ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

เอกสารแนบ 5-1 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศบริเวณชุมชน

เอกสารแนบ 5-2 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ บริเวณอุตสาหกรรมบางปู

เอกสารแนบ 5-3 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่องเตาเผา

เอกสารแนบ 5-4 เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงโดยทั่วไป

เอกสารแนบ 5-5 เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงของเครื่องจักร

เอกสารแนบ 5-6 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำเสียจากบ่อพักน้ำเสีย

เอกสารแนบ 5-7 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำฝน

เอกสารแนบ 5-8 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำในบ่อสังเกตการณ์การรั่วซึมของถังเก็บน้ำเสีย

เอกสารแนบ 5-9 เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำใต้ดิน

เอกสารแนบ 5-10 เอกสารสอบเทียบเครื่องมือการตรวจวัดฝุ่นละอองในสถานที่ทำงาน

เอกสารแนบ 5-11 เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานที่ทำงาน

เอกสารแนบ 5-12 เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงที่ลูกจ้างได้รับเฉลี่ยตลอดเวลาการทำงานในแต่ละวัน (TWA)

เอกสารแนบ 5-13 เอกสารสอบเทียบเครื่องมือการตรวจวัดความร้อนบริเวณพื้นที่ปฏิบัติงาน (WBGT)

เอกสารแนบ 5-14 เอกสารสอบเทียบเครื่องมือการตรวจวัดความร้อนที่พนักงานได้รับจากการปฏิบัติงาน

เอกสารแนบ 5-15 เอกสารสอบเทียบเครื่องมือการตรวจวัดสารเคมีในบรรยากาศของสถานที่ทำงาน

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศในบรรยากาศบริเวณชุมชน		
SO_2	SO_2 Analyzer No. B07, B09, B10, B11	SO_2 Analyzer No. B07, B09, B10, B11
NO_2	NO_2 Analyzer No. B02, B03, B13, B15	NO_2 Analyzer No. B02, B03, B13, B15
TSP	High Volume Air Sampler No. B04, B08, B11, R04	Digital Balance
PM_{10}	High Volume PM10 Air Sampler No. B03, B14, R11, R17	Digital Balance
Cadmium	High Volume Air Sampler No. B04, B08, B11, R04	ICP
Arsenic	High Volume Air Sampler No. B04, B08, B11, R04	ASS
Lead	High Volume Air Sampler No. B04, B08, B11, R04	ICP
Mercury	High Volume Air Sampler No. B04, B08, B11, R04	ASS
Beryllium	High Volume Air Sampler No. B04, B08, B11, R04	ICP
Nickel	High Volume Air Sampler No. B04, B08, B11, R04	ICP
คุณภาพอากาศในบรรยากาศบริเวณอุตสาหกรรมบางปู		
Arsenic	High Volume Air Sampler No. B18	ASS
Nickel	High Volume Air Sampler No. B18	ICP
คุณภาพอากาศจากปล่อง		
Particulate	Console No. B04 Pitot Tube No. B04	Digital Balance
HCl	Console No. B04 Pitot Tube No. B04	IC
CO	Personal Pump SKC No. B62 Rotameter No. H-B09	CO Analyzer No. B01
SO_2	Personal Pump SKC No. B06 Rotameter No. H-B09	-
NO_X	Vacuum Gauge	Spectrophotometer
Dioxin	Console No. B02 Pitot Tube No. B04	GC/MS

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพอากาศจากปล่อง (ต่อ)		
Mercury	Console No. B04 Pitot Tube No. B04	AAS
Cadmium	Console No. B04 Pitot Tube No. B04	ICP
Lead	Console No. B04 Pitot Tube No. B04	ICP
Arsenic	Console No. B04 Pitot Tube No. B04	AAS
Beryllium	Console No. B04 Pitot Tube No. B04	ICP
Chromium	Console No. B04 Pitot Tube No. B04	ICP
HF	Console No. B04 Pitot Tube No. B04	IC
Hydrogen bromide	Personal Pump DG No. B02 Rotameter No. H-B09	IC
ระดับเสียงในบรรยากาศ		
LAeq 24 hr	Acoustic Calibrator No. 130006	-
LAeq 1 hr LA90 LAmax LAdn	Sound Level Meter No. ACO-B37, B38, C1-B03, C1-B04	
ระดับเสียงของเครื่องจักร		
LAeq 5 min	Acoustic Calibrator No. 130006	-
	Sound Level Meter No. ACO-B41, B43	
คุณภาพน้ำเสียจากบ่อพักน้ำเสีย		
pH	-	pH Meter
Temperature	-	Thermometer
Color	-	Spectrophotometer
Total Dissolved Solids	-	Digital balances
		Incubator
Total Suspended Solids	-	Digital balances
BOD	-	DO Meter
COD	-	COD Reactor
Cyanide	-	Spectrophotometer
Grease And Oil	-	Digital balances
Formaldehyde	-	Spectrophotometer
Phenol compound	-	Spectrophotometer

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพน้ำเสียจากบ่อพักน้ำเสีย (ต่อ)		
TKN	-	Block Digestion
Fluoride	-	Spectrophotometer
Surfactants	-	Spectrophotometer
Pesticide	-	GC/MS
Lead	-	ICP
Cadmium	-	ICP
Copper	-	ICP
Zinc	-	ICP
Trivalent Chromium	-	Spectrophotometer
		ICP
Hexavalent Chromium	-	Spectrophotometer
Nickel	-	ICP
Arsenic	-	AAS
Mercury	-	AAS
Barium	-	ICP
Selenium	-	AAS
Manganese	-	ICP
Silver	-	ICP
Total Iron	-	ICP
Ammonia-Nitrogen	-	Spectrophotometer
คุณภาพน้ำฝน		
pH	-	pH Meter
Temperature	-	Thermometer
EC	-	Conductivity Meter
Dissolved Oxygen	-	DO Meter
BOD	-	DO Meter
Total Coliform Bacteria	-	Incubator
Fecal Coliform Bacteria	-	Water bath
Nitrate-Nitrogen	-	Spectrophotometer
Ammonia-Nitrogen	-	Spectrophotometer
Phenols	-	Spectrophotometer
Copper	-	ICP
Nickel	-	ICP
Manganese	-	ICP
Zinc	-	ICP
Cadmium	-	ICP
Hexavalent Chromium	-	Spectrophotometer
Lead	-	ICP
Mercury	-	AAS
Arsenic	-	AAS

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
คุณภาพน้ำฝน (ต่อ)		
Cyanide	-	Spectrophotometer
คุณภาพน้ำในบ่อสังเกตการณ์		
การรั่วซึมของถังเก็บน้ำเสีย		
pH	-	pH Meter
EC	-	Conductivity Meter
Total Dissolved Solids	-	Digital balances
BOD_5	-	DO Meter
COD	-	COD Reactor
คุณภาพน้ำใต้ดิน	-	
pH	-	pH Meter
Total Chromium	-	ICP
Copper	-	ICP
Nickel	-	ICP
Lead	-	ICP
Zinc	-	ICP
Benzene	-	GC/MS
Xylene	-	GC/MS
Toluene	-	GC/MS
Total Xylene	-	GC/MS
Methanol	-	GC/MS
TPH (C5-C8)	-	GC/FID
TPH (C>8-C16)	-	GC/FID
TPH (C>16-C35)	-	GC/FID
ฝุ่นละอองในสถานที่ทำงาน		
Total Dust	Personal Pump No. B08, B89 Rotameter No. H-B07	Digital Balance
Respirable Dust	Personal Pump No. B07, B83 Rotameter No. H-B07	Digital Balance
ระดับเสียงในสถานที่ทำงาน		
Leq 8 hr	Acoustic Calibrator No. 130006	-
Lmax	Sound Level Meter No. ACO-B18, B29, B33, B36, B41	
ระดับเสียงที่ลูกจ้างได้รับเฉลี่ยตลอดเวลาการทำงานในแต่ละวัน		
Noise Dose	Acoustic Calibrator No. 83820	-
	Noise Dosimeter No. NMD-B06, B07, B12, B13, B14	

RP/B062/2025/BPEC/JAN-JUN/CAL

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

รายการตรวจวัด	เครื่องมือเก็บตัวอย่าง	เครื่องมือตรวจวิเคราะห์
	ชื่อเครื่องมือ	ชื่อเครื่องมือ
ความร้อนบริเวณพื้นที่ปฏิบัติงาน WBGT	Heat Stress WBGT Meter No. B05, B07, B11, B12, B17	-
ความร้อนที่พนักงานได้รับจากการปฏิบัติงาน WBGT	Heat Stress WBGT Meter No. B05, B07, B11, B12, B17	-
สารเคมีในบรรยากาศของสถานที่ทำงาน Sodium Hydroxide	Personal Pump No. B64 Rotameter No. H-B07	-
Hydrogen Chloride	Personal Pump No. B45 Rotameter No. H-B07	IC
Ammonia	Personal Pump No. B68, B87 Rotameter No. L-B07	IC
Benzene	Personal Pump No. B79 Rotameter No. L-B07	GC/FID
Toluene	Personal Pump No. B92 Rotameter No. L-B07	GC/FID
Xylene	Personal Pump No. B56 Rotameter No. L-B07	GC/FID
Thinners as Methanol	Personal Pump No. B03 Rotameter No. L-B07	GC/FID

เอกสารแนบ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศบริเวณชุมชน

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CALIBRATION REPORT

SO_2 FLUORESCENT ANALYZER

DATE :	09 March 2025	BRAND :	API	MODEL :	100E
NO.	SO_2-B07			SERIAL NO.	1706

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Sulphur Dioxide (SO_2)			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 49.8 ppm

CALIBRATING CONDITION

Pressure	1011	mmbar	Temp.	24.6	24.6	% RH	50

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	400.3	0.075	400.0	1.011

API Model 100E SO_2 Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.5	in-Hg	25-35
SAMPLE FLOW	659	cc/min	650 ± 10%
PMT	103.1	mV	-20-150 with Zero Air
UV LAMP	3019.5	mV	1000-4900
STR. LGT	61.8	PPB	<100
DRK PMT	63.3	mV	-50 - 200
DRK LMP	58.1	mV	-50 - 200
HVPS	674	V	550-900 constant
DCPS	2528	mV	2500 ± 200
RCELL TEMP	50.3	°C	50 ± 1
BOX TEMP	29.1	°C	5-40
PMT TEMP	7.4	°C	7 ± 2.0
SO_2 Span Conc	400	PPB	20-20,000
SO_2 Slope	1.011	-	1.0 ± 0.3
SO_2 Offset	21.9	mV	<250
Stability at Zero	0.1	PPB	<0.2
Stability at Span	0.2	PPB	0.5% of reading (above 50 ppb)

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr.Peera Detudom)

บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
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CALIBRATION REPORT

SO_2 FLUORESCENT ANALYZER

DATE :	09 March 2025	BRAND :	Thermo	MODEL :	43C
NO.	SO2-B09			SERIAL NO.	43C-59325-322

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Sulphur Dioxide (SO_2)			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 49.8 ppm

CALIBRATING CONDITION

Pressure	1011	mmbar	24.6	24.6	°C	50 % RH	50

CALIBRATION SETTING

Span	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
Set Point	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.11	-	0
SO_2 Span	400.0	400.2	0.050	400.0

INSTRUMENT STATUS

CHAMBER TEMP	44.5 °C	FLOW	1.0 LPM
PRESSURE	728.7 mm Hg		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr.Peera Detudom)

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CALIBRATION REPORT

SO_2 FLUORESCENT ANALYZER

DATE :	09 March 2025	BRAND :	Thermo	MODEL :	43C
NO.	SO2-B10			SERIAL NO.	43C-69604-364

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Sulphur Dioxide (SO_2)			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 49.8 ppm

CALIBRATING CONDITION

Pressure	1011	mmbar	24.6	24.6	°C	50	% RH

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
SO_2 Span	400.0	399.7	-0.075	400.0

INSTRUMENT STATUS

CHAMBER TEMP	44.3 °C	FLOW	1.0 LPM
PRESSURE	728.6 mm Hg		

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr.Peera Detudom)

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CALIBRATION REPORT

SO_2 FLUORESCENT ANALYZER

DATE :	09 March 2025	BRAND :	TELEDYNE	MODEL :	TML-50
NO.	SO_2-B11			SERIAL NO.	SO2187

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Sulphur Dioxide (SO_2)			Cylinder No.	: A00814SK
Certified Date	: 21 June 2021	Expired Date	: 21 June 2029	Cylinder Conc.	: 49.8 ppm

CALIBRATING CONDITION

Pressure	1011	mmbar	Temp.	24.6	24.6	% RH	50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
SO_2 Span	400.0	399.8	-0.050	400.0	1.007

API Model 100A SO_2 Analyzer Check list

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	0-500
SAMPLE PRESS	28.4	in-Hg	25-35
SAMPLE FLOW	657	cc/min	650 ± 10%
PMT	103.2	mV	-20-150 with Zero Air
UV LAMP	3026.7	mV	1000-4900
STR. LGT	61.6	PPB	<100
DRK PMT	63.1	mV	-50 - 200
DRK LMP	57.9	mV	-50 - 200
HVPS	673	V	550-900 constant
DCPS	2521	mV	2500 ± 200
RCELL TEMP	50.0	℃	50 ± 1
BOX TEMP	29.2	℃	5-40
PMT TEMP	7.3	℃	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 : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr.Peera Detudom)

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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
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Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO_2 / NO_X ANALYZER

DATE : 09 March 2025 BRAND : API MODEL : 200A

NO. NOX-B02 SERIAL NO. 2409

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00726SV
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.8	-0.050	400.0	1.008
NO_x Span	400	400.2	0.050	400.0	1.012

API Model 200A NO_x Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	508	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.4	mV	-20 - 150
AZERO	94.2	mV	-20 - 150
HVPS	670	V	420 - 900 constant
RCELL TEMP	50.2	°C	50 ± 1
BOX TEMP	29.4	°C	8 - 48
PMT TEMP	7.5	°C	7 ± 2
MOLY TEMP	315.2	°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	1.008	-	1.0 ± 0.3
NO_x Slope	1.012	-	1.0 ± 0.3
NO Offset	1.5	mV	-20 to +150
NO_x Offset	0.9	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by : Adul Dangklam
(Mr.Adul Dangklom)

Approved by :
(Mr.Peera Detudom)

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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO_2 / NO_X ANALYZER

DATE : 09 March 2025 BRAND : API MODEL : 200A

NO. NOX-B03 SERIAL NO. 2617

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00726SV
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm

CALIBRATING CONDITION

Pressure 1011 mmbar Temp. 24.6 °C % RH 50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.11	-	0	-
NO Span	400	400.1	0.025	400.0	1.010
NO_x Span	400	400.3	0.075	400.0	1.014

API Model 200A 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	511	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.1	mV	-20 - 150
AZERO	93.9	mV	-20 - 150
HVPS	673	V	420 - 900 constant
RCELL TEMP	50.4	°C	50 ± 1
BOX TEMP	29.0	°C	8 - 48
PMT TEMP	7.2	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.5	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.7	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO_x Span Conc	400	PPB	20 - 20,000
NO Slope	1.010	-	1.0 ± 0.3
NO_x Slope	1.014	-	1.0 ± 0.3
NO Offset	1.7	mV	-20 to +150
NO_x Offset	1.0	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by : Adul Dangklam
(Mr.Adul Dangklom)

Approved by :
(Mr.Peera Detudom)

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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO_2 / NO_X ANALYZER

DATE :	09 March 2025	BRAND :	API	MODEL :	200A
NO.	NOX-B13			SERIAL NO.	1983

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00726SV
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm

CALIBRATING CONDITION

Pressure	1011 mmbar	Temp.	24.6 °C	% RH	50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	-0.10	-	0	-
NO Span	400	399.7	-0.075	400.0	1.006
NO_X Span	400	400.1	0.025	400.0	1.010

API Model 200E NO_X Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	512	cc/min	500 ± 50
OZONE FLOW	79	cc/min	80 ± 15
PMT	103.2	mV	-20 - 150
AZERO	94.0	mV	-20 - 150
HVPS	675	V	420 - 900 constant
RCELL TEMP	50.1	°C	50 ± 1
BOX TEMP	29.2	°C	8 - 48
PMT TEMP	7.3	°C	7 ± 2
MOLY TEMP	315.1	°C	315 ± 5
RCELL PRESS	8.4	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.6	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO_X Span Conc	400	PPB	20 - 20,000
NO Slope	1.006	-	1.0 ± 0.3
NO_X Slope	1.010	-	1.0 ± 0.3
NO Offset	1.2	mV	-20 to +150
NO_X Offset	0.8	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by : Adul Dangklam (Mr.Adul Dangklom)

Approved by : (Mr.Peera Detudom)

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CALIBRATION REPORT

CHEMILUMINESCENT NO / NO_2 / NO_X ANALYZER

DATE :	09 March 2025	BRAND :	API	MODEL :	200A
NO.	NOX-B15			SERIAL NO.	213

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Nitric Oxide (NO)			Cylinder No.	: A00726SV
Certified Date	: 05 January 2023	Expired Date	: 05 January 2026	Cylinder Conc.	: 48.8 ppm

CALIBRATING CONDITION

Pressure	1011 mmbar	Temp.	24.6 °C	% RH	50

CALIBRATION SETTING

Span Set Point	Initial Reading (Before Adj.),PPB			Final Reading (After Adj.),PPB	
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response	Slope
Zero	0	0.10	-	0	-
NO Span	400	399.6	-0.100	400.0	1.004
NO_X Span	400	399.9	-0.025	400.0	1.008

API Model 200A NO_X Analyzer Check List

Test Values	Observed Value	Units	Nominal Range
RANGE	500	PPB	500 standard
STABILITY (Zero Gas)	0.1	PPB	< 2 with zero air
SAMPLE FLOW	506	cc/min	500 ± 50
OZONE FLOW	78	cc/min	80 ± 15
PMT	103.0	mV	-20 - 150
AZERO	93.7	mV	-20 - 150
HVPS	672	V	420 - 900 constant
RCELL TEMP	50.5	°C	50 ± 1
BOX TEMP	29.1	°C	8 - 48
PMT TEMP	7.4	°C	7 ± 2
MOLY TEMP	314.9	°C	315 ± 5
RCELL PRESS	8.2	IN-Hg-A	2 - 10 constant
SAMPLE PRESS	28.4	IN-Hg-A	25 - 30 constant
NO Span Conc	400	PPB	20 - 20,000
NO_X Span Conc	400	PPB	20 - 20,000
NO Slope	1.004	-	1.0 ± 0.3
NO_X Slope	1.008	-	1.0 ± 0.3
NO Offset	1.0	mV	-20 to +150
NO_X Offset	0.6	mV	-20 to 150
Stability at Zero	0.1	PPB	< 0.2
Stability at Span	0.2	PPB	< 2 ppb @ 400 ppb span gas

Calibrated by : Adul Dangklam (Mr.Adul Dangklom)

Approved by : (Mr.Peera Detudom)

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High Volume Air Sampler Calibration Report

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

Calibration Data				
High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft^3/min)	R^2
B01	B01	05/02/2025	y = 1.190x-4.759	0.999
B02	B02	05/02/2025	y = 1.167x-1.802	0.999
B03	B03	03/02/2025	y = 1.142x-3.352	0.997
B04	B04	06/02/2025	y = 1.160x-3.139	0.998
B05	B05	06/02/2025	y = 1.155x-5.601	0.996
B06	B06	06/02/2025	y = 1.150x-1.476	0.999
B07	B07	03/02/2025	y = 1.143x-3.035	0.998
B08	B08	03/02/2025	y = 1.161x-4.459	0.999
B09	B09	05/02/2025	y = 1.177x-3.970	0.996
B10	B10	03/02/2025	y = 1.144x-2.471	0.998
B11	B11	03/02/2025	y = 1.195x-5.384	0.996
B12	B12	04/02/2025	y = 1.168x-4.228	0.998
B13	B13	04/02/2025	y = 1.165x-3.801	0.999
B14	B14	04/02/2025	y = 1.148x-3.248	0.996
B15	B15	04/02/2025	y = 1.173x-4.773	0.997
B16	B16	04/02/2025	y = 1.156x-4.042	0.998
B17	B17	06/02/2025	y = 1.140x-2.730	0.999
B18	B18	06/02/2025	y = 1.171x-4.178	0.999
B19	B19	06/02/2025	y = 1.151x-3.979	0.999
B20	B20	04/02/2025	y = 1.129x-1.255	0.999
B21	B21	04/02/2025	y = 1.132x-3.156	0.999
B22	B22	04/02/2025	y = 1.147x-2.649	0.997
B23	B23	03/02/2025	y = 1.158x-3.223	0.999
B24	B24	05/02/2025	y = 1.144x-3.476	0.997
B25	B25	03/02/2025	Y = 1.071x+1.478	0.997
B26	B26	04/02/2025	y = 1.142x-4.263	0.999
B27	B27	04/02/2025	y = 1.175x-5.192	0.996
B28	B28	04/02/2025	y = 1.173x-5.127	0.999
B29	B29	04/02/2025	y = 1.145x-1.952	0.996
B30	B30	06/02/2025	y = 1.162x-3.062	0.999
B31	B31	03/02/2025	y = 1.182x-5.652	0.998
B32	B32	03/02/2025	y = 1.167x-3.993	0.999
B33	B33	05/02/2025	y = 1.168x-4.451	0.998
B34	B34	05/02/2025	y = 1.127x-3.203	0.999

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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High Volume Air Sampler Calibration Report

