.0	35.012	34.7	-0.312	0.20
40.0	40.017	39.7	-0.317	0.21

Note :

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration

Certificate Number : SPR25100063-3 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 : Metrosonics

Model : hs-32

Serial Number : MCD070028

ID. Number : R06

Environmental Conditions

Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 06 Oct 2025

Relative Humidity : $50\% \pm 15\%$ Calibration Date : 08 Oct 2025

Location of Calibration : In-Lab Recommend Due Date : 08 Oct 2026

Calibration Procedure : SP-CPT-04-13 Date of Issue : 09 Oct 2025

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



(Mr.Poothipong A.)

Authorized Signatory

SP-FM-04-15 rev.0



Calibration Report

Certificate Number : SPR25100063-3 Page : 2 of 3

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
THERMO-HYGROMETER	5020A	A47046	TMU2500342	29 Jan 2026
Temp & Humidity Test Chamber	TEMI1500-01/SD/N/N/	S7110ZL742 1014	SPR25040010-13	20 Apr 2026

Traceability

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

NA - NA Caltechnologies Co., Ltd.

SP Metrology - SP Metrology system (Thailand) Co.Ltd.

SP-FM-04-15 rev.0

Result of Calibration

Certificate Number : SPR25100063-3

Page : 3 of 3

Temperature Accuracy in the Measurement: (WET)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.8	-0.214	0.20
35.0	35.012	34.8	-0.212	0.20
40.0	40.018	39.8	-0.218	0.20

Temperature Accuracy in the Measurement: (DRY)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.9	-0.114	0.20
35.0	35.012	34.9	-0.112	0.20
40.0	40.018	39.9	-0.118	0.20

Temperature Accuracy in the Measurement: (GLOVE)

Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.014	29.9	-0.114	0.20
35.0	35.012	34.9	-0.112	0.20
40.0	40.018	39.9	-0.118	0.20

Note :

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

Measurement Uncertainty

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

- End of Certificate -



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

Heat R024

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: B33	Verification Date	: 07 April 2026
Brand	: Quest Technologies	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 32	Barometric Pressure	: 1011 mmbar
Serial No.	: TPK120034	Relative Humidity	: 4 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Heeson L.
(Mr.Heeson Lormae)

Approved by : Yutthana Tanatharanit
(Mr.Yutthana Tanatharanit)



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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

Heat R024

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R04	Verification Date	: 07 April 2026
Brand	: Quest Technologies	Ambient Temp.	: 24.5 °C
Model	: QUESTemp 34	Barometric Pressure	: 1011 mmbar
Serial No.	: TEN040005	Relative Humidity	: 49 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.5	0.0	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.3	-0.2	± 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 : Heeson L.
(Mr. Heeson Lormae)

Approved by : Yutthana Tanatharanit
(Mr. Yutthana Tanatharanit)



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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 R024

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R05	Verification Date	: 07 April 2026
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	12.3	0.2	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.1	0.0	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.1	0.2	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Heeson L.
(Mr. Heeson Lormae)

Approved by : Yutthana F.
(Mr. Yutthana Tanatharanit)



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

Heat R024

Heat Stress WBGT Meter Verification Report			
Verification Data			
Heat Stress WBGT Meter No.	: R06	Verification Date	: 07 April 2026
Brand	: METROSONICS	Ambient Temp.	: 24.5 °C
Model	: hs-32	Barometric Pressure	: 1011 mmbar
Serial No.	: MCD070028	Relative Humidity	: 4 %
Verification Module (Electronic Sensor Check) :			
Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C			
Result of Verification : Without Adjustment			
Wet Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5
Dry Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5
Globe Probe Temperature Measurement			
Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5
UUC* = UNIT UNDER CALIBRATION			

Verified by : Heeson L.
(Mr. Heeson Lormae)

Approved by : Yutthana F.
(Mr. Yutthana Tanatharanit)