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

Calibration Data				
High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft^3/min)	R^2
B35	B35	05/02/2025	y = 1.163x-3.579	0.997
B36	B36	05/02/2025	y = 1.130x-2.116	0.999
B37	B37	04/02/2025	y = 1.146x-2.265	0.996
B38	B38	04/02/2025	y = 1.156x-6.034	0.998
B39	B39	03/02/2025	y = 1.151x-3.366	0.998
B40	B40	03/02/2025	y = 1.174x-4.582	0.999
B41	B41	06/02/2025	y = 1.123x-1.633	0.997
B42	B42	03/02/2025	y = 1.149x-3.382	0.997
B43	B43	03/02/2025	y = 1.137x-2.074	0.997
B44	B44	03/02/2025	y = 1.155x-1.460	0.999
R01	R01	04/02/2025	y = 1.121x-3.007	0.999
R02	R02	03/02/2025	y = 1.159x-5.099	0.999
R03	R03	05/02/2025	y = 1.138x-2.774	0.998
R04	R04	05/02/2025	y = 1.118x-2.575	0.999
R05	R05	03/02/2025	y = 1.136x-1.720	0.998
R06	R06	05/02/2025	y = 1.154x-2.706	0.997
R07	R07	03/02/2025	y = 1.037x+1.361	0.999
R08	R08	03/02/2025	y = 1.146x-3.762	0.996
R09	R09	05/02/2025	y = 1.121x-2.360	0.997
R10	R10	05/02/2025	y = 1.180x-4.626	0.999
R11	R11	05/02/2025	y = 1.147x-3.861	0.996
R12	R12	03/02/2025	y = 1.128x-4.676	0.998
R13	R13	04/02/2025	y = 1.135x-4.055	0.999
R14	R14	04/02/2025	y = 1.153x-3.122	0.997
R15	R15	03/02/2025	y = 1.161x-5.223	0.998
R16	R16	03/02/2025	y = 1.187x-6.674	0.999
R17	R17	03/02/2025	y = 1.120x-1.730	0.999
R18	R18	03/02/2025	y = 1.146x-2.347	0.998
R19	R19	06/02/2025	y = 1.161x-5.195	0.999
R20	R20	06/02/2025	y = 1.134x-3.449	0.998

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(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	04/02/2025	y = 1.135x-1.122	0.996
B02	B02	04/02/2025	y = 1.140x-0.728	0.999
B03	B03	04/02/2025	y = 1.160x-3.702	0.998
B04	B04	05/02/2025	y = 1.154x-4.671	0.999
B05	B05	06/02/2025	y = 1.151x-2.705	0.998
B06	B06	03/02/2025	y = 1.114x-1.672	0.997
B07	B07	03/02/2025	y = 1.085x+0.543	0.996
B08	B08	04/02/2025	y = 1.149x-2.014	0.998
B09	B09	03/02/2025	y = 1.081x+0.344	0.997
B10	B10	03/02/2025	y = 1.094x-1.679	0.997
B11	B11	05/02/2025	y = 1.137x-0.690	0.997
B12	B12	03/02/2025	y = 1.094x-1.679	0.997
B13	B13	03/02/2025	y = 1.172x-3.186	0.998
B14	B14	05/02/2025	y = 1.160x-5.111	0.998
B15	B15	03/02/2025	y = 1.141x-2.637	0.998
B16	B16	04/02/2025	y = 1.106x+1.699	0.998
B17	B17	04/02/2025	y = 1.105x+1.676	0.998
B18	B18	04/02/2025	y = 1.176x-3.948	0.997
B19	B19	04/02/2025	y = 1.065x+0.997	0.998
B20	B20	04/02/2025	y = 1.163x-5.103	0.997
B21	B21	05/02/2025	y = 1.120x+0.250	0.999
B22	B22	06/02/2025	y = 1.152x-3.458	0.998
B23	B23	06/02/2025	y = 1.149x-3.696	0.999
B24	B24	03/02/2025	y = 1.109x-1.930	0.999
B25	B25	03/02/2025	y = 1.166x-4.876	0.998
B26	B26	05/02/2025	y = 1.118x-2.223	0.997
B27	B27	03/02/2025	y = 1.127x-3.668	0.999
B28	B28	04/02/2025	y = 1.112x-2.294	0.999
B29	B29	04/02/2025	y = 1.155x-4.309	0.997
B30	B30	04/02/2025	y = 1.136x-2.651	0.998
B31	B31	03/02/2025	y = 1.086x+2.828	0.999
B32	B32	04/02/2025	y = 1.099x-0.279	0.998
B33	B33	04/02/2025	y = 1.152x-4.474	0.997
B34	B34	04/02/2025	y = 1.149x-0.892	0.997

Calibrated by :	Approved by :
Adul Dangklom (Mr.Adul Dangklom)	(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	04/02/2025	y = 1.168x-5.536	0.996
R02	R02	04/02/2025	y = 1.116x-2.200	0.998
R03	R03	03/02/2025	y = 1.160x-5.911	0.997
R04	R04	03/02/2025	y = 1.129x-4.829	0.999
R05	R05	03/02/2025	y = 1.119x-3.825	0.998
R06	R06	05/02/2025	y = 1.125x-1.580	0.997
R07	R07	06/02/2025	y = 1.152x-2.503	0.997
R08	R08	03/02/2025	y = 1.114x-1.275	0.996
R09	R09	03/02/2025	y = 1.130x-4.187	0.999
R10	R10	05/02/2025	y = 1.151x-2.832	0.998
R11	R11	05/02/2025	y = 1.134x-2.692	0.997
R12	R12	05/02/2025	y = 1.158x-4.761	0.996
R13	R13	03/02/2025	y = 1.137x-3.435	0.999
R14	R14	03/02/2025	y = 1.126x-2.499	0.996
R15	R15	04/02/2025	y = 1.111x-3.285	0.999
R16	R16	04/02/2025	y = 1.124x-0.808	0.996
R17	R17	04/02/2025	y = 1.141x-3.412	0.999
R18	R18	03/02/2025	y = 1.115x-3.615	0.998
R19	R19	03/02/2025	y = 1.117x-0.234	0.996
R20	R20	06/02/2025	y = 1.146x-4.675	0.997

Calibrated by :	Approved by :
Adul Dangklom (Mr.Adul Dangklom)	(Mr. Peera Detudom)

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

NSC-TISI-TISI7025
CALIBRATION 0349

CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

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.

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

CERTIFICATE No : 25M2254

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 ± 1mbar	**CALIBRATION DATE**	:	07-Mar-25
AMBIENT TEMPERATURE	:	24° C ± 1° C	**RELATIVE HUMIDITY**	:	54 %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 LINEARLITY 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

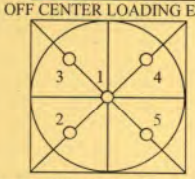
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

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 (± 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	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0002	-0.0002	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

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	**S.P.S.Consulting Service Co.,Ltd**	Date Tested:	January 6, 2025
		Recommendation Recertification	
Address :	**7 Soi Phaholyothin 24**	Period	6 Months
	Paholyothin Road	Recertification Due:	July 6, 2025
	Jompol Chatuchak, Bangkok 1090	Date Last Certified:	July 4, 2024
User Name:	**K.Phenpha Viphasthawat**	Visit Number:	2 of 2
Phone:	**083-9269252**	PerkinElmer Phone:	02-719-6420 ext 206
Fax:	**02-513-4221**	PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		**ACCESSORIES/COMPONENT NOT INCLUDED**
MODEL	**SERIAL NUMBER**	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	**CALIBRATION NUMBER**	**EXPIRATION**
IPV Methods		
TEST STANDARD USED	**PART NUMBER**	**EXPIRATION DATE**
Multielement Standard	N069-1579	December 30, 2025
Wavecal Solution	N058-2152	April 30, 2025
VIS Wavecal solution	N930-2946	December 30, 2025
Instrument Cal. STD4	N930-0221	August 30, 2025
CUSTOMER SUPPLIED	**COMMENTS**	**CUSTOMER INITIALS**
2 % HNO3		
10 % HNO3		

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

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

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 **DATE TESTED :** January 6, 2025

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	**As 193.696 nm**	≤ 0.007		0.00519	
	Ni 231.604 nm	≤ 0.008		0.00667	
	Ni 341.476 nm	≤ 0.012		0.00757	
Spectral Resolution : VIS	**La 408.672 nm**	≤ 0.020		0.01621	
	Ba 455.403 nm	≤ 0.025		0.02183	
Precision					
	As 193.656 nm	% RSD	< 1.0	0.51	%
	Zn 213.856 nm	% RSD	< 1.0	0.48	%
	Mn 257.610 nm	% RSD	< 1.0	0.03	%
	La 379.478 nm	% RSD	< 1.0	0.05	%
	Ba 455.403 nm	% RSD	< 1.0	0.07	%
	Ba 493.408 nm	% RSD	< 1.0	0.04	%
Detection Limits : Axial	**Tl 190.080 nm**	3(sd)		10.65	ppb
	As 193.696 nm	3(sd)		2.48	ppb
	Pb 220.353 nm	3(sd)		3.09	ppb
Detection Limits : Radial	**As 193.696 nm**	3(sd)		12.41	ppb
	Zn 213.856 nm	3(sd)		0.91	ppb
	Mn 257.610 nm	3(sd)		0.13	ppb
	La 379.478 nm	3(sd)		4.74	ppb
	Ba 455.403 nm	3(sd)		0.10	ppb
	Ba 493.408 nm	3(sd)		0.18	ppb
BEC : Axial (IB X 500)/(IS-IB)	**Cd 226.502 nm**	≤ 150 ppb		14.22	
BEC : Radial (IB X 1000)/(IS-IB)	**Mn 257.610 nm**	≤ 45 ppb		6.14	

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WO-02612424/2024

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been perfomed 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: วิพัฒน์ พรหมลุมดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	**Date Tested:**	January 6, 2025
		Recommendation Recertification	
Address :	7 Soi Phaholyothin 24	**Period**	6 Months
	Paholyothin Road	**Recertification Due:**	July 6, 2025
	Jompol Chatuchak, Bangkok 10900	**Date Last Certified:**	July 4, 2024
User Name:	K.Phenpha Viphasthawat	**Visit Number:**	1 OF 2
Phone:	083-9269252	**PerkinElmer Phone:**	02-719-6420 ext 204
Email:		**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

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WO-03012875/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

1. INSTRUMENT CHECKS	
A. The Mirror and Lenses Condition	OK
B. Grating Condition	OK
C. Replace or Clean Dust Filter	OK
D. Cleaning the Contact Cylinders	OK
E. Cleaning the Furnace Windows	OK
F. Cleaning the Burner Head	OK
G. Cleaning the Nebulizer	OK
H. Cleaning the Drain System	OK
2. AUTOSAMPLE CHECK	
A. Sampling and Arm	OK
B. Sampling & Rinse Pump	OK
C. Sample Position & Clean	OK
3. COOLING SYSTEM CHECKS	
A. Clean and Change Distill water	OK
B. Themosensor	OK
4. FIAS CHECKS	
A. Pump and 5 Port Valve	N/A
B. Chemifold and Tubing	N/A
C. Power Supply	N/A
D. Flow meter and Gas system	N/A

PerkinElmer Scientific (Thailand) Co., Ltd.
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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
A. Flame Mode Tests		
1. Detector-Linearity with Barium (553.55 nm)		
Neutral Density Filter 0.2 :	0.2042 Abs. ± 5%	0.2029 Abs.
Neutral Density Filter 1.0 :	0.9798 Abs. + 5%	1.0137 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.010 Abs.	0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.001 Abs.	0.0002 Abs.
4. D_2 Background Compensation (Copper 324.75 nm) with Neutral Density Filter 1.0	Absorbance ≤ 0.010 Abs	0.0020 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0002 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0007 Abs.

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 DATE TESTED January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
7. Flame Interlock Shutdown	Shutdown correct?	OK
8. Flame Sensitivity with Copper (324.75 nm) (5 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and Stainless stell nebulizer)	Sensitivity ≥ 0.250 Abs.	0.3115 Abs.
(2 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and High sensitivity nebulizer)	Sensitivity ≥ 0.250 Abs.	N/A Abs.

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE	
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm)			
(mesure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0012	
	SD ≤ 0.005 Int.Abs	0.0002	Int.Abs.
3. Chromium Characteristic Mass(m_0) and Precition (357.87 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 10 ug/L Cr standard)			
	m0 Results ≤ 7.0 pg/0.0044A-s	5.4	pg/0.0044A-s
	Precision ≤ 2.0%	1.15	%
4. Copper Characteristic Mass(m_0) and Zeeman Ratio (324.75 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 25 ug/L Cu standard)			
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
	Zeeman Ratio 0.52 ± 0.04	0.542	

PerkinElmer Scientific (Thailand) Co., Ltd.
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WO-03012875/2025

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio = Atomic Signal(peak area) / Atomic Signal(peak area)+Backgroung Signal(peak area)

= 0.1635/0.1635+0.1378

0.542

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

☑ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Customer Service Engineer: วิพรรณ พรมลุ่มดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

เอกสารแนบ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ

บริเวณอุตสาหกรรมบางปู

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

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	05/02/2025	y = 1.190x-4.759	0.999
B02	B02	05/02/2025	y = 1.167x-1.802	0.999
B03	B03	03/02/2025	y = 1.142x-3.352	0.997
B04	B04	06/02/2025	y = 1.160x-3.139	0.998
B05	B05	06/02/2025	y = 1.155x-5.601	0.996
B06	B06	06/02/2025	y = 1.150x-1.476	0.999
B07	B07	03/02/2025	y = 1.143x-3.035	0.998
B08	B08	03/02/2025	y = 1.161x-4.459	0.999
B09	B09	05/02/2025	y = 1.177x-3.970	0.996
B10	B10	03/02/2025	y = 1.144x-2.471	0.998
B11	B11	03/02/2025	y = 1.195x-5.384	0.996
B12	B12	04/02/2025	y = 1.168x-4.228	0.998
B13	B13	04/02/2025	y = 1.165x-3.801	0.999
B14	B14	04/02/2025	y = 1.148x-3.248	0.996
B15	B15	04/02/2025	y = 1.173x-4.773	0.997
B16	B16	04/02/2025	y = 1.156x-4.042	0.998
B17	B17	06/02/2025	y = 1.140x-2.730	0.999
B18	B18	06/02/2025	y = 1.171x-4.178	0.999
B19	B19	06/02/2025	y = 1.151x-3.979	0.999
B20	B20	04/02/2025	y = 1.129x-1.255	0.999
B21	B21	04/02/2025	y = 1.132x-3.156	0.999
B22	B22	04/02/2025	y = 1.147x-2.649	0.997
B23	B23	03/02/2025	y = 1.158x-3.223	0.999
B24	B24	05/02/2025	y = 1.144x-3.476	0.997
B25	B25	03/02/2025	Y = 1.071x+1.478	0.997
B26	B26	04/02/2025	y = 1.142x-4.263	0.999
B27	B27	04/02/2025	y = 1.175x-5.192	0.996
B28	B28	04/02/2025	y = 1.173x-5.127	0.999
B29	B29	04/02/2025	y = 1.145x-1.952	0.996
B30	B30	06/02/2025	y = 1.162x-3.062	0.999
B31	B31	03/02/2025	y = 1.182x-5.652	0.998
B32	B32	03/02/2025	y = 1.167x-3.993	0.999
B33	B33	05/02/2025	y = 1.168x-4.451	0.998
B34	B34	05/02/2025	y = 1.127x-3.203	0.999

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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

High Volume Air Sampler Calibration Report

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

Calibration Data				
High Volume Air Sampler Data		Calibration Data		
Recorder No.	Blower No.	Date	Actual Flowrate (ft^3/min)	R^2
B35	B35	05/02/2025	y = 1.163x-3.579	0.997
B36	B36	05/02/2025	y = 1.130x-2.116	0.999
B37	B37	04/02/2025	y = 1.146x-2.265	0.996
B38	B38	04/02/2025	y = 1.156x-6.034	0.998
B39	B39	03/02/2025	y = 1.151x-3.366	0.998
B40	B40	03/02/2025	y = 1.174x-4.582	0.999
B41	B41	06/02/2025	y = 1.123x-1.633	0.997
B42	B42	03/02/2025	y = 1.149x-3.382	0.997
B43	B43	03/02/2025	y = 1.137x-2.074	0.997
B44	B44	03/02/2025	y = 1.155x-1.460	0.999
R01	R01	04/02/2025	y = 1.121x-3.007	0.999
R02	R02	03/02/2025	y = 1.159x-5.099	0.999
R03	R03	05/02/2025	y = 1.138x-2.774	0.998
R04	R04	05/02/2025	y = 1.118x-2.575	0.999
R05	R05	03/02/2025	y = 1.136x-1.720	0.998
R06	R06	05/02/2025	y = 1.154x-2.706	0.997
R07	R07	03/02/2025	y = 1.037x+1.361	0.999
R08	R08	03/02/2025	y = 1.146x-3.762	0.996
R09	R09	05/02/2025	y = 1.121x-2.360	0.997
R10	R10	05/02/2025	y = 1.180x-4.626	0.999
R11	R11	05/02/2025	y = 1.147x-3.861	0.996
R12	R12	03/02/2025	y = 1.128x-4.676	0.998
R13	R13	04/02/2025	y = 1.135x-4.055	0.999
R14	R14	04/02/2025	y = 1.153x-3.122	0.997
R15	R15	03/02/2025	y = 1.161x-5.223	0.998
R16	R16	03/02/2025	y = 1.187x-6.674	0.999
R17	R17	03/02/2025	y = 1.120x-1.730	0.999
R18	R18	03/02/2025	y = 1.146x-2.347	0.998
R19	R19	06/02/2025	y = 1.161x-5.195	0.999
R20	R20	06/02/2025	y = 1.134x-3.449	0.998

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	**S.P.S.Consulting Service Co.,Ltd**	Date Tested:	January 6, 2025
		Recommendation Recertification	
Address :	**7 Soi Phaholyothin 24**	Period	6 Months
	Paholyothin Road	Recertification Due:	July 6, 2025
	Jompol Chatuchak, Bangkok 1090	Date Last Certified:	July 4, 2024
User Name:	**K.Phenpha Viphasthawat**	Visit Number:	2 of 2
Phone:	**083-9269252**	PerkinElmer Phone:	02-719-6420 ext 206
Fax:	**02-513-4221**	PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		**ACCESSORIES/COMPONENT NOT INCLUDED**
MODEL	**SERIAL NUMBER**	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	**CALIBRATION NUMBER**	**EXPIRATION**
IPV Methods		
TEST STANDARD USED	**PART NUMBER**	**EXPIRATION DATE**
Multielement Standard	N069-1579	December 30, 2025
Wavecal Solution	N058-2152	April 30, 2025
VIS Wavecal solution	N930-2946	December 30, 2025
Instrument Cal. STD4	N930-0221	August 30, 2025
CUSTOMER SUPPLIED	**COMMENTS**	**CUSTOMER INITIALS**
2 % HNO3		
10 % HNO3		

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

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MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

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

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 **DATE TESTED :** January 6, 2025

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	**As 193.696 nm**	≤ 0.007		0.00519	
	Ni 231.604 nm	≤ 0.008		0.00667	
	Ni 341.476 nm	≤ 0.012		0.00757	
Spectral Resolution : VIS	**La 408.672 nm**	≤ 0.020		0.01621	
	Ba 455.403 nm	≤ 0.025		0.02183	
Precision					
	As 193.656 nm	% RSD	< 1.0	0.51	%
	Zn 213.856 nm	% RSD	< 1.0	0.48	%
	Mn 257.610 nm	% RSD	< 1.0	0.03	%
	La 379.478 nm	% RSD	< 1.0	0.05	%
	Ba 455.403 nm	% RSD	< 1.0	0.07	%
	Ba 493.408 nm	% RSD	< 1.0	0.04	%
Detection Limits : Axial	**Tl 190.080 nm**	3(sd)		10.65	ppb
	As 193.696 nm	3(sd)		2.48	ppb
	Pb 220.353 nm	3(sd)		3.09	ppb
Detection Limits : Radial	**As 193.696 nm**	3(sd)		12.41	ppb
	Zn 213.856 nm	3(sd)		0.91	ppb
	Mn 257.610 nm	3(sd)		0.13	ppb
	La 379.478 nm	3(sd)		4.74	ppb
	Ba 455.403 nm	3(sd)		0.10	ppb
	Ba 493.408 nm	3(sd)		0.18	ppb
BEC : Axial (IB X 500)/(IS-IB)	**Cd 226.502 nm**	≤ 150 ppb		14.22	
BEC : Radial (IB X 1000)/(IS-IB)	**Mn 257.610 nm**	≤ 45 ppb		6.14	

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WO-02612424/2024

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been perfomed 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: วิพัฒน์ พรหมลุมดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	**Date Tested:**	January 6, 2025
		Recommendation Recertification	
Address :	7 Soi Phaholyothin 24	**Period**	6 Months
	Paholyothin Road	**Recertification Due:**	July 6, 2025
	Jompol Chatuchak, Bangkok 10900	**Date Last Certified:**	July 4, 2024
User Name:	K.Phenpha Viphasthawat	**Visit Number:**	1 OF 2
Phone:	083-9269252	**PerkinElmer Phone:**	02-719-6420 ext 204
Email:		**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

PerkinElmer Scientific (Thailand) Co., Ltd.
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WO-03012875/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

1. INSTRUMENT CHECKS	
A. The Mirror and Lenses Condition	OK
B. Grating Condition	OK
C. Replace or Clean Dust Filter	OK
D. Cleaning the Contact Cylinders	OK
E. Cleaning the Furnace Windows	OK
F. Cleaning the Burner Head	OK
G. Cleaning the Nebulizer	OK
H. Cleaning the Drain System	OK
2. AUTOSAMPLE CHECK	
A. Sampling and Arm	OK
B. Sampling & Rinse Pump	OK
C. Sample Position & Clean	OK
3. COOLING SYSTEM CHECKS	
A. Clean and Change Distill water	OK
B. Themosensor	OK
4. FIAS CHECKS	
A. Pump and 5 Port Valve	N/A
B. Chemifold and Tubing	N/A
C. Power Supply	N/A
D. Flow meter and Gas system	N/A

PerkinElmer Scientific (Thailand) Co., Ltd.
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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
A. Flame Mode Tests		
1. Detector-Linearity with Barium (553.55 nm)		
Neutral Density Filter 0.2 :	0.2042 Abs. ± 5%	0.2029 Abs.
Neutral Density Filter 1.0 :	0.9798 Abs. + 5%	1.0137 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.010 Abs.	0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.001 Abs.	0.0002 Abs.
4. D_2 Background Compensation (Copper 324.75 nm) with Neutral Density Filter 1.0	Absorbance ≤ 0.010 Abs	0.0020 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0002 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0007 Abs.

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 DATE TESTED January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
7. Flame Interlock Shutdown	Shutdown correct?	OK
8. Flame Sensitivity with Copper (324.75 nm) (5 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and Stainless stell nebulizer)	Sensitivity ≥ 0.250 Abs.	0.3115 Abs.
(2 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and High sensitivity nebulizer)	Sensitivity ≥ 0.250 Abs.	N/A Abs.

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE	
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm)			
(mesure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0012	
	SD ≤ 0.005 Int.Abs	0.0002	Int.Abs.
3. Chromium Characteristic Mass(m_0) and Precition (357.87 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 10 ug/L Cr standard)			
	m0 Results ≤ 7.0 pg/0.0044A-s	5.4	pg/0.0044A-s
	Precision ≤ 2.0%	1.15	%
4. Copper Characteristic Mass(m_0) and Zeeman Ratio (324.75 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 25 ug/L Cu standard)			
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
	Zeeman Ratio 0.52 ± 0.04	0.542	

PerkinElmer Scientific (Thailand) Co., Ltd.
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WO-03012875/2025

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio = Atomic Signal(peak area) / Atomic Signal(peak area)+Backgroung Signal(peak area)

= 0.1635/0.1635+0.1378

0.542

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

☑ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Customer Service Engineer: วิพรรณ พรมลุ่มดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

เอกสารแนบ 5-3

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	$\Delta H_@$ (mmH_2O)
B01	1563	03/12/2024	0.999	49.77
B02	8002514	02/12/2024	0.997	49.92
B03	1503016	04/12/2024	0.996	49.68
B04	00006659	02/12/2024	0.998	49.59
B05	00007428	04/12/2024	0.996	49.73
R01	1561	05/12/2024	0.999	49.88
R02	8002513	03/12/2024	0.996	49.65
R03	1570	02/12/2024	1.002	50.04
R04	8002519	03/12/2024	0.997	49.45
R05	1503015	04/12/2024	1.003	49.98

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

Accept Value of $\Delta H_@$ (test) is 46.7 ± 6.4 (mmH_2O)

Calibrated by :	Approved by :
Adul Dangklom (Mr. Adul Dangklom)	(Mr. Peera Detudom)

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Console Calibration Report

Calibration Method	Critical Orifices

Calibration Data				
Console Data		Calibration Data		
No.	Serial No.	Date	y	$DH_@$ (mmH_2O)
B01	1563	03/03/2025	1.003	49.40
B02	8002514	03/03/2025	1.004	49.57
B03	1503016	04/03/2025	0.999	49.93
B04	00006659	04/03/2025	0.996	49.88
B05	00007428	04/03/2025	1.007	49.14
R01	1561	05/03/2025	0.996	49.32
R02	8002513	04/03/2025	1.003	49.96
R03	1570	04/03/2025	0.998	50.08
R04	8002519	03/03/2025	0.997	49.53
R05	1503015	05/03/2025	1.005	50.25

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

Accept Value of $DH_@$ (test) is 46.7 ± 6.4 (mmH_2O)

Calibrated by :	Approved by :
Adul Dangklom (Mr. Adul Dangklom)	(Mr. Peera Detudom)

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

Pitot Tube Calibration Report

Calibration Method	Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficience of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	05/11/2024	0.84	0.85
B04	S	0.99	05/11/2024	0.84	0.83
B05	S	0.99	01/11/2024	0.84	0.85
B07	S	0.99	04/11/2024	0.84	0.84
B08	S	0.99	04/11/2024	0.84	0.85
B09	S	0.99	04/11/2024	0.84	0.84
B11	S	0.99	01/11/2024	0.84	0.83
B16	S	0.99	05/11/2024	0.84	0.84
B18	S	0.99	04/11/2024	0.84	0.84
B19	S	0.99	04/11/2024	0.84	0.83
B21	S	0.99	04/11/2024	0.84	0.84
B24	S	0.99	01/11/2024	0.85	0.84
B27	S	0.99	05/11/2024	0.84	0.84
B30	S	0.99	04/11/2024	0.84	0.83
B31	S	0.99	05/11/2024	0.84	0.84
B33	S	0.99	05/11/2024	0.85	0.84
B35	S	0.99	01/11/2024	0.84	0.84

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

Calibrated by :	Approved by :
Adul Dangklom	
(Mr. Adul Dangklom)	(Mr. Peera Detudom)

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

Pitot Tube Calibration Report

Calibration Method	Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficience of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	03/02/2025	0.84	0.84
B04	S	0.99	04/02/2025	0.85	0.84
B05	S	0.99	04/02/2025	0.84	0.83
B07	S	0.99	04/02/2025	0.84	0.85
B08	S	0.99	05/02/2025	0.84	0.84
B09	S	0.99	03/02/2025	0.85	0.84
B11	S	0.99	03/02/2025	0.84	0.84
B16	S	0.99	05/02/2025	0.84	0.83
B18	S	0.99	05/02/2025	0.85	0.84
B19	S	0.99	04/02/2025	0.84	0.84
B21	S	0.99	04/02/2025	0.85	0.84
B24	S	0.99	04/02/2025	0.84	0.84
B27	S	0.99	05/02/2025	0.84	0.85
B30	S	0.99	05/02/2025	0.84	0.84
B31	S	0.99	05/02/2025	0.85	0.84
B33	S	0.99	05/02/2025	0.84	0.84
B35	S	0.99	03/02/2025	0.85	0.84

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

Calibrated by :	Approved by :
Adul Dangklom	
(Mr. Adul Dangklom)	(Mr. Peera Detudom)

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

Pitot Tube Calibration Report

Calibration Method	Standard Pitot Tube

Calibration Data

Pitot Tube Data			Calibration Data		
No.	Type of Pitot	Coefficience of Standard Pitot	Date	Avg. of Cp (test)	
				Side A	Side B
B03	S	0.99	01/05/2025	0.84	0.83
B04	S	0.99	01/05/2025	0.84	0.84
B05	S	0.99	01/05/2025	0.85	0.84
B07	S	0.99	01/05/2025	0.84	0.83
B08	S	0.99	01/05/2025	0.85	0.84
B09	S	0.99	02/05/2025	0.83	0.84
B11	S	0.99	01/05/2025	0.84	0.85
B16	S	0.99	01/05/2025	0.84	0.84
B18	S	0.99	01/05/2025	0.84	0.83
B19	S	0.99	01/05/2025	0.85	0.84
B21	S	0.99	02/05/2025	0.84	0.84
B24	S	0.99	05/05/2025	0.85	0.84
B27	S	0.99	05/05/2025	0.85	0.84
B30	S	0.99	05/05/2025	0.84	0.85
B31	S	0.99	05/05/2025	0.84	0.84
B33	S	0.99	01/05/2025	0.84	0.85
B35	S	0.99	01/05/2025	0.84	0.84

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

Calibrated by :	Approved by :
Adul Dangklom	
(Mr. Adul Dangklom)	(Mr. Peera Detudom)

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter | Model : Defender 510-H | S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
					Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
No.	Brand	Model	Serial No.	Date	1	2	3	1	2	3	y	R^2
B01	SKC	224-PCXR4	262101	03/01/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x – 5.913	1.000
B02	SKC	224-PCXR4	626166	03/01/2025	1,000	1,500	2,000	997	1,499	1,996	0.998x - 0.140	1.000
B03	SKC	224-PCXR4	612968	06/01/2025	1,000	1,500	2,000	1,008	1,504	1,998	0.999x + 1.131	0.999
B04	SKC	224-PCXR4	602804	06/01/2025	1,000	1,500	2,000	994	1,505	2,004	1.010x - 17.826	1.000
B05	SKC	224-PCXR4	612693	07/01/2025	1,000	1,500	2,000	997	1,508	1,997	1.009x – 14.660	0.999
B06	SKC	224-PCXR4	262188	07/01/2025	1,000	1,500	2,000	1,005	1,493	2,002	0.995x + 7.108	1.000
B07	SKC	224-PCXR4	626262	07/01/2025	1,000	1,500	2,000	994	1,498	2,004	1.006x - 10.434	1.000
B08	SKC	224-PCXR4	626100	03/01/2025	1,000	1,500	2,000	1,014	1,505	2,010	1.004x - 2.659	0.999
B09	SKC	224-PCXR4	626479	06/01/2025	1,000	1,500	2,000	998	1,491	2,006	1.012x - 22.408	1.000
B10	SKC	224-PCXR4	091950	06/01/2025	1,000	1,500	2,000	999	1,507	2,007	1.010x – 15.236	1.000
B11	SKC	224-PCXR8	564315	06/01/2025	1,000	1,500	2,000	997	1,496	1,996	1.001x - 3.394	1.000
B12	SKC	224-PCXR4	034656	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,004	1.011x – 19.282	0.999
B13	SKC	224-PCXR4	602073	07/01/2025	1,000	1,500	2,000	995	1,505	1,998	1.006x - 12.605	1.000
B14	SKC	224-PCXR4	626313	03/01/2025	1,000	1,500	2,000	1,003	1,506	2,007	1.007x - 8.152	1.000
B15	SKC	224-PCXR4	626474	06/01/2025	1,000	1,500	2,000	1,010	1,498	2,001	0.994x + 9.807	1.000
B16	SKC	224-PCXR4	626477	06/01/2025	1,000	1,500	2,000	998	1,507	2,002	1.013x - 22.572	0.999
B17	SKC	224-PCXR4	626860	06/01/2025	1,000	1,500	2,000	1,005	1,499	2,001	0.995x + 7.368	1.000
B18	SKC	224-PCXR4	691484	06/01/2025	1,000	1,500	2,000	1,008	1,494	2,002	0.993x + 10.346	1.000
B19	SKC	224-PCXR4	691599	06/01/2025	1,000	1,500	2,000	1,010	1,505	2,010	1.000x + 6.532	1.000
B20	SKC	224-PCXR4	691587	07/01/2025	1,000	1,500	2,000	1,006	1,512	2,009	1.002x – 1.671	0.999
B21	SKC	224-PCXR4	691531	07/01/2025	1,000	1,500	2,000	1,001	1,510	2,007	1.007x – 10.035	1.000
B22	SKC	224-PCXR4	691654	07/01/2025	1,000	1,500	2,000	1,015	1,513	2,012	0.999x + 8.423	0.999
B23	SKC	224-PCXR4	798393	07/01/2025	1,000	1,500	2,000	999	1,498	2,001	1.001x - 0.856	1.000
B24	SKC	224-PCXR4	626363	06/01/2025	1,000	1,500	2,000	1,001	1,506	2,006	1.007x – 12.177	0.999
B25	SKC	224-PCXR4	798489	06/01/2025	1,000	1,500	2,000	996	1,514	2,005	1.011x + 13.301	1.000
B26	SKC	224-PCXR4	798479	03/01/2025	1,000	1,500	2,000	998	1,509	2,002	1.005x - 9.187	1.000
B27	SKC	224-PCXR4	691673	03/01/2025	1,000	1,500	2,000	1,001	1,511	1,995	0.998x - 0.700	0.999
B28	SKC	224-PCXR4	691570	03/01/2025	1,000	1,500	2,000	1,004	1,513	2,006	1.001x + 1.779	1.000
B29	SKC	224-PCXR4	626472	03/01/2025	1,000	1,500	2,000	998	1,508	2,007	1.009x – 13.557	1.000
B30	SKC	224-PCXR4	691489	03/01/2025	1,000	1,500	2,000	1,003	1,503	2,012	1.008x – 10.099	1.000
B31	SKC	224-PCXR4	691509	06/01/2025	1,000	1,500	2,000	997	1,510	2,009	1.012x - 18.438	1.000
B32	SKC	224-PCXR4	091567	06/01/2025	1,000	1,500	2,000	1,014	1,517	2,007	0.995x + 11.654	0.999
B33	SKC	224-PCXR4	091756	06/01/2025	1,000	1,500	2,000	999	1,510	2,003	1.003x – 4.801	1.000
B34	SKC	224-PCXR4	612962	07/01/2025	1,000	1,500	2,000	1,001	1,511	2,008	1.008x – 11.354	0.999
B35	SKC	224-PCXR4	602682	07/01/2025	1,000	1,500	2,000	1,008	1,514	1,996	0.993x + 11.338	0.999
B36	SKC	224-PCXR4	626164	07/01/2025	1,000	1,500	2,000	1,005	1,506	2,007	1.003x - 2.339	1.000
B37	SKC	224-PCXR4	626256	07/01/2025	1,000	1,500	2,000	1,003	1,503	2,005	1.011x - 16.311	0.999
B38	SKC	224-PCXR4	626167	03/01/2025	1,000	1,500	2,000	1,006	1,514	2,007	1.000x + 0.712	0.999
B39	SKC	224-PCXR4	034637	06/01/2025	1,000	1,500	2,000	1,013	1,515	2,013	1.002x + 3.638	0.999
B40	SKC	224-PCXR4	798349	07/01/2025	1,000	1,500	2,000	999	1,508	2,001	1.000x - 1.691	1.000

Calibrated by : Adul Dangklom (Mr. Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter | Model : Defender 510-H | S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
					Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
No.	Brand	Model	Serial No.	Date	1	2	3	1	2	3	y	R^2
B41	SKC	224-PCXR4	612669	07/01/2025	1,000	1,500	2,000	996	1,512	2,005	1.008x - 10.246	1.000
B42	SKC	224-PCXR4	626041	07/01/2025	1,000	1,500	2,000	995	1,499	2,002	1.002x - 2.343	1.000
B43	SKC	224-PCXR4	034636	03/01/2025	1,000	1,500	2,000	999	1,495	1,997	0.996x + 2.703	1.000
B44	SKC	224-PCXR8	529341	03/01/2025	1,000	1,500	2,000	998	1,510	2,003	1.009x - 16.871	0.999
B45	SKC	224-PCXR8	529594	03/01/2025	1,000	1,500	2,000	997	1,508	2,004	1.012x - 21.113	0.999
B46	SKC	224-PCXR8	566743	03/01/2025	1,000	1,500	2,000	996	1,497	2,003	1.010x – 16.955	1.000
B47	SKC	224-PCXR8	566747	03/01/2025	1,000	1,500	2,000	1,002	1,504	2,001	1.003x - 2.758	1.000
B48	SKC	224-PCXR8	566753	03/01/2025	1,000	1,500	2,000	998	1,512	2,002	1.008x -13.876	0.999
B49	SKC	224-PCXR8	566780	03/01/2025	1,000	1,500	2,000	997	1,497	1,997	1.002x - 5.465	1.000
B50	SKC	224-PCXR8	500400	03/01/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x – 7.316	1.000
B51	SKC	224-PCXR8	500363	06/01/2025	1,000	1,500	2,000	1,003	1,505	1,998	0.995x + 8.579	1.000
B52	SKC	224-PCXR8	093186	06/01/2025	1,000	1,500	2,000	1,002	1,496	1,999	0.999x - 0.396	1.000
B53	SKC	224-PCXR8	707670	07/01/2025	1,000	1,500	2,000	997	1,505	2,005	1.010x - 19.569	0.999
B54	SKC	224-PCXR3	509821	07/01/2025	1,000	1,500	2,000	1,004	1,506	2,002	1.002x - 0.736	1.000
B55	SKC	224-PCXR3	510710	07/01/2025	1,000	1,500	2,000	998	1,501	2,001	1.003x - 5.629	1.000
B56	SKC	224-PCXR3	511450	07/01/2025	1,000	1,500	2,000	995	1,509	2,007	1.013x – 22.400	0.999
B57	SKC	224-PCXR3	510798	07/01/2025	1,000	1,500	2,000	999	1,498	1,996	0.996x + 4.985	1.000
B58	SKC	224-PCXR3	509852	06/01/2025	1,000	1,500	2,000	1,002	1,503	2,005	1.009x - 13.249	1.000
B59	SKC	224-PCXR3	509862	06/01/2025	1,000	1,500	2,000	996	1,506	2,007	1.015x - 25.718	0.999
B60	SKC	224-PCXR3	512655	06/01/2025	1,000	1,500	2,000	1,012	1,504	2,001	0.995x + 10.338	1.000
B61	SKC	224-PCXR3	503915	03/01/2025	1,000	1,500	2,000	1,003	1,507	2,010	1.010x - 13.769	1.000
B62	SKC	224-PCXR3	505975	03/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.012x - 17.586	0.999
B63	SKC	224-PCXR3	511432	03/01/2025	1,000	1,500	2,000	999	1,503	2,003	1.013x - 21.568	0.999
B64	SKC	224-PCXR3	508302	06/01/2025	1,000	1,500	2,000	996	1,506	2,006	1.010x - 15.623	1.000
B65	SKC	224-PCXR3	508310	06/01/2025	1,000	1,500	2,000	1,003	1,502	2,002	1.001x + 1.279	1.000
B66	SKC	224-PCXR3	509861	06/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.004x - 7.200	1.000
B67	SKC	224-PCXR3	506295	06/01/2025	1,000	1,500	2,000	997	1,497	2,007	1.011x – 22.995	0.999
B68	SKC	224-PCXR3	505872	07/01/2025	1,000	1,500	2,000	1,001	1,493	1,999	0.998x - 1.515	1.000
B69	SKC	224-PCXR3	508375	07/01/2025	1,000	1,500	2,000	995	1,508	2,003	1.013x – 23.639	0.999
B70	SKC	224-PCXR3	510623	07/01/2025	1,000	1,500	2,000	1,004	1,502	2,007	1.011x – 17.470	0.999
B71	SKC	224-PCXR3	508367	06/01/2025	1,000	1,500	2,000	1,003	1,504	2,008	1.016x – 24.787	0.999
B72	SKC	224-PCXR3	505977	06/01/2025	1,000	1,500	2,000	1,008	1,496	2,007	1.001x + 0.904	1.000
B73	SKC	224-PCXR3	512606	06/01/2025	1,000	1,500	2,000	1,003	1,502	2,003	1.007x – 15.456	0.999
B74	SKC	224-PCXR3	505993	06/01/2025	1,000	1,500	2,000	1,004	1,501	1,999	1.000x – 0.624	1.000
B75	SKC	224-PCXR3	509820	06/01/2025	1,000	1,500	2,000	996	1,510	2,003	1.010x - 17.886	0.999
B76	SKC	224-PCXR3	509811	07/01/2025	1,000	1,500	2,000	994	1,509	2,008	1.013x - 21.308	1.000
B77	SKC	224-PCXR3	508301	07/01/2025	1,000	1,500	2,000	1,002	1,491	2,006	1.006x – 10.302	1.000
B78	SKC	224-PCXR3	510677	07/01/2025	1,000	1,500	2,000	1,005	1,504	2,007	1.012x – 19.957	0.999
B79	SKC	224-PCXR3	510920	06/01/2025	1,000	1,500	2,000	1,003	1,503	2,006	1.015x – 24.223	0.999

Calibrated by : Adul Dangklom (Mr. Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter | Model : Defender 510-H | S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R^2
B01	SKC	224-PCXR4	262101	01/04/2025	1,000	1,500	2,000	998	1,494	2,002	1.001x – 3.594	1.000
B02	SKC	224-PCXR4	626166	01/04/2025	1,000	1,500	2,000	995	1,508	2,003	1.008x - 12.605	1.000
B03	SKC	224-PCXR4	612968	03/04/2025	1,000	1,500	2,000	1,003	1,502	2,006	1.006x - 7.796	1.000
B04	SKC	224-PCXR4	602804	03/04/2025	1,000	1,500	2,000	1,001	1,499	2,013	1.004x - 7.060	0.999
B05	SKC	224-PCXR4	612693	03/04/2025	1,000	1,500	2,000	1,004	1,498	2,007	1.003x – 2.455	1.000
B06	SKC	224-PCXR4	262188	03/04/2025	1,000	1,500	2,000	1,003	1,512	2,004	1.000x + 0.696	1.000
B07	SKC	224-PCXR4	626262	03/04/2025	1,000	1,500	2,000	1,012	1,504	1,996	0.994x + 10.330	0.999
B08	SKC	224-PCXR4	626100	02/04/2025	1,000	1,500	2,000	996	1,511	2,007	1.010x - 14.048	1.000
B09	SKC	224-PCXR4	626479	03/04/2025	1,000	1,500	2,000	999	1,510	2,003	1.003x - 4.677	1.000
B10	SKC	224-PCXR4	091950	03/04/2025	1,000	1,500	2,000	1,002	1,498	2,004	1.004x – 6.544	1.000
B11	SKC	224-PCXR8	564315	04/04/2025	1,000	1,500	2,000	1,013	1,505	2,010	1.002x + 2.171	1.000
B12	SKC	224-PCXR8	034656	04/04/2025	1,000	1,500	2,000	1,004	1,506	2,009	1.008x - 9.391	1.000
B13	SKC	224-PCXR4	602073	03/04/2025	1,000	1,500	2,000	1,001	1,497	2,012	1.009x - 9.643	1.000
B14	SKC	224-PCXR4	626313	03/04/2025	1,000	1,500	2,000	1,004	1,515	1,997	1.002x - 1.275	0.999
B15	SKC	224-PCXR4	626474	03/04/2025	1,000	1,500	2,000	999	1,497	1,996	1.000x - 2.511	1.000
B16	SKC	224-PCXR4	626477	03/04/2025	1,000	1,500	2,000	1,012	1,504	2,007	0.997x + 8.160	1.000
B17	SKC	224-PCXR4	626860	01/04/2025	1,000	1,500	2,000	997	1,506	1,999	1.001x - 1.435	1.000
B18	SKC	224-PCXR4	691484	02/04/2025	1,000	1,500	2,000	1,007	1,493	2,005	0.998x + 4.350	1.000
B19	SKC	224-PCXR4	691599	03/04/2025	1,000	1,500	2,000	1,004	1,513	2,001	1.003x - 2.043	1.000
B20	SKC	224-PCXR4	691587	03/04/2025	1,000	1,500	2,000	999	1,504	1,998	0.999x + 0.556	1.000
B21	SKC	224-PCXR4	691531	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,997	1.003x - 7.572	0.999
B22	SKC	224-PCXR4	691654	04/04/2025	1,000	1,500	2,000	1,008	1,504	2,006	1.005x - 4.941	1.000
B23	SKC	224-PCXR4	798393	04/04/2025	1,000	1,500	2,000	995	1,499	1,998	1.002x - 4.953	1.000
B24	SKC	224-PCXR4	626363	04/04/2025	1,000	1,500	2,000	1,002	1,501	1,996	0.999x – 1.539	1.000
B25	SKC	224-PCXR4	798489	04/04/2025	1,000	1,500	2,000	1,010	1,515	2,001	0.990x + 16.203	0.999
B26	SKC	224-PCXR4	798479	03/04/2025	1,000	1,500	2,000	999	1,492	1,999	0.998x - 0.596	1.000
B27	SKC	224-PCXR4	691673	03/04/2025	1,000	1,500	2,000	996	1,498	2,002	1.004x - 6.496	1.000
B28	SKC	224-PCXR4	691570	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,994	0.993x + 8.068	1.000
B29	SKC	224-PCXR4	626472	03/04/2025	1,000	1,500	2,000	1,001	1,501	1,996	0.994x + 9.367	1.000
B30	SKC	224-PCXR4	691489	01/04/2025	1,000	1,500	2,000	996	1,507	2,003	1.006x – 12.489	1.000
B31	SKC	224-PCXR4	691509	02/04/2025	1,000	1,500	2,000	1,010	1,509	2,008	1.003x - 3.858	0.999
B32	SKC	224-PCXR4	091567	02/04/2025	1,000	1,500	2,000	996	1,497	1,997	0.998x - 0.764	1.000
B33	SKC	224-PCXR4	091756	03/04/2025	1,000	1,500	2,000	998	1,508	2,006	1.007x – 13.441	0.999
B34	SKC	224-PCXR4	612962	03/04/2025	1,000	1,500	2,000	1,004	1,494	1,995	0.993 + 8.471	1.000
B35	SKC	224-PCXR4	602682	03/04/2025	1,000	1,500	2,000	999	1,491	2,001	1.000x - 2.275	1.000
B36	SKC	224-PCXR4	626164	03/04/2025	1,000	1,500	2,000	1,004	1,499	1,997	0.995x + 5.109	1.000
B37	SKC	224-PCXR4	626256	03/04/2025	1,000	1,500	2,000	998	1,503	1,996	0.996x + 5.729	1.000
B38	SKC	224-PCXR4	626167	03/04/2025	1,000	1,500	2,000	996	1,509	2,004	1.008x - 15.248	0.999
B39	SKC	224-PCXR4	034637	02/04/2025	1,000	1,500	2,000	1,006	1,505	2,010	1.011x - 15.064	0.999
B40	SKC	224-PCXR4	798349	03/04/2025	1,000	1,500	2,000	997	1,510	2,008	1.012x - 19.381	1.000

Calibrated by : Adul Dangklom (Mr. Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter | Model : Defender 510-H | S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
					1	2	3	1	2	3	y	R^2
B41	SKC	224-PCXR4	612669	03/04/2025	1,000	1,500	2,000	1,005	1,502	2,004	1.005x - 8.923	1.000
B42	SKC	224-PCXR4	626041	03/04/2025	1,000	1,500	2,000	1,004	1,501	2,008	1.009x - 13.856	1.000
B43	SKC	224-PCXR4	034636	01/04/2025	1,000	1,500	2,000	1,012	1,497	1,996	0.990x + 15.132	1.000
B44	SKC	224-PCXR8	529341	01/04/2025	1,000	1,500	2,000	1,011	1,511	2,008	1.002x - 0.860	0.999
B45	SKC	224-PCXR8	529594	04/04/2025	1,000	1,500	2,000	993	1,512	2,003	1.009x - 14.476	1.000
B46	SKC	224-PCXR8	566743	04/04/2025	1,000	1,500	2,000	1,008	1,508	2,008	1.000x – 0.100	0.999
B47	SKC	224-PCXR8	566747	04/04/2025	1,000	1,500	2,000	999	1,510	2,010	1.010x - 14.444	1.000
B48	SKC	224-PCXR8	566753	01/04/2025	1,000	1,500	2,000	1,010	1,506	2,006	0.999x + 2.782	1.000
B49	SKC	224-PCXR8	566780	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,004	1.003x - 2.183	1.000
B50	SKC	224-PCXR8	500400	04/04/2025	1,000	1,500	2,000	1,002	1,493	1,995	0.994x + 5.841	1.000
B51	SKC	224-PCXR8	500363	04/04/2025	1,000	1,500	2,000	998	1,511	2,011	1.013x - 19.465	0.999
B52	SKC	224-PCXR8	093186	02/04/2025	1,000	1,500	2,000	997	1,505	2,006	1.008x - 12.641	1.000
B53	SKC	224-PCXR8	707670	02/04/2025	1,000	1,500	2,000	1,004	1,503	2,007	1.007x - 7.992	1.000
B54	SKC	224-PCXR3	509821	02/04/2025	1,000	1,500	2,000	1,005	1,504	2,008	1.010x - 15.060	0.999
B55	SKC	224-PCXR3	510710	02/04/2025	1,000	1,500	2,000	1,001	1,495	1,997	0.996x + 5.073	1.000
B56	SKC	224-PCXR3	511450	02/04/2025	1,000	1,500	2,000	1,005	1,494	1,996	0.991x – 13.385	1.000
B57	SKC	224-PCXR3	510798	03/04/2025	1,000	1,500	2,000	997	1,511	2,009	1.014x - 21.540	0.999
B58	SKC	224-PCXR3	509852	03/04/2025	1,000	1,500	2,000	1,006	1,493	2,002	1.001x - 4.094	1.000
B59	SKC	224-PCXR3	509862	03/04/2025	1,000	1,500	2,000	995	1,502	2,003	1.012x - 21.564	1.000
B60	SKC	224-PCXR3	512655	03/04/2025	1,000	1,500	2,000	998	1,507	2,004	1.010x - 18.510	0.999
B61	SKC	224-PCXR3	503915	03/04/2025	1,000	1,500	2,000	997	1,499	2,001	1.002x - 4.374	1.000
B62	SKC	224-PCXR3	505975	01/04/2025	1,000	1,500	2,000	1,002	1,503	2,005	1.008x - 11.138	1.000
B63	SKC	224-PCXR3	511432	04/04/2025	1,000	1,500	2,000	998	1,502	1,996	0.996x + 3.970	1.000
B64	SKC	224-PCXR3	508302	04/04/2025	1,000	1,500	2,000	1,005	1,509	2,008	1.009x - 10.402	1.000
B65	SKC	224-PCXR3	508310	04/04/2025	1,000	1,500	2,000	1,004	1,503	2,007	1.010x - 14.088	1.000
B66	SKC	224-PCXR3	509861	04/04/2025	1,000	1,500	2,000	1,003	1,504	2,010	1.008x - 12.369	1.000
B67	SKC	224-PCXR3	506295	04/04/2025	1,000	1,500	2,000	1,002	1,498	2,004	0.998x + 4.290	1.000
B68	SKC	224-PCXR3	505872	04/04/2025	1,000	1,500	2,000	999	1,504	1,998	1.000x + 0.436	1.000
B69	SKC	224-PCXR3	508375	02/04/2025	1,000	1,500	2,000	1,004	1,498	2,002	0.996x + 5.501	1.000
B70	SKC	224-PCXR3	510623	02/04/2025	1,000	1,500	2,000	996	1,497	2,005	1.005x - 8.735	1.000
B71	SKC	224-PCXR3	508367	02/04/2025	1,000	1,500	2,000	1,013	1,505	2,009	1.000x + 3.294	0.999
B72	SKC	224-PCXR3	505977	02/04/2025	1,000	1,500	2,000	997	1,494	2,003	1.006x - 11.350	1.000
B73	SKC	224-PCXR3	512606	01/04/2025	1,000	1,500	2,000	1,010	1,507	2,004	0.998x + 5.129	1.000
B74	SKC	224-PCXR3	505993	01/04/2025	1,000	1,500	2,000	998	1,499	2,010	1.009x - 11.942	1.000
B75	SKC	224-PCXR3	509820	01/04/2025	1,000	1,500	2,000	995	1,511	2,004	1.011x - 18.966	0.999
B76	SKC	224-PCXR3	509811	01/04/2025	1,000	1,500	2,000	998	1,504	2,010	1.012x - 20.993	0.999
B77	SKC	224-PCXR3	508301	03/04/2025	1,000	1,500	2,000	1,007	1,509	2,008	1.001x + 3.750	1.000
B78	SKC	224-PCXR3	510677	04/04/2025	1,000	1,500	2,000	998	1,508	2,001	1.003x – 3.278	1.000
B79	SKC	224-PCXR3	510920	04/04/2025	1,000	1,500	2,000	1,001	1,501	1,994	0.999x – 1.819	1.000

Calibrated by : Adul Dangklom (Mr. Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Rotameter Data			Calibration Data								
				Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
No.	Brand	Model	Date	1	2	3	1	2	3	y	R^2
H-B01	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	498.1	999.3	2001.2	0.997x + 4.404	1.000
H-B02	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	499.2	998.1	2012.5	1.003x - 8.556	0.999
H-B03	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	502.4	1002.9	2008.6	1.000x - 2.203	1.000
H-B04	Dwyer	VFB-65	07/01/2025	500	1,000	2,000	501.7	997.4	1993.2	0.996x + 5.850	1.000
H-B05	Dwyer	VFB-65	07/01/2025	500	1,000	2,000	500.9	994.7	1984.4	0.985x + 17.991	0.999
H-B06	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	502.5	997.1	1993.6	0.993x + 7.901	1.000
H-B07	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	501.4	998.8	2009.5	1.001x + 0.428	1.000
H-B08	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	500.9	999.4	1993.8	0.997x + 2.266	0.999
H-B09	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	502.3	1004.1	2009.7	0.996x + 11.111	1.000
H-B10	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	498.6	999.5	2010.3	1.001x - 0.553	0.999

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Rotameter Data			Calibration Data								
				Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
No.	Brand	Model	Date	1	2	3	1	2	3	y	R^2
H-B01	Dwyer	VFB-65	01/04/2025	500	1,000	2,000	499.1	997.5	1996.2	0.992x + 10.557	1.000
H-B02	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	501.5	996.9	2004.4	1.002x - 0.966	1.000
H-B03	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	498.9	997.4	1996.5	0.997x - 0.674	1.000
H-B04	Dwyer	VFB-65	01/04/2025	500	1,000	2,000	498.0	996.5	2007.8	1.001x - 8.142	0.999
H-B05	Dwyer	VFB-65	02/04/2025	500	1,000	2,000	501.2	998.6	1993.7	0.994x + 6.199	1.000
H-B06	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	499.7	995.3	1989.1	0.995x + 1.374	0.999
H-B07	Dwyer	VFB-65	03/04/2025	500	1,000	2,000	500.1	999.7	2006.4	0.998x - 1.014	1.000
H-B08	Dwyer	VFB-65	01/04/2025	500	1,000	2,000	499.8	997.4	1994.8	0.993x + 6.689	1.000
H-B09	Dwyer	VFB-65	04/04/2025	500	1,000	2,000	498.2	997.1	2005.6	0.999x + 0.065	0.999
H-B10	Dwyer	VFB-65	04/04/2025	500	1,000	2,000	501.2	998.4	2009.2	0.998x + 3.713	1.000

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Rotameter Data			Calibration Data							
				Flow Rate (ml/min)						Value From Calibration Curve
				Flow Rate (Reading)			Actual (Q std.)			
No.	Brand	Model	Date	1	2	3	1	2	3	y / R^2
L-B01	Dwyer	VFA-21	03/01/2025	50	100	200	50.2	100.1	199.4	0.997x + 0.962 / 0.999
L-B02	Dwyer	VFA-21	06/01/2025	50	100	200	49.3	99.2	201.5	0.994x + 0.453 / 1.000
L-B03	Dwyer	VFA-21	03/01/2025	50	100	200	49.6	99.8	199.7	0.996x + 0.107 / 1.000
L-B04	Dwyer	VFA-21	07/01/2025	50	100	200	50.5	100.6	200.4	0.995x + 1.286 / 1.000
L-B05	Dwyer	VFA-21	07/01/2025	50	100	200	50.4	101.1	202.5	0.994x + 1.572 / 1.000
L-B06	Dwyer	VFA-21	06/01/2025	50	100	200	50.9	99.2	198.7	1.000x + 0.411 / 0.999
L-B07	Dwyer	VFA-21	06/01/2025	50	100	200	49.7	99.1	201.4	0.997x + 0.176 / 1.000
L-B08	Dwyer	VFA-21	03/01/2025	50	100	200	50.6	99.8	200.2	0.998x + 1.116 / 0.999
L-B09	Dwyer	VFA-21	03/01/2025	50	100	200	49.8	101.9	198.3	1.000x + 0.229 / 1.000
L-B10	Dwyer	VFA-21	03/01/2025	50	100	200	49.6	99.3	200.2	1.002x - 0.688 / 1.000

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Rotameter Data			Calibration Data							
				Flow Rate (ml/min)						Value From Calibration Curve
				Flow Rate (Reading)			Actual (Q std.)			
No.	Brand	Model	Date	1	2	3	1	2	3	y / R^2
L-B01	Dwyer	VFA-21	01/04/2025	50	100	200	49.7	99.0	200.9	0.993x + 0.389 / 1.000
L-B02	Dwyer	VFA-21	03/04/2025	50	100	200	50.1	100.2	199.3	0.995x + 1.127 / 0.999
L-B03	Dwyer	VFA-21	04/04/2025	50	100	200	50.4	100.7	201.1	0.992x + 1.381 / 1.000
L-B04	Dwyer	VFA-21	01/04/2025	50	100	200	50.8	99.0	198.2	0.998x + 0.410 / 0.999
L-B05	Dwyer	VFA-21	02/04/2025	50	100	200	50.6	99.5	198.9	0.993x + 0.837 / 1.000
L-B06	Dwyer	VFA-21	03/04/2025	50	100	200	50.1	100.2	201.7	1.002x - 0.009 / 1.000
L-B07	Dwyer	VFA-21	03/04/2025	50	100	200	50.3	101.7	200.5	0.996x + 1.584 / 1.000
L-B08	Dwyer	VFA-21	01/04/2025	50	100	200	50.8	99.2	199.4	0.991x + 0.972 / 1.000
L-B09	Dwyer	VFA-21	04/04/2025	50	100	200	50.5	99.6	199.7	0.996x + 1.101 / 0.999
L-B10	Dwyer	VFA-21	04/04/2025	50	100	200	50.4	101.5	202.0	0.998x + 1.243 / 1.000

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Dry Gas Meter Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML | S/N : 136164

Calibration Data

No.	Brand	Serial No.	Date	Flow Rate (ml/min)				Dry Gas Meter Calibration Factor (Y)	Y (Average)
				Setting	Actual Flowrate	Value From Calibration			
						y	R^2		
B01	BETA	06H00004	03/03/2025	500	501	0.994x + 5.503	1.000	0.993	0.999
				1,000	996			0.996	
				1,500	1,495			1.004	
				2,000	2,014			1.007	
				2,500	2,477			0.993	
B02	BETA	06H00007	04/03/2025	500	496	0.995x + 1.371	1.000	0.973	0.995
				1,000	995			0.994	
				1,500	1,501			1.008	
				2,000	1,998			0.992	
				2,500	2,483			1.009	
B03	BETA	06H00022	03/03/2025	500	499	0.992x + 6.400	0.999	0.978	0.992
				1,000	995			0.997	
				1,500	1,494			0.999	
				2,000	2,020			1.004	
				2,500	2,467			0.981	
B04	BETA	06H00002	03/03/2025	500	499	0.991x + 10.362	0.999	0.989	0.994
				1,000	998			0.992	
				1,500	1,502			0.999	
				2,000	2,019			1.002	
				2,500	2,466			0.988	
B05	BETA	06H00011	05/03/2025	500	495	0.996x + 4.080	1.000	0.994	1.003
				1,000	1,002			1.020	
				1,500	1,505			0.991	
				2,000	2,007			1.007	
				2,500	2,483			1.002	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
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CLC Accredited ISO/IEC 17025

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ANAB ACCREDITED CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

CERTIFICATE OF CALIBRATION

FOR

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

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

DATE OF RECEIVED : 20 July 2024 DATE OF ISSUED : 23 July 2024

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

Calibrated By : Sittipong Pimdee
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
23 July 2024

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

@clccalibration

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

CLC Accredited ISO/IEC 17025

ilac-MRA

ANAB ACCREDITED CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	VACUUM GAUGE
MANUFACTURER	:	HI-LIGHT
MODEL / TYPE	:	N/A
SERIAL NO.	:	N/A[64-220088-1]
DATE OF CALIBRATION	:	22 July 2024
DUE DATE OF CALIBRATION	:	22 July 2025

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 10) %RH

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPPP-05** according to **DKD-R 6-1** as calibration guidelines.
The calibration was performed by direct measurement with Document Process Calibrator and Pressure Module which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

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

TRACEABILITY :

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

UNCERTAINTY :

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

@clccalibration

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CLC Accredited ISO/IEC 17025

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ANAB ANSI National Accreditation Board ACCREDITED ISO/IEC 17025 CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

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

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

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

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

End of Certificate

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

ilac-MRA NSC-TISI-TIS17025 CALIBRATION 0049

CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	METTLER TOLEDO
MODEL	:	XS105DU
SERIAL No	:	1126422905
ID No	:	BA05/50
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	08-Mar-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	14-Mar-24
RECEIVED DATE	:	08-Mar-24

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

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

CERTIFICATE No : 24M2227

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	XS105DU
MANUFACTURER	:	METTLER TOLEDO	**S/N**	:	1126422905
ID No	:	BA05/50	**RECEIVED DATE**	:	08-Mar-24
AIR PRESSURE	:	1010mbar ± 1mbar	**CALIBRATION DATE**	:	08-Mar-24
AMBIENT TEMPERATURE	:	25° C ± 1° C	**RELATIVE HUMIDITY**	:	53 %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 LINEARLITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
2. REFERENCE STANDARD INSTRUMENTS :-

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

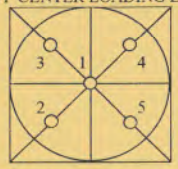
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

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

NSC-TISI-TISI7025
CALIBRATION 0349

CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

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.

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

CERTIFICATE No : 25M2254

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 ± 1mbar	**CALIBRATION DATE**	:	07-Mar-25
AMBIENT TEMPERATURE	:	24° C ± 1° C	**RELATIVE HUMIDITY**	:	54 %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 LINEARLITY 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

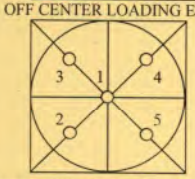
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND)

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 (± 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	50.0000	0.0000	0.00013
100.00	100.0001	-0.0001	0.00019
120.00	120.0002	-0.0002	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

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	**S.P.S.Consulting Service Co.,Ltd**	Date Tested:	January 6, 2025
		Recommendation Recertification	
Address :	**7 Soi Phaholyothin 24**	Period	6 Months
	Paholyothin Road	Recertification Due:	July 6, 2025
	Jompol Chatuchak, Bangkok 1090	Date Last Certified:	July 4, 2024
User Name:	**K.Phenpha Viphasthawat**	Visit Number:	2 of 2
Phone:	**083-9269252**	PerkinElmer Phone:	02-719-6420 ext 206
Fax:	**02-513-4221**	PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		**ACCESSORIES/COMPONENT NOT INCLUDED**
MODEL	**SERIAL NUMBER**	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	**CALIBRATION NUMBER**	**EXPIRATION**
IPV Methods		
TEST STANDARD USED	**PART NUMBER**	**EXPIRATION DATE**
Multielement Standard	N069-1579	December 30, 2025
Wavecal Solution	N058-2152	April 30, 2025
VIS Wavecal solution	N930-2946	December 30, 2025
Instrument Cal. STD4	N930-0221	August 30, 2025
CUSTOMER SUPPLIED	**COMMENTS**	**CUSTOMER INITIALS**
2 % HNO3		
10 % HNO3		

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

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

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 **DATE TESTED :** January 6, 2025

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	**As 193.696 nm**	≤ 0.007		0.00519	
	Ni 231.604 nm	≤ 0.008		0.00667	
	Ni 341.476 nm	≤ 0.012		0.00757	
Spectral Resolution : VIS	**La 408.672 nm**	≤ 0.020		0.01621	
	Ba 455.403 nm	≤ 0.025		0.02183	
Precision					
	As 193.656 nm	% RSD	< 1.0	0.51	%
	Zn 213.856 nm	% RSD	< 1.0	0.48	%
	Mn 257.610 nm	% RSD	< 1.0	0.03	%
	La 379.478 nm	% RSD	< 1.0	0.05	%
	Ba 455.403 nm	% RSD	< 1.0	0.07	%
	Ba 493.408 nm	% RSD	< 1.0	0.04	%
Detection Limits : Axial	**Tl 190.080 nm**	3(sd)		10.65	ppb
	As 193.696 nm	3(sd)		2.48	ppb
	Pb 220.353 nm	3(sd)		3.09	ppb
Detection Limits : Radial	**As 193.696 nm**	3(sd)		12.41	ppb
	Zn 213.856 nm	3(sd)		0.91	ppb
	Mn 257.610 nm	3(sd)		0.13	ppb
	La 379.478 nm	3(sd)		4.74	ppb
	Ba 455.403 nm	3(sd)		0.10	ppb
	Ba 493.408 nm	3(sd)		0.18	ppb
BEC : Axial (IB X 500)/(IS-IB)	**Cd 226.502 nm**	≤ 150 ppb		14.22	
BEC : Radial (IB X 1000)/(IS-IB)	**Mn 257.610 nm**	≤ 45 ppb		6.14	

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been perfomed 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: วิพัฒน์ พรหมลุมดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

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

Calibration Report
Non-Dispersive Infrared CO Analyzer

Date :	01 May 2025	Brand :	API	Model :	300E
No.	CO-B01			Serial No.	782

Calibrator (Dilution System)

Brand	: Teledyne	Model	: 700E
Last Cal. Date	: 28 October 2024	Serial No.	: 201-S

Reference Standard Gas

Standard Gas	: Carbon Monoxide (CO)			Cylinder No.	: D711839
Certified Date	: 14 March 2024	Expired Date	: 14 March 2032	Cylinder Conc.	: 4,580 ppm

Calibrating Condition

Pressure	1011	mmbar	Temp.	24.6	°C	% RH	50

Calibration Setting

Span Set Point	Initial Reading (Before Adj.), PPM			Final Reading (After Adj.), PPM
	Expected Concentration	Analyzer Response	%Dif	Analyzer Response
Zero	0	0.10	-	0
CO Span	40.00	40.07	0.175	40.00

API Model 300E CO Analyzer Check List

Parameter	Observed Value	Units	Nominal Range
Range	50	PPM	0-1000 ppm
Stability	0.10	PPM	< 1 ppm With Zero Air
CO Measure	4013.1	mV	2500-4800 mV
CO Reference	3948.8	mV	2500-4800 mV
Measure/Reference Ratio	1.179	-	1.1-1.3 W/Zero Air
Sample Pressure	28.7	In-Hg-A	~2"< Ambient Absolute Pressure
Sample Flow	805	CC/Min	800 ± 10%
Sample Temperature	48.3	°C	48 ± 4
Bench Temperature	48.1	°C	48 ± 2
Wheel Temperature	68.2	°C	68 ± 2
Box Temperature	30.7	°C	Ambient Temp + 7 ± 10
Photo-Drive	3032.6	mV	250 mV to 4750 mV
Slope	1.016	-	1.0 ± 0.3
Offset	0.2	-	0 ± 0.3

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

ilac-MRA

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP24020
Pages 1 of 3

Calibration Certificate

Equipment :	UV-VIS SPECTROPHOTOMETER
Manufacturer :	PERKINELMER
Model :	LAMBDA 25
Serial No.:	501S14123010
ID No.:	SP03/58
Calibration Mode :	WAVELENGTH ACCURACY PHOTOMETRIC ACCURACY
Condition As Found :	GOOD
Customer :	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD, CHOMPHON, CHATUCHAK, BANGKOK 10900, THAILAND.
Location :	WET CHEMISTRY LABORATORY IV
Ambient Temperature :	(28.1 ± 5) °C
Relative Humidity :	(47.2 ± 25) %
Received Date :	27 AUGUST 2024
Calibration Date :	27 AUGUST 2024
Date of Issue :	27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

NSC-TISI-TIS 17025
CALIBRATION 0394

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

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

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

2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certificate is traceable to the international system of unit maintained at :
   - 3.1 The UK National Physical Laboratory (NPL)
   - 3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

NSC-TISI-TIS 17025
CALIBRATION 0394

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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

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

UUC* = Unit Under Calibration

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

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

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

**Specific Acceptance :
Transmission $\leq$ 1.0 T(%), Absorbance $\geq$ 2.0 A
**Stray light not TISI Accredited

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

End of Calibration Certificate

T. Petch.

Waters® AutoSpec Premier™

Installation Checklist

Introduction

Warning: There are various hazards associated with the installation and operation of this equipment. The precautions detailed in the *Waters AutoSpec Premier Operator's Guide* (71500089202) must be observed when following procedures listed in this checklist.

The AutoSpec Premier Installation Checklist is completed by a Waters field service engineer (FSE) during the installation of the instrument. The purpose of the document is:

- To ensure that all the necessary steps are followed during the installation.
- To provide proof of installation by a qualified Waters engineer.
- To demonstrate performance of the AutoSpec Premier to the customer.
- To ensure that the customer is trained to a level to allow basic operation of the system.

The checklists follow the installation sequence for a typical AutoSpec Premier system. During the installation, the FSE marks the checkboxes to indicate that each statement is true.

The tests in this document are sufficient to test the performance of the instrument. If the customer has purchased a qualification, then the FSE does not need to fill out this entire checklist, but does need to fill out the *Customer Training* section.

A signed copy of the checklist is left with the customer to document system installation and testing. The FSE also retains a copy of this checklist and/or faxes it to the regional office.

The serial numbers of the major components used in the system at the time of installation are recorded in the following table.

Component summary	
Company: Cheng Shiu University Address: 高雄市鳥松區澄清路840號 Tel: 886-7-7310606	Component Serial Number: AutoSpec Premier: P829 MassLynx PC: S4DVH96 Separations module (if applicable): Other : GC: A7890/CN12061030 GC PAL/161974

Notice

The information in this document is subject to change without notice and should not be construed as a commitment by Waters Corporation. Waters Corporation assumes no responsibility for any errors that may appear in this document. This checklist is believed to be complete and accurate at the time of publication. In no event shall Waters Corporation be liable for incidental or consequential damages in connection with or arising from the use of this document.

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Instrument Setup

The site meets the criteria specified in the *Site Preparation Guide* ..... ☑

The consignment has been checked for shortages. Any discrepancies have been reported to Waters representatives ..... ☑

The consignment has been checked for physical condition. Any damage has been reported to Waters representatives ..... ☑

The instrument is positioned in its final location ..... ☑

The magnet is in good physical condition ..... ☑

The Hall probe is fitted to the instrument ..... ☑

The top half of the magnet is fitted to the instrument ..... ☑

The magnet transformer is connected to the instrument ..... ☑

Water fittings are connected to the instrument and the cooling water system ..... ☑

The cooling water system is set up and primed ..... ☑

The rotary or scroll pumps are connected to the system ..... ☑

The instrument power cable is connected to the mains transformer, if present ..... ☑

or:

The instrument power cable is connected to the power supply ..... ☑

The EPC is connected to the instrument ..... ☑

The communications cables are connected to the instrument ..... ☑

The GC table from the panels kit is fitted ..... ☑

The compressed air is connected to the inlet and the pressure is set to 6.2 bar (90 psi) ..... ☑

The EPC is powered up and a communications link is established ..... ☑

The soft vent dry nitrogen supply is connected and the pressure is set to ≤ 1 bar (15 psi) ..... ☐ N/A

The CI gas is connected and the pressure is set to ≤ 1 bar (15 psi) ..... ☐ N/A

The rotary pumps are primed (not applicable for scroll pumps) ..... ☑

The system is rough-pumped and the diffusion or turbo pumps are on ..... ☑

Initial vacuum readings (shown below) have been recorded after 2 hours fine pumping ..... ☑

	Source	Analyzer	Inlets
Rough	$1.00e^{-2}$ mbar	$1.91e^{-2}$ mbar	$1.82e^{-2}$ mbar
Fine	$2.88e^{-7}$ mbar	$2.63e^{-7}$ mbar	

The optical bench is raised ..... ☑

The GC is fitted to the instrument ..... ☑

The gas supplies and cables are connected to the GC and the helium pressure is set to 7 bar (100 psi) ..... ☑

The GC is powered up and checked for leaks ..... ☑

The Tune page readbacks are credible ..... ☑

The instrument has been baked overnight ..... ☑

Vacuum readings (shown below) have been recorded after baking ..... ☑

	Source	Analyzer	Inlets
Rough	$1.00e^{-2}$ mbar	$1.91e^{-2}$ mbar	$1.66e^{-2}$ mbar
Fine	$2.63e^{-7}$ mbar	$1.64e^{-7}$ mbar	

System Checks

The Connections INSIGHT® software is installed, setup and registered (if applicable) ..... ☐ N/A

NOTE: *For details on installing Connections INSIGHT software refer to the Connections INSIGHT Installation Guide (p/n 715001399) and the Connections INSIGHT User Guide (p/n 715001400). Also refer to latest service notes for more information.*

An ion beam is visible ..... ☑

The slits have been set up and the parameters recorded below ..... ☑

		Source	Collector
Left side	maximum	70.40	63.80
	minimum	61.80	43.20
Right side	maximum	70.80	66.20
	minimum	41.60	45.80

The magnet is positioned and the EFF value has been recorded below ..... ☐

EFF Value	1000

The lens compensation has been checked ..... ☑

The Y focus tracking has been checked ..... ☑

The peak side ripple on mass 219 has been measured and recorded below. ..... ☑

Peak Side Ripple	17 ppm

The DCI probe tip has been verified for current regulation (option) ..... ☒ N/A

The standard cooled probe heaters regulate and sample introduction has been verified (option) ..... ☒ N/A

The external heated, water cooled probe heaters regulate and sample introduction has been verified (option) ..... ☐ N/A

The instrument's covers have been fitted ..... ☑

Basic Tests (All Instruments)

Before running the tests ensure that the mass spectrometer has been in *Operate* for at least 30 minutes. The results of each test should be printed out and annotated.

Resolution

Resolving power measured using the 10% valley definition while statically tuning on a suitable peak above mass 200 Da is ≥ 80,000:

Measured Value for Ultima Magnet: 87719.

Transmission

The detector response for a reference compound peak at 10,000 resolving power compared to that for the same peak at 1000 resolving power using the same detector voltage and ionization parameters is ≥ 10%.

Transmission: 9

EI Positive Ion Sensitivity

Using a 200 pg/µL solution of methyl stearate in hexane, with 1 µL deposited on the solids probe, the charge collected in SIR mode while monitoring the molecular ion (298.3 Da) in EI mode at 1000 resolving power is ≥ 5×10^{-7} C/µg:

Measured Value for Ultima Magnet: $6.359e^{-7}$ C/µg

Optional Tests (Non-Dioxin Instruments Only)

Use Methane gas when performing the GC and probe.

Mass Measurement Accuracy (RMS)

Using 10 ng of n-$C_{36}H_{74}$ on the probe, the root mean square error on averaged data between measured and accepted masses for the molecular ion (m/z 506) and all peaks of the composition C_nH_{2n+1} above m/z 70 and greater than 0.5% of the base peak (m/z 71) $\leq$ 1.5 mDa.

RMS Error :_____

Scan Cycle Rate

The scan cycle rate for Ultima Magnet over the range m/z 500-50-500 is $\geq$ 3 scans per second:

Measured Value:_____

CI Tests (Option)

Use Methane gas when performing the CI specification.

CI Positive Ion Sensitivity

The charge collected for Ultima Magnet while monitoring the 299.3 peak from methyl stearate at 1000 resolution is $\geq 5 \times 10^{-8}$ C/µg:

Measured Value:_____

CI Negative Ion Sensitivity

The charge collected for Ultima Magnet while monitoring the 208.1 peak from anthraquinone at 1000 resolution is $\geq 5 \times 10^{-8}$ C/µg:

Measured Value:_____

GC/MS Tests (Option)

GC/MS Sensitivity - Dioxin Instruments Only

The following values are based on a GC peak width at half height of 2 seconds. For other values, the signal-to-noise ratio may be calculated by assuming a relationship inversely proportional to GC peak width. The cycle time for selecting all 6 masses is about 0.5 seconds. At least 1 pg of $^{13}C_{12}$-2,3,7,8-TCDD is co-injected with the 100 fg standard.

In SIR mode at 10,000 resolution, while selecting m/z 319.8965 and 321.8936 from natural 2,3,7,8-TCDD and m/z 331.9368 and 333.9339 from $^{13}C_{12}$-2,3,7,8-TCDD, plus a lock mass and lock mass check, the signal-to-noise ratio at m/z 321.8936 from 100 fg of 2,3,7,8-TCDD standard injected on to a 30 metre DB5 column is:

- ≥ 125:1, where noise is a peak-to-peak measurement encompassing 95% of raw noise data points (equivalent to 4 standard deviations, or ± 2σ about the mean).

or

- ≥250:1, where noise is mean positive to mean negative going noise about the mean (EPA 8290 definition, equivalent to 2 standard deviations, or ± σ about the mean).

Signal-to-Noise Ratio (2σ definition) : 187.72

Signal-to-Noise Ratio (4σ definition) : _____

GC/MS Sensitivity - Non-Dioxin Instruments Only

From an injection of 200 pg of methyl stearate onto a direct inlet capillary column, the signal-to-noise ratio for the molecular ion (m/z 298.3) at 1000 resolution while scanning at 1 sec/decade over the range m/z 500-50 ≥ 400:1.

Signal-to-Noise Ratio : _____

GC/MS Mass Measurement Accuracy - Non-Dioxin Instruments Only

From an injection of 10 ng of methyl stearate, at 5000 resolution while scanning at 0.5 sec/decade, the RMS error determined from averaged data between measured and accepted masses for all peaks which are above m/z 70 and > 5% of the base peak (m/z 74) ≤ 2 mDa RMS.

RMS Error : _____

Split Detector (Option)

For a Methyl Stearate (exact mass = 298.2872 Da)/Butyl stearate (fragment exact mass = 298.2827 Da) mixture injected on to a 30m DB5 column, at an instrument resolution of 10,000, the symmetry values measured on the split detector will be > 95% for the true masses and < 60% for the interfering masses in each channel.

Symmetry Values	True Mass	Interferrence Mass
Methyl stearate		
Butyl stearate		

Customer Training

The Waters engineer will introduce the following topics while demonstrating the system installation specifications. Waters intends only to provide familiarization with the basic operation and maintenance of the system, and does not attempt to provide comprehensive training during installation.

Safety Around the Instrument

- Voltage hazards
- Current hazards
- Thermal hazards
- Mechanical hazards
- Trip hazards
- Stray magnetic fields
- Chemical hazards
- Compressed gases

Overview

- Utilities connections
- The vacuum system
- Covers and panels

Starting up the Instrument

- Connection for power, air and water services
- Switch on procedure

Establishing Communications with the Embedded PC System

- Ping
- Telnet connection
- Telnet logging
- rioMainMenu

Starting the Instrument Peripherals

- GC
- Autosampler

Basic Operation

- Starting MassLynx
- Pumping down the instrument - manual controls
- Pumping down the instrument - software controls
- Baking the flight tube
- Switching the instrument into operate
- Obtaining an EI beam
- Optimizing the instrument at 1000 resolving power

MassLynx Familiarization

- MassLynx project creation
- Tour of the MassLynx file system
- File extensions

Advanced Operation

Tuning the instrument to beyond 10,000 resolving power .....
Setting up a SIR experiment .....
Calibrating a SIR experiment .....
Setting up a magnet scan .....
Setting up a voltage scan .....
Calibrating a magnet and voltage scan .....
Setting up a sample list .....
Running a sample list .....
Configuring a GC inlet .....
Fitting a GC column to the instrument .....
Using the inlets .....
Setting up a GC and autosampler method

Data Processing

Chromatograph .....
Spectrum .....
Applications managers (options) .....
Libraries (option) .....

Routine Maintenance

Venting the source .....
Venting the analyzer .....
Changing an inner EI source .....
Changing an outer EI source .....

Hardware Options

Inner source options .....
Inlet options .....
Linked scanning .....
Split Detector .....

Additional Resources

Support Center (www.waters.com). .....
Education and training (www.waters.com). .....
Obtaining spares at waters.com. .....
Use of Connections INSIGHT and submitting requests (if connected). .....
The benefits of Total Assurance Warranty (TAW) .....

Installation Confirmation

The instrument installation and set-up has been performed and acknowledged by marking each step in this checklist ..... ☑

All tests pertinent to this installation have been performed and have met the defined specification criteria ..... ☑

The customer has been trained in all applicable aspects of instrument operation listed in this installation checklist ..... ☑

I confirm on behalf of Cheng Shiu University
Company Name

that the instrument has been installed in accordance with the procedures detailed in this installation checklist and that instrument operation has been demonstrated by conducting all tests relevant to this installation. The test specifications defined in this installation checklist have been achieved.

Signed: _____ **Date:** 2012/10/30
Customer

I certify that the installation has been successfully completed.

Signed: Dan Shen Lim **Date:** 2012/10/30
Waters Engineer

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	**Date Tested:**	January 6, 2025
		Recommendation Recertification	
Address :	7 Soi Phaholyothin 24	**Period**	6 Months
	Paholyothin Road	**Recertification Due:**	July 6, 2025
	Jompol Chatuchak, Bangkok 10900	**Date Last Certified:**	July 4, 2024
User Name:	K.Phenpha Viphasthawat	**Visit Number:**	1 OF 2
Phone:	083-9269252	**PerkinElmer Phone:**	02-719-6420 ext 204
Email:		**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-03012875/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

1. INSTRUMENT CHECKS	
A. The Mirror and Lenses Condition	OK
B. Grating Condition	OK
C. Replace or Clean Dust Filter	OK
D. Cleaning the Contact Cylinders	OK
E. Cleaning the Furnace Windows	OK
F. Cleaning the Burner Head	OK
G. Cleaning the Nebulizer	OK
H. Cleaning the Drain System	OK
2. AUTOSAMPLE CHECK	
A. Sampling and Arm	OK
B. Sampling & Rinse Pump	OK
C. Sample Position & Clean	OK
3. COOLING SYSTEM CHECKS	
A. Clean and Change Distill water	OK
B. Themosensor	OK
4. FIAS CHECKS	
A. Pump and 5 Port Valve	N/A
B. Chemifold and Tubing	N/A
C. Power Supply	N/A
D. Flow meter and Gas system	N/A

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
A. Flame Mode Tests		
1. Detector-Linearity with Barium (553.55 nm)		
Neutral Density Filter 0.2 :	0.2042 Abs. ± 5%	0.2029 Abs.
Neutral Density Filter 1.0 :	0.9798 Abs. + 5%	1.0137 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.010 Abs.	0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.001 Abs.	0.0002 Abs.
4. D_2 Background Compensation (Copper 324.75 nm) with Neutral Density Filter 1.0	Absorbance ≤ 0.010 Abs	0.0020 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0002 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0007 Abs.

PerkinElmer Scientific (Thailand) Co., Ltd.
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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 DATE TESTED January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
7. Flame Interlock Shutdown	Shutdown correct?	OK
8. Flame Sensitivity with Copper (324.75 nm) (5 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and Stainless stell nebulizer)	Sensitivity ≥ 0.250 Abs.	0.3115 Abs.
(2 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and High sensitivity nebulizer)	Sensitivity ≥ 0.250 Abs.	N/A Abs.

PerkinElmer Scientific (Thailand) Co., Ltd.
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PerkinElmer
For the Better

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE	
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm)			
(mesure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0012	
	SD ≤ 0.005 Int.Abs	0.0002	Int.Abs.
3. Chromium Characteristic Mass(m_0) and Precition (357.87 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 10 ug/L Cr standard)			
	m0 Results ≤ 7.0 pg/0.0044A-s	5.4	pg/0.0044A-s
	Precision ≤ 2.0%	1.15	%
4. Copper Characteristic Mass(m_0) and Zeeman Ratio (324.75 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 25 ug/L Cu standard)			
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
	Zeeman Ratio 0.52 ± 0.04	0.542	

PerkinElmer Scientific (Thailand) Co., Ltd.
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WO-03012875/2025

PerkinElmer
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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio = Atomic Signal(peak area) / Atomic Signal(peak area)+Backgroung Signal(peak area)

= 0.1635/0.1635+0.1378

0.542

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

☑ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Customer Service Engineer: วิพรรณ พรมลุ่มดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

ARCHEMICA

Certificate of Calibration

Aquion: Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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

ARCHEMICA LAB
บริษัท อาร์เคมีก้า แลบ จำกัด
ARCHEMICA LAB CO.,LTD.

Operator Signature: _____ **Date: June 24, 2024**

(Mr. Ponwut Kornthongnimit)

Test Engineer

เอกสารแนบ 5-4

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงโดยทั่วไป

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220 **MTC No.** EEL. BP. 44/0268

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 Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 19 Feb. 2025

Date of Calibration : 21 Feb. 2025

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

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Office
196 Phahonyothin Road, Ladyao, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220 **MTC No.** EEL. BP. 44/0268

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	93.81	-0.19	± 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	0.95	± 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 Kluaypa)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 20112680219007390O1

End of Certificate

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

FM.BL.MTC.002 Rev.5

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

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

Noise B_081/25

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	21 February 2025
		Due Date	21 February 2026

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B37	ACO	6236	00192028	10 March 2025	93.9	93.9
ACO-B38	ACO	6236	00192029	10 March 2025	93.8	93.9
ACO-C1-B03	ACO	6238	00223040	10 March 2025	93.9	93.9
ACO-C1-B04	ACO	6238	00223041	10 March 2025	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

เอกสารแนบ 5-5

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงของเครื่องจักร

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220 **MTC No.** EEL. BP. 44/0268

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 Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 19 Feb. 2025

Date of Calibration : 21 Feb. 2025

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.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220 **MTC No.** EEL. BP. 44/0268

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	93.81	-0.19	± 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	0.95	± 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 Kluaypa)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 20112680219007390O1

End of Certificate

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

FM.BL.MTC.002 Rev.5

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

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

Noise B_017/25

Sound Level Meter Calibration Report

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

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B41	ACO	6236	00192032	09 February 2025	94.0	93.9
ACO-B43	ACO	6236	00192034	09 February 2025	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.85 ± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

เอกสารแนบ 5-6

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำเสียจากบ่อพักน้ำเสีย

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

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24E6416
REFERENCE No : 73694-1

Certificate of Calibration

EQUIPMENT	:	pH METER
MANUFACTURER	:	HANNA
MODEL	:	HI 3512
SERIAL No	:	TH118035
ID No	:	pH 04/56
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	27-Jun-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	27-Jun-24
RECEIVED DATE	:	24-Jun-24

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

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

CERTIFICATE No : 24E6416

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3

F-G010 REV 03

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

CERTIFICATE No : 24E6416

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

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

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

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

Certificate

CAL
Calibratech Co.,Ltd.
7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

ilac-MRA
NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 67-400037-2 **Page : 1 of 2**

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

Equipment : Liquid in Glass Thermometer

Manufacturer : SK Model : N/A
Range : 0 °C to 100 °C Resolution : 1 °C
Serial No. : N/A Immersion : Total
ID No. : TM21/59

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

Date of Received : 23 January 2024
Date of Calibration : 03 February 2024
Date of Issue : 03 February 2024
Calibrated by : Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by :
(Surachai Promthong)
Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

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CAL
Calibratech Co.,Ltd.
7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 67-400037-2 **Page : 2 of 2**

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 °C Standard reading 0.4336 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
20.5609	20	0.6	0.31

Remark

UUC : Unit Under Calibration

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

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

-oOo-

CAL-F0031-03

CAL
Calibratech Co.,Ltd.
7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 68-400046-2 **Page : 1 of 2**

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

Equipment : Liquid in Glass Thermometer

Manufacturer : SK Model : N/A
Range : 0 °C to 100 °C Resolution : 1 °C
Serial No. : N/A Immersion : Total
ID No. : TM21/59

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

Date of Received : 21 January 2025
Date of Calibration : 24 January 2025
Date of Issue : 24 January 2025
Calibrated by : Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0023-24	16 Feb 2026	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by :
(Permpon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL
Calibratech Co.,Ltd.
7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 68-400046-2 **Page : 2 of 2**

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 ° C Standard reading 0.4429 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
20.4801	20	0.5	0.31

Remark

UUC : Unit Under Calibration

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

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

- oOo -

CAL-F0031-03

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

ilac-MRA

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP24020
Pages 1 of 3

Calibration Certificate

Equipment :	UV-VIS SPECTROPHOTOMETER
Manufacturer :	PERKINELMER
Model :	LAMBDA 25
Serial No.:	501S14123010
ID No.:	SP03/58
Calibration Mode :	WAVELENGTH ACCURACY PHOTOMETRIC ACCURACY
Condition As Found :	GOOD
Customer :	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD, CHOMPHON, CHATUCHAK, BANGKOK 10900, THAILAND.
Location :	WET CHEMISTRY LABORATORY IV
Ambient Temperature :	(28.1 ± 5) °C
Relative Humidity :	(47.2 ± 25) %
Received Date :	27 AUGUST 2024
Calibration Date :	27 AUGUST 2024
Date of Issue :	27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

NSC-TISI-TIS 17025
CALIBRATION 0394

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

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

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

2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certificate is traceable to the international system of unit maintained at :
   - 3.1 The UK National Physical Laboratory (NPL)
   - 3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

NSC-TISI-TIS 17025
CALIBRATION 0394

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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

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

UUC* = Unit Under Calibration

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

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

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

**Specific Acceptance :
Transmission $\leq$ 1.0 T(%), Absorbance $\geq$ 2.0 A
**Stray light not TISI Accredited

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

End of Calibration Certificate

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

NSC-TISI-TIS17025 CALIBRATION 0049

CERTIFICATE No : 24M2229
REFERENCE No : 72448-3

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	SARTORIUS
MODEL	:	BSA224S-CW
SERIAL No	:	36591843
ID No	:	BA 09/61
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	08-Mar-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	14-Mar-24
RECEIVED DATE	:	08-Mar-24

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

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

CERTIFICATE No : 24M2229

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	BSA224S-CW
MANUFACTURER	:	SARTORIUS	**S/N**	:	36591843
ID No	:	BA 09/61	**RECEIVED DATE**	:	08-Mar-24
AIR PRESSURE	:	1010mbar ± 1mbar	**CALIBRATION DATE**	:	08-Mar-24
AMBIENT TEMPERATURE	:	25° C ± 1° C	**RELATIVE HUMIDITY**	:	55 %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 LINEARLITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

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

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

5. OFF CENTER LOADING ERROR

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

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

END OF CALIBRATION REPORT

F-G010 REV 03

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

NSC-TISI-TIS17025
CALIBRATION 0849

CERTIFICATE No : 25M2256
REFERENCE No : 76365-3

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	SARTORIUS
MODEL	:	BSA224S-CW
SERIAL No	:	36591843
ID No	:	BA09/61
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	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.

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

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	BSA224S-CW
MANUFACTURER	:	SARTORIUS	**S/N**	:	36591843
ID No	:	BA09/61	**RECEIVED DATE**	:	07-Mar-25
AIR PRESSURE	:	1009mbar ± 1mbar	**CALIBRATION DATE**	:	07-Mar-25
AMBIENT TEMPERATURE	:	24° C ± 1° C	**RELATIVE HUMIDITY**	:	52 %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 LINEARLITY 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 200 g WAS 0.000071 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.00	0.0000	0.0000	0.00012
0.10	0.1000	0.0000	0.00012
0.20	0.2000	0.0000	0.00012
0.50	0.5000	0.0000	0.00012
1.00	1.0000	0.0000	0.00012
2.00	2.0000	0.0000	0.00012
5.00	5.0000	0.0000	0.00012
10.00	10.0000	0.0000	0.00012
20.00	20.0001	-0.0001	0.00012
50.00	50.0000	0.0000	0.00014
100.00	100.0001	-0.0001	0.00019
200.00	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

MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD
214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th

NSC-TISI-TIS 17025 CALIBRATION 0052

CALIBRATION CERTIFICATE

Certificate No. : S2024090374-0003
Date Issued : 23-Sep-24

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

Equipment : Incubator

Manufacturer : BINDER
Model : BD 115
Serial No. : 12-16967
ID No./Tag No. : IN 05/56
Date Received : 16-Sep-24
Date Calibrated : 16-Sep-24

Calibrated by : Anusak Songliam

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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: Sarayuth T.
(Sarayuth Tochua)

CERTIFIED MIT

Certificate No. : S2024090374-0003

Environment : Ambient Temperature : Start record 23.7 °C, Stop record 23.5 °C
Relative Humidity : Start record 54.6 %RH, Stop record 54.4 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability[1] (°C)	Measured Uniformity[2] (°C)	Overall Variation[3] (°C)
35	35.0	35.0	0.04	0.21	0.38
41.5	41.5	41.5	0.07	0.19	0.30

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty[4] ±°C
35	34.81	35.12	34.93	34.92	35.02	34.82	34.92	35.13	34.98	0.23
41.5	41.31	41.49	41.33	41.34	41.41	41.31	41.52	41.32	41.46	0.23

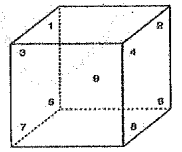
Decision Rule with Guard Band

Calibration Temperature	Pass / Fail									MPE
(°C)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	(±°C)
35	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5
41.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5

Pass = **|error| + |uncertainty| <= |MPE|** **MPE = Maximum Permissible Error**
Fail = **|error| + |uncertainty| > |MPE|**

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202407373-0005 for Temperature Indicator with Sensor Serial No. US37020317, Due 31-Jan-25

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
4. The uncertainty of measurement is included temperature stability.
5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

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

CERT.No.: HS-V015C

Certificate of Calibration

Calibration Date : 20 Mar 24

Submitted by : ASIA LAB @ CONSULTANT CO.,LTD
184 Soi Phutthamonthon Sai 2 Soi 12,
Bangphai, Bangkae, Bangkok 10160

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

Model : YSI 5000
S/N : 15B100751
Probe : YSI 5010
S/N : 22D100097
ID NO. : -
Air Temp ref : S/N. F8065C26
Barometric ref : S/N. F8065C26
Water Temp ref : S/N. 11430

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)		(status)
Measurement 1 (mg/l)	9.08	(PASS)	-	-
Measurement 2 (mg/l)	9.08	(PASS)	-	-
Measurement 3 (mg/l)	9.08	(PASS)	-	-
Measurement 4 (mg/l)	9.08	(PASS)	-	-
Measurement 5 (mg/l)	9.08	(PASS)	-	-
Measurement 6 (mg/l)	9.08	(PASS)	-	-
Measurement 7 (mg/l)	9.08	(PASS)	-	-
Measurement 8 (mg/l)	9.08	(PASS)	-	-
Measurement 9 (mg/l)	9.08	(PASS)		-
Measurement 10 (mg/l)	9.08	(PASS)	-	-
Mean Measurement	9.08	mg/l	-	-
Inaccuracy	0.01	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature
(Kittipong Maekwong)

Laboratory Manager
(Supreecha Sumaritam)

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

CERT.No.: HS-W015C

Certificate of Calibration

Calibration Date : 18 Mar 25

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)	9.08	(PASS)	-	-
Measurement 2 (mg/l)	9.08	(PASS)	-	-
Measurement 3 (mg/l)	9.08	(PASS)	-	-
Measurement 4 (mg/l)	9.07	(PASS)	-	-
Measurement 5 (mg/l)	9.07	(PASS)	-	-
Measurement 6 (mg/l)	9.07	(PASS)	-	-
Measurement 7 (mg/l)	9.07	(PASS)	-	-
Measurement 8 (mg/l)	9.07	(PASS)	-	-
Measurement 9 (mg/l)	9.07	(PASS)		-
Measurement 10 (mg/l)	9.07	(PASS)	-	-
Mean Measurement	9.07	mg/l	-	-
Inaccuracy	0.02	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)

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

CERTIFICATE No : 24T0774
REFERENCE No : 71986-2

Certificate of Calibration

EQUIPMENT	:	COD REACTOR
MANUFACTURER	:	HACH
MODEL	:	DRB 200
SERIAL No	:	15110C0235
ID No	:	CRB 05/59
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	5-Feb-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	5-Feb-24
RECEIVED DATE	:	5-Feb-24

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

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

CERTIFICATE No : 24T0774

Calibration Report

EQUIPMENT	:	COD REACTOR			
MANUFACTURER	:	HACH	**MODEL**	:	DRB 200
ID NUMBER	:	CRB 05/59	**SERIAL NUMBER**	:	15110C0235
RECEIVED DATE	:	5-Feb-24	**CALIBRATION DATE**	:	5-Feb-24
AMBIENT TEMPERATURE	:	23° C ± 1° C	**RELATIVE HUMIDITY**	:	52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

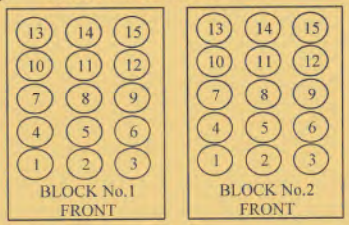
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

	INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1)	DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	23T6640	14-Jul-24

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.		1	2
Controller temperature (°C)		145	145
Indicating Temperature		145	145
Measured Temperature (° C) at Spread Locations	1	150.2	150.1
	2	150.2	150.1
	3	150.2	149.8
	4	149.9	150.3
	5	150.1	149.8
	6	150.7	149.6
	7	149.9	150.2
	8	149.9	149.6
	9	150.8	150.4
	10	149.5	150.1
	11	150.2	150.6
	12	150.0	150.1
	13	149.5	149.6
	14	149.5	149.4
	15	149.6	149.5
Uncertainty of Measurement(± °C)		0.86	0.86

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

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

Certificate of Calibration

EQUIPMENT	:	COD REACTOR
MANUFACTURER	:	HACH
MODEL	:	DRB 200
SERIAL No	:	15110C0497
ID No	:	DRB 05/59
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	:	CHAICHARN CH.
CALIBRATION DATE	:	27-Jan-25
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	27-Jan-25
RECEIVED DATE	:	15-Jan-25

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

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

Calibration Report

EQUIPMENT	:	COD REACTOR			
MANUFACTURER	:	HACH	**MODEL**	:	DRB 200
ID NUMBER	:	DRB 05/59	**SERIAL NUMBER**	:	15110C0497
RECEIVED DATE	:	15-Jan-25	**CALIBRATION DATE**	:	27-Jan-25
AMBIENT TEMPERATURE	:	23° C ± 1° C	**RELATIVE HUMIDITY**	:	53 %RH ± 10 % RH

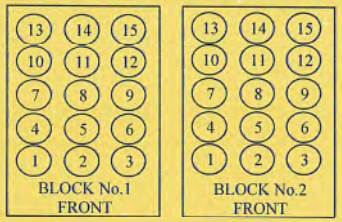
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASURMENT 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	6635300	24T6468	26-Jun-25

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



		Block No.	1	2
		Calibration Point (°C)	150	150
		Controller temperature (°C)	144	144
		Indicating Temperature	144	144
Measured Temperature (° C) at Spread Locations	1		150.01	149.57
	2		150.69	150.44
	3		150.40	149.46
	4		150.22	149.89
	5		150.27	149.75
	6		150.51	150.45
	7		150.24	150.03
	8		150.20	150.08
	9		150.14	150.14
	10		149.70	149.83
	11		149.58	149.89
	12		149.46	149.79
	13		148.77	149.03
	14		148.99	149.14
	15		149.02	149.62
		Uncertainty of Measurement(± °C)	0.87	0.87

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.
NOTE 3 : 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

MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD
214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th

CALIBRATION CERTIFICATE

Certificate No. : L202407024-0001
Date Issued : 31-Jul-24

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

Equipment : Block Digestion (Gerhardt, TR)

Manufacturer : Gerhardt
Model : -
Serial No. : 4061832
ID No./Tag No. : KJ 01/43
Date Received : 18-Jul-24
Date Calibrated : 30-Jul-24

Calibrated by : Surat Aumarb

Calibration Method or Calibration Procedure Used

In-house method : CP-49 base on TLAS G-20 by comparing against Standard Thermometer.

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: (Sarayuth Tochua)

CERTIFIED MIT

Certificate No. : L202407024-0001
Environment : Ambient Temperature : Start record 26.8 °C, Stop record 26.9 °C
Relative Humidity : Start record 54.4 %RH, Stop record 57.1 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability[1] (°C)	Measured Uniformity[2] (°C)	Overall Variation[3] (°C)
380	380	380	1.34	2.28	3.27

Calibration Temperature (°C)	Standard Reading (°C), Probe No. 20 is Reference Probe					Uncertainty[4] (±°C)
	No. 1	**No. 2**	**No. 3**	**No. 4**	**No. 5**	
	380.07	379.54	380.96	379.66	379.31	
	No. 6	**No. 7**	**No. 8**	**No. 9**	**No. 10**	
380	380.63	380.22	379.71	380.41	380.72	2.2
	No. 11	**No. 12**	**No. 13**	**No. 14**	**No. 15**	
	380.40	380.28	380.03	379.69	380.47	
	No. 16	**No. 17**	**No. 18**	**No. 19**	**No. 20**	
	380.11	379.97	379.93	379.81	379.58	

Decision Rule with Guard Band

Calibration Temperature (°C)	Pass / Fail					MPE (±°C)
	No. 1	**No. 2**	**No. 3**	**No. 4**	**No. 5**	
	Pass	Pass	Pass	Pass	Pass	
	No. 6	**No. 7**	**No. 8**	**No. 9**	**No. 10**	
	Pass	Pass	Pass	Pass	Pass	
380	**No. 11**	**No. 12**	**No. 13**	**No. 14**	**No. 15**	5
	Pass	Pass	Pass	Pass	Pass	
	No. 16	**No. 17**	**No. 18**	**No. 19**	**No. 20**	
	Pass	Pass	Pass	Pass	Pass	

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

Without adjustment

No.1	No.2	No.3	No.4
No.5	No.6	No.7	No.8
No.9	No.10	No.11	No.12
No.13	No.14	No.15	No.16
No.17	No.18	No.19	No.20

Top view position

Condition As-Received : Used Item
The measurment results and statements of conformity with specification only relate to the item calibrated.

Measurement Standards Used & Traceabilitly :

The International System of Units (SI) through

MIT Certificate No. L202403007-0003 for Digital Thermometer with Probe (Agilent) Module 2 (172) Type K Serial No. US37011204, Due 10-Sep-24

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
4. The uncertainty of measurement is included temperature stability.

End of Certificate

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

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

Part Number	Release	Publication Date
TH09370064	C	March 2013

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

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3	PSS,PSS,FID
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

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

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

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Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

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PC Maintenance:

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

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.

This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.

Review of Preventive Maintenance:		
Authorized PerkinElmer Representative Monchai Kitcharoenkeat	Monchai	Date: 22-Aug-2024 (DD-MMM-YYYY)
Authorized Customer Representative: Ms. Naruecha	Narucha	Date: 22-Aug-2024 (DD-MMM-YYYY)

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MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	**S.P.S.Consulting Service Co.,Ltd**	Date Tested:	January 6, 2025
		Recommendation Recertification	
Address :	**7 Soi Phaholyothin 24**	Period	6 Months
	Paholyothin Road	Recertification Due:	July 6, 2025
	Jompol Chatuchak, Bangkok 1090	Date Last Certified:	July 4, 2024
User Name:	**K.Phenpha Viphasthawat**	Visit Number:	2 of 2
Phone:	**083-9269252**	PerkinElmer Phone:	02-719-6420 ext 206
Fax:	**02-513-4221**	PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		**ACCESSORIES/COMPONENT NOT INCLUDED**
MODEL	**SERIAL NUMBER**	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	**CALIBRATION NUMBER**	**EXPIRATION**
IPV Methods		
TEST STANDARD USED	**PART NUMBER**	**EXPIRATION DATE**
Multielement Standard	N069-1579	December 30, 2025
Wavecal Solution	N058-2152	April 30, 2025
VIS Wavecal solution	N930-2946	December 30, 2025
Instrument Cal. STD4	N930-0221	August 30, 2025
CUSTOMER SUPPLIED	**COMMENTS**	**CUSTOMER INITIALS**
2 % HNO3		
10 % HNO3		

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

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MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

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

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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-
Date PM Performed: (DD-MMM-YYYY)	22-Feb-2025	**Next PM Due Date:** (DD-MMM-YYYY)	22-Aug-2025

Part Number	Release	Publication Date
TH09370070	C	August 2016

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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				

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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 0.33 Volt

**Neutral to ground not more than 0.5 volts peak to peak*

☑ Inspect all gas line filters and traps; Replace if necessary with customer supplied spares.
Carrier gas ☑ Helium ☐ Nitrogen ☐ Hydrogen
Moisture level ☑ Good ☐ Need to replace ☐ Other _____

Detector gas ☑ Air Zero ☑ Hydrogen ☐ Nitrogen ☐ Helium
Moisture level ☑ Good ☐ Need to replace ☐ Other _____

☑ Inspect the customer log book and make any appropriate PM entries.

☑ Leak check all fittings from the gas source to instrument.
Gas leakage ☑ Pass ☐ Fail Comment _____

☑ Perform general inspection of system for cleanliness.

☑ Inspect for functional and clean electronic cooling and oven vent fans
Electronic cooling fan ☑ Yes ☐ No
Oven cooling fan ☑ Yes ☐ No

2. Electronic :

☑ Check oven temperature. Calibrate if necessary.
Oven temperature set point 150 °C ☑ Pass ☐ Fail

☐ Check sub-ambient option. (If installed).
Oven temperature set point 5 °C ☐ Pass ☐ Fail

☑ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.

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☑ 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 1.12 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

The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed. ***This Clarus600/680 GC*** **Pass** ***the preventive maintenance.***		
Review of Preventive Maintenance:		
Authorized PerkinElmer Representative: Monchai Kitcharoenkeat	Monchai	Date: 22-Feb-2025 (DD-MMM-YYYY)
Authorized Customer Representative: Ms.Naruecha	Naruecha	Date: 22-Feb-2025 (DD-MMM-YYYY)

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	**Date Tested:**	January 6, 2025
		Recommendation Recertification	
Address :	7 Soi Phaholyothin 24	**Period**	6 Months
	Paholyothin Road	**Recertification Due:**	July 6, 2025
	Jompol Chatuchak, Bangkok 10900	**Date Last Certified:**	July 4, 2024
User Name:	K.Phenpha Viphasthawat	**Visit Number:**	1 OF 2
Phone:	083-9269252	**PerkinElmer Phone:**	02-719-6420 ext 204
Email:		**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-03012875/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

1. INSTRUMENT CHECKS	
A. The Mirror and Lenses Condition	OK
B. Grating Condition	OK
C. Replace or Clean Dust Filter	OK
D. Cleaning the Contact Cylinders	OK
E. Cleaning the Furnace Windows	OK
F. Cleaning the Burner Head	OK
G. Cleaning the Nebulizer	OK
H. Cleaning the Drain System	OK
2. AUTOSAMPLE CHECK	
A. Sampling and Arm	OK
B. Sampling & Rinse Pump	OK
C. Sample Position & Clean	OK
3. COOLING SYSTEM CHECKS	
A. Clean and Change Distill water	OK
B. Themosensor	OK
4. FIAS CHECKS	
A. Pump and 5 Port Valve	N/A
B. Chemifold and Tubing	N/A
C. Power Supply	N/A
D. Flow meter and Gas system	N/A

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

Customer :	**S.P.S.Consulting Service Co.,Ltd**	Date Tested:	January 6, 2025
		Recommendation Recertification	
Address :	**7 Soi Phaholyothin 24**	Period	6 Months
	Paholyothin Road	Recertification Due:	July 6, 2025
	Jompol Chatuchak, Bangkok 1090	Date Last Certified:	July 4, 2024
User Name:	**K.Phenpha Viphasthawat**	Visit Number:	2 of 2
Phone:	**083-9269252**	PerkinElmer Phone:	02-719-6420 ext 206
Fax:	**02-513-4221**	PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		**ACCESSORIES/COMPONENT NOT INCLUDED**
MODEL	**SERIAL NUMBER**	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	**CALIBRATION NUMBER**	**EXPIRATION**
IPV Methods		
TEST STANDARD USED	**PART NUMBER**	**EXPIRATION DATE**
Multielement Standard	N069-1579	December 30, 2025
Wavecal Solution	N058-2152	April 30, 2025
VIS Wavecal solution	N930-2946	December 30, 2025
Instrument Cal. STD4	N930-0221	August 30, 2025
CUSTOMER SUPPLIED	**COMMENTS**	**CUSTOMER INITIALS**
2 % HNO3		
10 % HNO3		

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

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

PerkinElmer Scientific (Thailand) Co., Ltd.
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PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 **DATE TESTED :** January 6, 2025

PARAMETER			SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	**As**	**193.696 nm**	≤ 0.007		0.00519	
	Ni	**231.604 nm**	≤ 0.008		0.00667	
	Ni	**341.476 nm**	≤ 0.012		0.00757	
Spectral Resolution : VIS	**La**	**408.672 nm**	≤ 0.020		0.01621	
	Ba	**455.403 nm**	≤ 0.025		0.02183	
Precision						
	As	**193.656 nm**	% RSD	< 1.0	0.51	%
	Zn	**213.856 nm**	% RSD	< 1.0	0.48	%
	Mn	**257.610 nm**	% RSD	< 1.0	0.03	%
	La	**379.478 nm**	% RSD	< 1.0	0.05	%
	Ba	**455.403 nm**	% RSD	< 1.0	0.07	%
	Ba	**493.408 nm**	% RSD	< 1.0	0.04	%
Detection Limits : Axial	**Tl**	**190.080 nm**	3(sd)		10.65	ppb
	As	**193.696 nm**	3(sd)		2.48	ppb
	Pb	**220.353 nm**	3(sd)		3.09	ppb
Detection Limits : Radial	**As**	**193.696 nm**	3(sd)		12.41	ppb
	Zn	**213.856 nm**	3(sd)		0.91	ppb
	Mn	**257.610 nm**	3(sd)		0.13	ppb
	La	**379.478 nm**	3(sd)		4.74	ppb
	Ba	**455.403 nm**	3(sd)		0.10	ppb
	Ba	**493.408 nm**	3(sd)		0.18	ppb
BEC : Axial (IB X 500)/(IS-IB)	**Cd**	**226.502 nm**	≤ 150 ppb		14.22	
BEC : Radial (IB X 1000)/(IS-IB)	**Mn**	**257.610 nm**	≤ 45 ppb		6.14	

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290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been perfomed 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: วิภา พรหมลุมดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
A. Flame Mode Tests		
1. Detector-Linearity with Barium (553.55 nm)		
Neutral Density Filter 0.2 :	0.2042 Abs. ± 5%	0.2029 Abs.
Neutral Density Filter 1.0 :	0.9798 Abs. + 5%	1.0137 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.010 Abs.	0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.001 Abs.	0.0002 Abs.
4. D_2 Background Compensation (Copper 324.75 nm) with Neutral Density Filter 1.0	Absorbance ≤ 0.010 Abs	0.0020 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0002 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0007 Abs.

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WO-03012875/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 DATE TESTED January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
7. Flame Interlock Shutdown	Shutdown correct?	OK
8. Flame Sensitivity with Copper (324.75 nm) (5 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and Stainless stell nebulizer)	Sensitivity ≥ 0.250 Abs.	0.3115 Abs.
(2 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and High sensitivity nebulizer)	Sensitivity ≥ 0.250 Abs.	N/A Abs.

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PerkinElmer
For the Better

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE	
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm)			
(mesure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0012	
	SD ≤ 0.005 Int.Abs	0.0002	Int.Abs.
3. Chromium Characteristic Mass(m_0) and Precition (357.87 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 10 ug/L Cr standard)			
	m0 Results ≤ 7.0 pg/0.0044A-s	5.4	pg/0.0044A-s
	Precision ≤ 2.0%	1.15	%
4. Copper Characteristic Mass(m_0) and Zeeman Ratio (324.75 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 25 ug/L Cu standard)			
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
	Zeeman Ratio 0.52 ± 0.04	0.542	

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WO-03012875/2025

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio = Atomic Signal(peak area) / Atomic Signal(peak area)+Backgroung Signal(peak area)

= 0.1635/0.1635+0.1378

0.542

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

☑ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Customer Service Engineer: วิพรรณ พรมลุ่มดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

เอกสารแนบ 5-7

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำฝน

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

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 24E6416
REFERENCE No : 73694-1

Certificate of Calibration

EQUIPMENT	:	pH METER
MANUFACTURER	:	HANNA
MODEL	:	HI 3512
SERIAL No	:	TH118035
ID No	:	pH 04/56
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	27-Jun-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	27-Jun-24
RECEIVED DATE	:	24-Jun-24

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

QUALITY CALIBRATION CO., LTD.
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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24E6416

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3

F-G010 REV 03

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CERTIFICATE No : 24E6416

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

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

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

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

Certificate

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

CLC Accredited ISO/IEC 17025

ACCREDITED ISO/IEC 17025 CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

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 Inchaisri
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)

@clccalibration

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

CLC Accredited ISO/IEC 17025

ACCREDITED ISO/IEC 17025 CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

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 ± 2.5) °C Relative Humidity : (50 ± 15) % 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, Kambic 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. PO00043543-1-10-1.

@clccalibration

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)"

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CLC Accredited ISO/IEC 17025
ACCREDITED ISO/IEC 17025 CALIBRATION AND DIMENSIONAL MEASUREMENT ACDM-2814

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 (± 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 ± (°C)
100	25.00	25.0	0.00	0.07

Technical Note. Type of sensor : Thermistor

Probe ∅ 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

CAL
Calibratech Co.,Ltd.
7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

NSC-TISI-TIS17025
CALIBRATION 0030

Certificate of Calibration

Certificate No. : 68-400046-2 **Page : 1 of 2**

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

Equipment : Liquid in Glass Thermometer

Manufacturer : SK Model : N/A
Range : 0 °C to 100 °C Resolution : 1 °C
Serial No. : N/A Immersion : Total
ID No. : TM21/59

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

Date of Received : 21 January 2025
Date of Calibration : 24 January 2025
Date of Issue : 24 January 2025
Calibrated by : Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

ID No.	Cert. No.	Due Date	Traceability
400001	TT-0023-24	16 Feb 2026	National Institute of Metrology Thailand (NIMT)

2. Standard Digital Thermometer

ID No.	Cert. No.	Due Date	Traceability
400003	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)
400004	23E1866	01 Jun 2025	National Institute of Metrology Thailand (NIMT)

Approved by :
(Permpon Chanpu)
Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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CAL
Calibratech Co.,Ltd.
7/106-7 Moo 2, Sukhaprachasan 3 Rd., Bangpood, Pakkred, Nonthaburi 11120
Tel.(02) 964-6211 Fax.(02) 964-5155, e-mail : calibratech_cal@yahoo.com, calibratech_cal@hotmail.com

Certificate of Calibration

Certificate No. : 68-400046-2 **Page : 2 of 2**

Result of Calibration : Without Adjustment

UUC Condition As-Received : Good

Function : Temperature measurement

Ice point check : UUC* reading 0 ° C Standard reading 0.4429 °C

Standard Reading (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (±°C)
20.4801	20	0.5	0.31

Remark

UUC : Unit Under Calibration

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

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

- oOo -

CAL-F0031-03

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

CLC Accredited ISO/IEC 17025

NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	CONDUCTIVITY METER
MANUFACTURER	:	METTLER TOLEDO
MODEL / TYPE	:	SEVEN COMPACT S230
SERIAL NO.	:	C141708983/5821320179[CD 05/65]
CLID. NO.	:	272300452
JOB CONTROL NO.	:	250204013412

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 : 04 February 2025 DATE OF ISSUED : 06 February 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 Inchaisri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
06 February 2025

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

@clccalibration

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com
CLC Accredited ISO/IEC 17025
NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	CONDUCTIVITY METER
MANUFACTURER	:	METTLER TOLEDO
MODEL / TYPE	:	SEVEN COMPACT S230
SERIAL NO.	:	C141708983/5821320179[CD 05/65]
DATE OF CALIBRATION	:	05 February 2025

ENVIRONMENT CONDITIONS :

Temperature : (25 ± 2.5) °C Relative Humidity : (50 ± 15) % RH

PROCEDURE USED :

This instrument [Conductivity Meter] was calibrated under procedure No. **WI-305-130.**

The calibration was performed by direct measurement with Certified Reference Material (CRM) and Reference Material (RM) .

This instrument [Temperature] was calibrated by comparison with Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Conductivity Solution , Hanna Product Code HI 7033L Lot Number 7830.
2. Potassium Chloride Solution (nominal 1.41 mS/cm)
3. Potassium Chloride Solution (nominal 12.8 mS/cm)
4. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
5. Precision Thermometer, ASL Model F201 S/N. 016168/09.
6. IPRT, ASL Model T100-250-1D S/N. PO106346-1-13.

@clccalibration

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Hanna instruments.

Certificate No. 20F21 , Due Date June 2025 .

2. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC30595403 , Due Date 31 January 2026 .

3. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC20111554 , Due Date 30 September 2025.

4. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co , Ltd.

Certificate No. Q24120999, Due Date 26 November 2025.

5. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0424/67, Due Date 21 February 2025.

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

Certificate No. TT-0035-24, Due Date 01 March 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)"

CALIBRATION LABORATORY CO., LTD.
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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com
CLC Accredited ISO/IEC 17025
NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

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 Conductivity Meter.

CALIBRATION DATA

1. Conductivity Solution Test @ 25°C

Standard Conductivity Solution	DUC Reading	Uncertainty of Measurement	*k* Factor
*84.00 µS/cm	84.02 µS/cm [Cell Constant 0.548589]	± 1.00 µS/cm	2,00
1414.0 µS/cm	1414 µS/cm [Cell Constant 0.548589]	± 21.0 µS/cm	2,00
12.83 mS/cm	12.84 mS/cm [Cell Constant 0.548589]	± 0.19 mS/cm	2,00

Note. The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 91 of 138

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

***2. TEMPERATURE RESULT**

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
100	25.01	24.9	+0.11	0.07

Technical Note. Type of sensor : Conductivity Probe

Probe Ø 12 mm

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2,00$.

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

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

End of Certificate

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

CERT.No.: HS-W015C

Certificate of Calibration

Calibration Date : 18 Mar 25

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)	9.08	(PASS)	-	-
Measurement 2 (mg/l)	9.08	(PASS)	-	-
Measurement 3 (mg/l)	9.08	(PASS)	-	-
Measurement 4 (mg/l)	9.07	(PASS)	-	-
Measurement 5 (mg/l)	9.07	(PASS)	-	-
Measurement 6 (mg/l)	9.07	(PASS)	-	-
Measurement 7 (mg/l)	9.07	(PASS)	-	-
Measurement 8 (mg/l)	9.07	(PASS)	-	-
Measurement 9 (mg/l)	9.07	(PASS)		-
Measurement 10 (mg/l)	9.07	(PASS)	-	-
Mean Measurement	9.07	mg/l	-	-
Inaccuracy	0.02	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)

MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD
214 Bangwaek Rd. Bangpai Bangkae Bangkok 10160
Tel.: 0-2865-4647-8 Fax: 0-2865-4649 http://www.mit.in.th

NSC-TISI-TIS 17025 CALIBRATION 0052

CALIBRATION CERTIFICATE

Certificate No. : S2024090374-0003
Date Issued : 23-Sep-24

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

Equipment : Incubator

Manufacturer : BINDER
Model : BD 115
Serial No. : 12-16967
ID No./Tag No. : IN 05/56
Date Received : 16-Sep-24
Date Calibrated : 16-Sep-24

Calibrated by : Anusak Songliam

Calibration Method or Calibration Procedure Used

Standard method : CP-05 TLAS G-20.

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: Sarayuth T.
(Sarayuth Tochua)

CERTIFIED MIT

Certificate No. : S2024090374-0003

Environment : Ambient Temperature : Start record 23.7 °C, Stop record 23.5 °C
Relative Humidity : Start record 54.6 %RH, Stop record 54.4 %RH

Calibration Temperature (°C)	Setting Temperature (°C)	Indicating Temperature (°C)	Measured Stability[1] (°C)	Measured Uniformity[2] (°C)	Overall Variation[3] (°C)
35	35.0	35.0	0.04	0.21	0.38
41.5	41.5	41.5	0.07	0.19	0.30

Without adjustment

Calibration Temperature (°C)	STD No. 1 (°C)	STD No. 2 (°C)	STD No. 3 (°C)	STD No. 4 (°C)	STD No. 5 (°C)	STD No. 6 (°C)	STD No. 7 (°C)	STD No. 8 (°C)	STD No. 9 (°C)	Uncertainty[4] ±°C
35	34.81	35.12	34.93	34.92	35.02	34.82	34.92	35.13	34.98	0.23
41.5	41.31	41.49	41.33	41.34	41.41	41.31	41.52	41.32	41.46	0.23

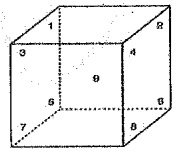
Decision Rule with Guard Band

Calibration Temperature	Pass / Fail									MPE
(°C)	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	(±°C)
35	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5
41.5	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	0.5

Pass = **|error| + |uncertainty| <= |MPE|** **MPE = Maximum Permissible Error**
Fail = **|error| + |uncertainty| > |MPE|**

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

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

Measurement Standards Used & Traceability :

The International System of Units (SI) through

MIT Certificate No. L202407373-0005 for Temperature Indicator with Sensor Serial No. US37020317, Due 31-Jan-25

Notes : 1. The temperature stability is the one-half of greatest maximum difference of measured temperatures at any one probe.
2. The temperature uniformity is the maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time.
3. Overall variation is the difference of maximum and minimum measured temperatures throughout observation time.
4. The uncertainty of measurement is included temperature stability.
5. The temperature uniformity, stability, overall variation and indicating temperature is applicable to all air or gas filled temperature controlled enclosures at atmospheric pressure.

End of Certificate

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

NSC-TISI-TIST7025
CALIBRATION 0049

CERTIFICATE No : 25T2261
REFERENCE No : 76365-8

Certificate of Calibration

EQUIPMENT	:	WATER BATH
MANUFACTURER	:	MEMMERT
MODEL	:	WNB29
SERIAL No	:	L614.0123
ID No	:	WB 05/58
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	:	SUCHART S.
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.

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

Calibration Report

EQUIPMENT	:	WATER BATH			
MANUFACTURER	:	MEMMERT	**MODEL**	:	WNB29
ID NUMBER	:	WB 05/58	**SERIAL NUMBER**	:	L614.0123
RECEIVED DATE	:	07-Mar-25	**CALIBRATION DATE**	:	07-Mar-25
AMBIENT TEMPERATURE	:	24 °C ± 1 °C	**RELATIVE HUMIDITY**	:	51 %RH ± 10 % RH

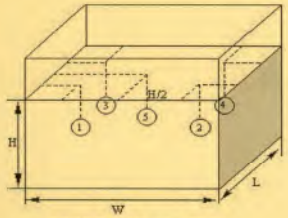
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001)BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE LOCATION) UNDER NO LOAD CONDITION.
2. REFERENCE STANDARD INSTRUMENTS :-

INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1) DATA LOGGER WITH RTD	2625A	6603614	24T6473	01-Jul-25

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



PROBE INSTALLATION
POSITION IN THE BATH

GENERAL INFORMATION

Overall Variation of Ambient Temperature around the Bath (°C) : 0.6
Overall Variation of Line Voltage (V) : 12
Instrument Condition : Normal
Bath Inner Size (W*L*H) : 60*40*10 cm

BATH PERFORMANCE

Calibration Point (°C)	Controller Temperature (°C)	Temperature Stability (±°C)	Radius Uniformity (°C)	Axial Uniformity (°C)	Overall Variation (°C)
50.0	50.2	0.06	0.05	0.03	0.16
60.0	60.2	0.06	0.08	0.04	0.17

TEMPERATURE MEASUREMENT ACCURACY TEST

Controller Temp (°C)	Indicating Temp (°C)	Measured Temperature (°C) at Spread Locations					Uncertainty (± ° C)
		#1	#2	#3	#4	Ref. 5	
50.2	50.2	49.84	49.88	49.86	49.88	49.89	0.15
60.2	60.2	59.83	59.84	59.85	59.86	59.91	0.16

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE BATH.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

ilac-MRA

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : SP24020
Pages 1 of 3

Calibration Certificate

Equipment :	UV-VIS SPECTROPHOTOMETER
Manufacturer :	PERKINELMER
Model :	LAMBDA 25
Serial No.:	501S14123010
ID No.:	SP03/58
Calibration Mode :	WAVELENGTH ACCURACY PHOTOMETRIC ACCURACY
Condition As Found :	GOOD
Customer :	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN ROAD, CHOMPHON, CHATUCHAK, BANGKOK 10900, THAILAND.
Location :	WET CHEMISTRY LABORATORY IV
Ambient Temperature :	(28.1 ± 5) °C
Relative Humidity :	(47.2 ± 25) %
Received Date :	27 AUGUST 2024
Calibration Date :	27 AUGUST 2024
Date of Issue :	27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : (Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

NSC-TISI-TIS 17025
CALIBRATION 0394

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

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

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

2. This result of calibration was found accurate as shown on date and place of calibration only.
3. This certificate is traceable to the international system of unit maintained at :
   - 3.1 The UK National Physical Laboratory (NPL)
   - 3.2 The National Institute of Standards and Technology,NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN associates

NSC-TISI-TIS 17025
CALIBRATION 0394

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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

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

UUC* = Unit Under Calibration

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

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

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

**Specific Acceptance :
Transmission $\leq$ 1.0 T(%), Absorbance $\geq$ 2.0 A
**Stray light not TISI Accredited

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

End of Calibration Certificate

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	**S.P.S.Consulting Service Co.,Ltd**	Date Tested:	January 6, 2025
		Recommendation Recertification	
Address :	**7 Soi Phaholyothin 24**	Period	6 Months
	Paholyothin Road	Recertification Due:	July 6, 2025
	Jompol Chatuchak, Bangkok 1090	Date Last Certified:	July 4, 2024
User Name:	**K.Phenpha Viphasthawat**	Visit Number:	2 of 2
Phone:	**083-9269252**	PerkinElmer Phone:	02-719-6420 ext 206
Fax:	**02-513-4221**	PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		**ACCESSORIES/COMPONENT NOT INCLUDED**
MODEL	**SERIAL NUMBER**	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	**CALIBRATION NUMBER**	**EXPIRATION**
IPV Methods		
TEST STANDARD USED	**PART NUMBER**	**EXPIRATION DATE**
Multielement Standard	N069-1579	December 30, 2025
Wavecal Solution	N058-2152	April 30, 2025
VIS Wavecal solution	N930-2946	December 30, 2025
Instrument Cal. STD4	N930-0221	August 30, 2025
CUSTOMER SUPPLIED	**COMMENTS**	**CUSTOMER INITIALS**
2 % HNO3		
10 % HNO3		

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

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

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 **DATE TESTED :** January 6, 2025

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	**As 193.696 nm**	≤ 0.007		0.00519	
	Ni 231.604 nm	≤ 0.008		0.00667	
	Ni 341.476 nm	≤ 0.012		0.00757	
Spectral Resolution : VIS	**La 408.672 nm**	≤ 0.020		0.01621	
	Ba 455.403 nm	≤ 0.025		0.02183	
Precision					
	As 193.656 nm	% RSD	< 1.0	0.51	%
	Zn 213.856 nm	% RSD	< 1.0	0.48	%
	Mn 257.610 nm	% RSD	< 1.0	0.03	%
	La 379.478 nm	% RSD	< 1.0	0.05	%
	Ba 455.403 nm	% RSD	< 1.0	0.07	%
	Ba 493.408 nm	% RSD	< 1.0	0.04	%
Detection Limits : Axial	**Tl 190.080 nm**	3(sd)		10.65	ppb
	As 193.696 nm	3(sd)		2.48	ppb
	Pb 220.353 nm	3(sd)		3.09	ppb
Detection Limits : Radial	**As 193.696 nm**	3(sd)		12.41	ppb
	Zn 213.856 nm	3(sd)		0.91	ppb
	Mn 257.610 nm	3(sd)		0.13	ppb
	La 379.478 nm	3(sd)		4.74	ppb
	Ba 455.403 nm	3(sd)		0.10	ppb
	Ba 493.408 nm	3(sd)		0.18	ppb
BEC : Axial (IB X 500)/(IS-IB)	**Cd 226.502 nm**	≤ 150 ppb		14.22	
BEC : Radial (IB X 1000)/(IS-IB)	**Mn 257.610 nm**	≤ 45 ppb		6.14	

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WO-02612424/2024

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been perfomed 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: วิพัฒน์ พรหมลุมดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

Customer :	S.P.S.Consulting Service Co.,Ltd	**Date Tested:**	January 6, 2025
		Recommendation Recertification	
Address :	7 Soi Phaholyothin 24	**Period**	6 Months
	Paholyothin Road	**Recertification Due:**	July 6, 2025
	Jompol Chatuchak, Bangkok 10900	**Date Last Certified:**	July 4, 2024
User Name:	K.Phenpha Viphasthawat	**Visit Number:**	1 OF 2
Phone:	083-9269252	**PerkinElmer Phone:**	02-719-6420 ext 204
Email:		**PerkinElmer Fax:**	02-318-5597

CONFIGURATION TESTED

MODEL	SERIAL NUMBER	SOFTWARE
PinAAcle 900T	PTCS14111103	Wiblab V5.1
AS 900		

TEST STANDARD USED	PART NUMBER	EXPIRATION DATE
Copper	N9300183	APR 30 2025
GFAAS Mixed standard	N9300244	FEB 28 2025
MG0-042	N101-3000	
MG2-045	N101-3002	

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-03012875/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

1. INSTRUMENT CHECKS	
A. The Mirror and Lenses Condition	OK
B. Grating Condition	OK
C. Replace or Clean Dust Filter	OK
D. Cleaning the Contact Cylinders	OK
E. Cleaning the Furnace Windows	OK
F. Cleaning the Burner Head	OK
G. Cleaning the Nebulizer	OK
H. Cleaning the Drain System	OK
2. AUTOSAMPLE CHECK	
A. Sampling and Arm	OK
B. Sampling & Rinse Pump	OK
C. Sample Position & Clean	OK
3. COOLING SYSTEM CHECKS	
A. Clean and Change Distill water	OK
B. Themosensor	OK
4. FIAS CHECKS	
A. Pump and 5 Port Valve	N/A
B. Chemifold and Tubing	N/A
C. Power Supply	N/A
D. Flow meter and Gas system	N/A

PerkinElmer Scientific (Thailand) Co., Ltd.
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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
A. Flame Mode Tests		
1. Detector-Linearity with Barium (553.55 nm)		
Neutral Density Filter 0.2 :	0.2042 Abs. ± 5%	0.2029 Abs.
Neutral Density Filter 1.0 :	0.9798 Abs. + 5%	1.0137 Abs.
2. Baseline Noise at 1 Abs with Barium (553.55 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.010 Abs.	0.0016 Abs.
3. AA Baseline with Copper (Cu 324.75 nm) (at an integration time of 0.5 seconds and 99 replicates)	SD ≤ 0.001 Abs.	0.0002 Abs.
4. D_2 Background Compensation (Copper 324.75 nm) with Neutral Density Filter 1.0	Absorbance ≤ 0.010 Abs	0.0020 Abs.
5. AA-BG Baseline Noise with Copper (324.75 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0002 Abs.
6. AA-BG Baseline Noise with Arsenic (193.70 nm) (at an integration time of 2.0 seconds and 99 replicates)	SD ≤ 0.005 Abs.	0.0007 Abs.

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WO-03012875/2025

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 DATE TESTED January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE
7. Flame Interlock Shutdown	Shutdown correct?	OK
8. Flame Sensitivity with Copper (324.75 nm) (5 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and Stainless stell nebulizer)	Sensitivity ≥ 0.250 Abs.	0.3115 Abs.
(2 mg/L Cu Standard a read time of 10 seconds 10 replicates, standard burner and High sensitivity nebulizer)	Sensitivity ≥ 0.250 Abs.	N/A Abs.

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

PARAMETER	SPECIFICATION	ACTUAL VAULE	
B. THGA Tests			
1. Furnace Gas Flows			
Internal Flow	250 ± 25 mL/min	250	mL/min
External Flow	100 ± 10 mL/min	100	mL/min
2. Chromium Baseline Noise (357.87 nm)			
(mesure 5 furnace dry firings without any sample)			
	Baseline ≤ 0.005 Int.Abs	0.0012	
	SD ≤ 0.005 Int.Abs	0.0002	Int.Abs.
3. Chromium Characteristic Mass(m_0) and Precition (357.87 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 10 ug/L Cr standard)			
	m0 Results ≤ 7.0 pg/0.0044A-s	5.4	pg/0.0044A-s
	Precision ≤ 2.0%	1.15	%
4. Copper Characteristic Mass(m_0) and Zeeman Ratio (324.75 nm)			
(measure 5 furnace firing using 20 ul			
sample injections of 25 ug/L Cu standard)			
	m0 Results ≤ 16.5 pg/0.0044A-s	14.4	pg/0.0044A-s
	Zeeman Ratio 0.52 ± 0.04	0.542	

PerkinElmer Scientific (Thailand) Co., Ltd.
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WO-03012875/2025

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MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

SERIAL NUMBER PTCS14111103 **DATE TESTED** January 6, 2025

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio = Atomic Signal(peak area) / Atomic Signal(peak area)+Backgroung Signal(peak area)

= 0.1635/0.1635+0.1378

0.542

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

☑ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Customer Service Engineer: วิพรรณ พรมลุ่มดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

เอกสารแนบ 5-8

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำในบ่อสังเกตการณ์
การรั่วซึมของถังเก็บน้ำเสีย

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

NSC-TISI-TIS17025 CALIBRATION 0049

CERTIFICATE No : 24E6416
REFERENCE No : 73694-1

Certificate of Calibration

EQUIPMENT	:	pH METER
MANUFACTURER	:	HANNA
MODEL	:	HI 3512
SERIAL No	:	TH118035
ID No	:	pH 04/56
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	27-Jun-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	27-Jun-24
RECEIVED DATE	:	24-Jun-24

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

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

CERTIFICATE No : 24E6416

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3

F-G010 REV 03

QUALITY CALIBRATION CO., LTD.
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CERTIFICATE No : 24E6416

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

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

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

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

Certificate

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

CLC Accredited ISO/IEC 17025

NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	CONDUCTIVITY METER
MANUFACTURER	:	METTLER TOLEDO
MODEL / TYPE	:	SEVEN COMPACT S230
SERIAL NO.	:	C141708983/5821320179
CLID. NO.	:	272300452
JOB CONTROL NO.	:	240213016389
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 : 13 February 2024 DATE OF ISSUED : 16 February 2024

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

Calibrated By : Sukgasem Seehanart
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
16 February 2024

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

@clccalibration

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com
CLC Accredited ISO/IEC 17025
NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	CONDUCTIVITY METER
MANUFACTURER	:	METTLER TOLEDO
MODEL / TYPE	:	SEVEN COMPACT S230
SERIAL NO.	:	C141708983/5821320179
DATE OF CALIBRATION	:	13 February 2024

ENVIRONMENT CONDITIONS :

Temperature : (25 ± 2.5) °C Relative Humidity : (50 ± 15) % RH

PROCEDURE USED :

This instrument [Conductivity Meter] was calibrated under procedure No. **WI-305-130.** The calibration was performed by direct measurement with Certified Reference Material (CRM) and Reference Material (RM) .

This instrument [Temperature] was calibrated under procedure No. **WI-305-244.** The calibration was performed by Comparison with Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Conductivity Solution , Hanna Product Code HI 7033L Lot Number 7830.
2. Potassium Chloride Solution (nominal 1.41 mS/cm)
3. Potassium Chloride Solution (nominal 12.8 mS/cm)
4. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
5. Precision Thermometer, ASL Model F200-A-8 S/N. 014433/03.
6. IPRT, ASL Model T100-250-1D S/N. L0193A-1-1.

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TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Hanna instruments.

Certificate No. 20F21 , Due Date June 2025 .

2. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC30595403 , Due Date 31 January 2026 .

3. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC20111554 , Due Date 30 September 2025.

4. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.

Certificate No. Q23136342, Due Date 20 December 2024.

5. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0203/67, Due Date 07 December 2024.

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

Certificate No. TT-0136-23, Due Date 12 December 2024.

UNCERTAINTY :

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

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

CALIBRATION LABORATORY CO., LTD.
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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com
CLC Accredited ISO/IEC 17025
ilac-MRA
NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

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 Conductivity Meter.

CALIBRATION DATA

1. Conductivity Solution Test @ 25°C

Standard Conductivity Solution	DUC Reading	Uncertainty of Measurement
*84.00 µS/cm	84.05 µS/cm [Cell Constant 0.548589]	± 1.00 µS/cm
1414.0 µS/cm	1415 µS/cm [Cell Constant 0.548589]	± 21.0 µS/cm
12.83 mS/cm	12.75 mS/cm [Cell Constant 0.548589]	± 0.19 mS/cm

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

The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 91 of 138

***2. Temperature Result [Probe Conductivity]**

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
100	25.00	24.9	+0.10	0.07

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

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

End of Certificate

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

CLC Accredited ISO/IEC 17025

NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE	:	CONDUCTIVITY METER
MANUFACTURER	:	METTLER TOLEDO
MODEL / TYPE	:	SEVEN COMPACT S230
SERIAL NO.	:	C141708983/5821320179[CD 05/65]
CLID. NO.	:	272300452
JOB CONTROL NO.	:	250204013412
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 : 04 February 2025 DATE OF ISSUED : 06 February 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 Inchaisri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
06 February 2025

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

@clccalibration

CALIBRATION LABORATORY CO., LTD.
2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com
CLC Accredited ISO/IEC 17025
NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

REPORT OF CALIBRATION

FOR

NOMENCLATURE	:	CONDUCTIVITY METER
MANUFACTURER	:	METTLER TOLEDO
MODEL / TYPE	:	SEVEN COMPACT S230
SERIAL NO.	:	C141708983/5821320179[CD 05/65]
DATE OF CALIBRATION	:	05 February 2025

ENVIRONMENT CONDITIONS :

Temperature : (25 ± 2.5) °C Relative Humidity : (50 ± 15) % RH

PROCEDURE USED :

This instrument [Conductivity Meter] was calibrated under procedure No. **WI-305-130.**

The calibration was performed by direct measurement with Certified Reference Material (CRM) and Reference Material (RM) .

This instrument [Temperature] was calibrated by comparison with Calibration Bath, Precision Thermometer and IPRT which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Conductivity Solution , Hanna Product Code HI 7033L Lot Number 7830.
2. Potassium Chloride Solution (nominal 1.41 mS/cm)
3. Potassium Chloride Solution (nominal 12.8 mS/cm)
4. Calibration Bath, Kambic Model OB-22/2 ULT S/N. 17115653.
5. Precision Thermometer, ASL Model F201 S/N. 016168/09.
6. IPRT, ASL Model T100-250-1D S/N. PO106346-1-13.

@clccalibration

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Hanna instruments.

Certificate No. 20F21 , Due Date June 2025 .

2. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC30595403 , Due Date 31 January 2026 .

3. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.

Certificate No. HC20111554 , Due Date 30 September 2025.

4. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co , Ltd.

Certificate No. Q24120999, Due Date 26 November 2025.

5. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0424/67, Due Date 21 February 2025.

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

Certificate No. TT-0035-24, Due Date 01 March 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)"

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
CLC Accredited ISO/IEC 17025
NSC-TISI-TIS 17025 CALIBRATION 0059 CLC

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 Conductivity Meter.

CALIBRATION DATA

1. Conductivity Solution Test @ 25°C

Standard Conductivity Solution	DUC Reading	Uncertainty of Measurement	*k* Factor
*84.00 µS/cm	84.02 µS/cm [Cell Constant 0.548589]	± 1.00 µS/cm	2,00
1414.0 µS/cm	1414 µS/cm [Cell Constant 0.548589]	± 21.0 µS/cm	2,00
12.83 mS/cm	12.84 mS/cm [Cell Constant 0.548589]	± 0.19 mS/cm	2,00

Note. The Scope of Accredited TISI Certificate No. 23-LB0092 Issue 02 Page 91 of 138

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

***2. TEMPERATURE RESULT**

Immersion depth (mm)	Actual Temperature (°C)	DUC Reading (°C)	Correction (°C)	Uncertainty ± (°C)
100	25.01	24.9	+0.11	0.07

Technical Note. Type of sensor : Conductivity Probe

Probe Ø 12 mm

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor of $k = 2,00$.

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

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

End of Certificate

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

NSC-TISI-TIS17025 CALIBRATION 0049

CERTIFICATE No : 24M2229
REFERENCE No : 72448-3

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	SARTORIUS
MODEL	:	BSA224S-CW
SERIAL No	:	36591843
ID No	:	BA 09/61
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	08-Mar-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	14-Mar-24
RECEIVED DATE	:	08-Mar-24

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

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

CERTIFICATE No : 24M2229

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	BSA224S-CW
MANUFACTURER	:	SARTORIUS	**S/N**	:	36591843
ID No	:	BA 09/61	**RECEIVED DATE**	:	08-Mar-24
AIR PRESSURE	:	1010mbar ± 1mbar	**CALIBRATION DATE**	:	08-Mar-24
AMBIENT TEMPERATURE	:	25° C ± 1° C	**RELATIVE HUMIDITY**	:	55 %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 LINEARLITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
2. REFERENCE STANDARD INSTRUMENTS :-

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

3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

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

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

5. OFF CENTER LOADING ERROR

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

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

END OF CALIBRATION REPORT

F-G010 REV 03

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

NSC-TISI-TIS17025
CALIBRATION 0049

CERTIFICATE No : 25M2256
REFERENCE No : 76365-3

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	SARTORIUS
MODEL	:	BSA224S-CW
SERIAL No	:	36591843
ID No	:	BA09/61
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	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.

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

CERTIFICATE No : 25M2256

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	BSA224S-CW
MANUFACTURER	:	SARTORIUS	**S/N**	:	36591843
ID No	:	BA09/61	**RECEIVED DATE**	:	07-Mar-25
AIR PRESSURE	:	1009mbar ± 1mbar	**CALIBRATION DATE**	:	07-Mar-25
AMBIENT TEMPERATURE	:	24° C ± 1° C	**RELATIVE HUMIDITY**	:	52 %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 LINEARLITY 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 200 g WAS 0.000071 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

NOMINAL VALUE (g)	BALANCE READING (g)	CORRECTION (g)	UNCERTAINTY (± g)
0.00	0.0000	0.0000	0.00012
0.10	0.1000	0.0000	0.00012
0.20	0.2000	0.0000	0.00012
0.50	0.5000	0.0000	0.00012
1.00	1.0000	0.0000	0.00012
2.00	2.0000	0.0000	0.00012
5.00	5.0000	0.0000	0.00012
10.00	10.0000	0.0000	0.00012
20.00	20.0001	-0.0001	0.00012
50.00	50.0000	0.0000	0.00014
100.00	100.0001	-0.0001	0.00019
200.00	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

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

CERT.No.: HS-V015C

Certificate of Calibration

Calibration Date : 20 Mar 24

Submitted by : ASIA LAB @ CONSULTANT CO.,LTD
184 Soi Phutthamonthon Sai 2 Soi 12,
Bangphai, Bangkae, Bangkok 10160

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

Model : YSI 5000
S/N : 15B100751
Probe : YSI 5010
S/N : 22D100097
ID NO. : -
Air Temp ref : S/N. F8065C26
Barometric ref : S/N. F8065C26
Water Temp ref : S/N. 11430

Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)		(status)
Measurement 1 (mg/l)	9.08	(PASS)	-	-
Measurement 2 (mg/l)	9.08	(PASS)	-	-
Measurement 3 (mg/l)	9.08	(PASS)	-	-
Measurement 4 (mg/l)	9.08	(PASS)	-	-
Measurement 5 (mg/l)	9.08	(PASS)	-	-
Measurement 6 (mg/l)	9.08	(PASS)	-	-
Measurement 7 (mg/l)	9.08	(PASS)	-	-
Measurement 8 (mg/l)	9.08	(PASS)	-	-
Measurement 9 (mg/l)	9.08	(PASS)		-
Measurement 10 (mg/l)	9.08	(PASS)	-	-
Mean Measurement	9.08	mg/l	-	-
Inaccuracy	0.01	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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

Technician Signature
(Kittipong Maekwong)

Laboratory Manager
(Supreecha Sumaritam)

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

CERT.No.: HS-W015C

Certificate of Calibration

Calibration Date : 18 Mar 25

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)	9.08	(PASS)	-	-
Measurement 2 (mg/l)	9.08	(PASS)	-	-
Measurement 3 (mg/l)	9.08	(PASS)	-	-
Measurement 4 (mg/l)	9.07	(PASS)	-	-
Measurement 5 (mg/l)	9.07	(PASS)	-	-
Measurement 6 (mg/l)	9.07	(PASS)	-	-
Measurement 7 (mg/l)	9.07	(PASS)	-	-
Measurement 8 (mg/l)	9.07	(PASS)	-	-
Measurement 9 (mg/l)	9.07	(PASS)		-
Measurement 10 (mg/l)	9.07	(PASS)	-	-
Mean Measurement	9.07	mg/l	-	-
Inaccuracy	0.02	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)

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

CERTIFICATE No : 24T0774
REFERENCE No : 71986-2

Certificate of Calibration

EQUIPMENT	:	COD REACTOR
MANUFACTURER	:	HACH
MODEL	:	DRB 200
SERIAL No	:	15110C0235
ID No	:	CRB 05/59
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	CHAICHARN CH.
CALIBRATION DATE	:	5-Feb-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	5-Feb-24
RECEIVED DATE	:	5-Feb-24

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

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

CERTIFICATE No : 24T0774

Calibration Report

EQUIPMENT	:	COD REACTOR			
MANUFACTURER	:	HACH	**MODEL**	:	DRB 200
ID NUMBER	:	CRB 05/59	**SERIAL NUMBER**	:	15110C0235
RECEIVED DATE	:	5-Feb-24	**CALIBRATION DATE**	:	5-Feb-24
AMBIENT TEMPERATURE	:	23° C ± 1° C	**RELATIVE HUMIDITY**	:	52 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

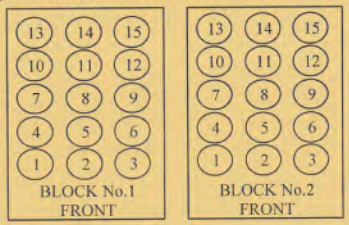
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

2. REFERENCE STANDARD INSTRUMENTS :-

	INSTRUMENT	MODEL	SERIAL No	CERTIFICATE No	DUE DATE
1)	DATA LOGGER WITH TC TYPE K	HYDRA 2635A	8009008	23T6640	14-Jul-24

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



TEMPERATURE MEASUREMENT ACCURACY TEST

Block No.		1	2
Controller temperature (°C)		145	145
Indicating Temperature		145	145
Measured Temperature (° C) at Spread Locations	1	150.2	150.1
	2	150.2	150.1
	3	150.2	149.8
	4	149.9	150.3
	5	150.1	149.8
	6	150.7	149.6
	7	149.9	150.2
	8	149.9	149.6
	9	150.8	150.4
	10	149.5	150.1
	11	150.2	150.6
	12	150.0	150.1
	13	149.5	149.6
	14	149.5	149.4
	15	149.6	149.5
Uncertainty of Measurement(± °C)		0.86	0.86

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2 : THIS CALIBRATION WAS CARRIED OUT AT THE CUSTOMER'S PLACE AT LABORATORY AREA.
THE REPORTED UNCERTAINTY OF MEASUREMENT WAS BASED ON A STANDARD UNCERTAINTY MULTIPLIED BY A COVERAGE FACTOR k =2, PROVIDING A LEVEL OF CONFIDENCE APPROXIMATELY 95%.

END OF CALIBRATION REPORT

QUALITY CALIBRATION CO., LTD.
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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

Certificate of Calibration

EQUIPMENT	:	COD REACTOR
MANUFACTURER	:	HACH
MODEL	:	DRB 200
SERIAL No	:	15110C0497
ID No	:	DRB 05/59
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	:	CHAICHARN CH.
CALIBRATION DATE	:	27-Jan-25
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	27-Jan-25
RECEIVED DATE	:	15-Jan-25

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

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

Calibration Report

EQUIPMENT	:	COD REACTOR			
MANUFACTURER	:	HACH	**MODEL**	:	DRB 200
ID NUMBER	:	DRB 05/59	**SERIAL NUMBER**	:	15110C0497
RECEIVED DATE	:	15-Jan-25	**CALIBRATION DATE**	:	27-Jan-25
AMBIENT TEMPERATURE	:	23° C ± 1° C	**RELATIVE HUMIDITY**	:	53 %RH ± 10 % RH

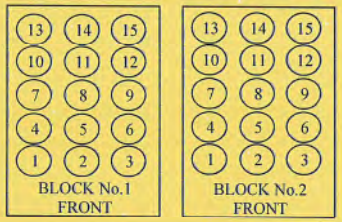
CONDITION OF THIS RESULTS OF CALIBRATION

1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASURMENT 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	6635300	24T6468	26-Jun-25

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



		Block No.	1	2
		Calibration Point (°C)	150	150
		Controller temperature (°C)	144	144
		Indicating Temperature	144	144
Measured Temperature (° C) at Spread Locations	1		150.01	149.57
	2		150.69	150.44
	3		150.40	149.46
	4		150.22	149.89
	5		150.27	149.75
	6		150.51	150.45
	7		150.24	150.03
	8		150.20	150.08
	9		150.14	150.14
	10		149.70	149.83
	11		149.58	149.89
	12		149.46	149.79
	13		148.77	149.03
	14		148.99	149.14
	15		149.02	149.62
		Uncertainty of Measurement(± °C)	0.87	0.87

NOTE 1 : THE UNCERTAINTY OF MEASUREMENT EXCLUDED TEMPERATURE UNIFORMITY OF THE CHAMBER.
NOTE 2 : LOCATION 10 WAS REFERENCE LOCATION.
NOTE 3 : 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

เอกสารแนบ 5-9

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำใต้ดิน

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

NSC-TISI-TIS17025 CALIBRATION 0049

CERTIFICATE No : 24E6416
REFERENCE No : 73694-1

Certificate of Calibration

EQUIPMENT	:	pH METER
MANUFACTURER	:	HANNA
MODEL	:	HI 3512
SERIAL No	:	TH118035
ID No	:	pH 04/56
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	27-Jun-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	27-Jun-24
RECEIVED DATE	:	24-Jun-24

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

QUALITY CALIBRATION CO., LTD.
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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584

CERTIFICATE No : 24E6416

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3

F-G010 REV 03

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CERTIFICATE No : 24E6416

Calibration Report

RESULT OF CALIBRATION (CONTINUE) :

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

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

3. DISPLAY UNIT WITH TEMPERATURE

STANDARD READING (°C)	UUC READING (°C)	CORRECTION (°C)	VALUE BEFORE ADJUSTMENT	UNCERTAINTY OF MEASUREMENT (± °C)	COVERAGE FACTOR k
25.004	25.0	0.004	---	0.0085	2.00

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT

Certificate

PerkinElmer

MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

Customer :	**S.P.S.Consulting Service Co.,Ltd**	Date Tested:	January 6, 2025
		Recommendation Recertification	
Address :	**7 Soi Phaholyothin 24**	Period	6 Months
	Paholyothin Road	Recertification Due:	July 6, 2025
	Jompol Chatuchak, Bangkok 1090	Date Last Certified:	July 4, 2024
User Name:	**K.Phenpha Viphasthawat**	Visit Number:	2 of 2
Phone:	**083-9269252**	PerkinElmer Phone:	02-719-6420 ext 206
Fax:	**02-513-4221**	PerkinElmer Fax:	02-318-5597

CONFIGURATION TESTED		**ACCESSORIES/COMPONENT NOT INCLUDED**
MODEL	**SERIAL NUMBER**	
OPTIMA 5300DV	077C7042401	
TESTED EQUIPMENT	**CALIBRATION NUMBER**	**EXPIRATION**
IPV Methods		
TEST STANDARD USED	**PART NUMBER**	**EXPIRATION DATE**
Multielement Standard	N069-1579	December 30, 2025
Wavecal Solution	N058-2152	April 30, 2025
VIS Wavecal solution	N930-2946	December 30, 2025
Instrument Cal. STD4	N930-0221	August 30, 2025
CUSTOMER SUPPLIED	**COMMENTS**	**CUSTOMER INITIALS**
2 % HNO3		
10 % HNO3		

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

WO-02612424/2024

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MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

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

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401 **DATE TESTED :** January 6, 2025

PARAMETER		SPECIFICATION		FINAL VALUE	
Spectral Resolution : UV	**As 193.696 nm**	≤ 0.007		0.00519	
	Ni 231.604 nm	≤ 0.008		0.00667	
	Ni 341.476 nm	≤ 0.012		0.00757	
Spectral Resolution : VIS	**La 408.672 nm**	≤ 0.020		0.01621	
	Ba 455.403 nm	≤ 0.025		0.02183	
Precision					
	As 193.656 nm	% RSD	< 1.0	0.51	%
	Zn 213.856 nm	% RSD	< 1.0	0.48	%
	Mn 257.610 nm	% RSD	< 1.0	0.03	%
	La 379.478 nm	% RSD	< 1.0	0.05	%
	Ba 455.403 nm	% RSD	< 1.0	0.07	%
	Ba 493.408 nm	% RSD	< 1.0	0.04	%
Detection Limits : Axial	**Tl 190.080 nm**	3(sd)		10.65	ppb
	As 193.696 nm	3(sd)		2.48	ppb
	Pb 220.353 nm	3(sd)		3.09	ppb
Detection Limits : Radial	**As 193.696 nm**	3(sd)		12.41	ppb
	Zn 213.856 nm	3(sd)		0.91	ppb
	Mn 257.610 nm	3(sd)		0.13	ppb
	La 379.478 nm	3(sd)		4.74	ppb
	Ba 455.403 nm	3(sd)		0.10	ppb
	Ba 493.408 nm	3(sd)		0.18	ppb
BEC : Axial (IB X 500)/(IS-IB)	**Cd 226.502 nm**	≤ 150 ppb		14.22	
BEC : Radial (IB X 1000)/(IS-IB)	**Mn 257.610 nm**	≤ 45 ppb		6.14	

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WO-02612424/2024

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401 **DATE TESTED** January 6, 2025

Remarks :

Commissioning follow as commissioning performance sheets.

This is to certify that the above tests have been perfomed 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: วิพัฒน์ พรหมลุมดา

(Wiphan Promlumda)

Service Engineer

PerkinElmer Scientific (Thailand) Co., Ltd.
290 Soi Soonvijai 4, Bangkapi, Huay Kwang, Bangkok 10310 Head Office

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

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

Part Number	Release	Publication Date
TH09370064	C	March 2013

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

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

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Component List

Component / Specific Model	Serial #	Software Version	Configuration Notes
Clarus680	680S14042502	Totalchrom6.3	PSS,PSS,FID
Clarus SQ8	648N4050804	Turbomass 6.4	
Atom X	US14113002	Tekma AtomX	

Parts lists

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

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

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Procedure Checklist

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

General:

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

Mechanical:

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

Electrical:

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

Operational Tests:

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

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PC Maintenance:

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

Review:

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

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for Turbomass/ Clarus Mass/ SQ8 have been completed.

This Turbomass/ClarusMS/SQ8 Pass the preventive maintenance.

Review of Preventive Maintenance:		
Authorized PerkinElmer Representative Monchai Kitcharoenkeat	Monchai	Date: 22-Aug-2024 (DD-MMM-YYYY)
Authorized Customer Representative: Ms. Naruecha	Narucha	Date: 22-Aug-2024 (DD-MMM-YYYY)

บริษัท ไทยยูนีค จำกัด THAI UNIQUE CO., LTD.
80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

Model : CP-3800

Serial Number : 00734

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

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

Date : 05/08/2024

ELECTRONIC TEST

CPU	☑ PASS	☐ FAIL
LCD TEST	☑ PASS	☐ FAIL
VENT TEST	☑ PASS	☐ FAIL
KEY ECHO TEST	☑ PASS	☐ FAIL
DESTRUCTION RAM TEST	☑ PASS	☐ FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

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

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

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

SENSITIVITY TEST: C15. (Area count) = 156,955 Counts.

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

Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	16,400	≥ 1,024

Temperature Specification

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

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.71	≤ 5
Retention Time C15(%)	0	≤ 0.5

APPROVAL :

Signature: Suwarot.

Engineer : Suwarot Trikainut

Date : 05/08/2024

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

Results Integrated System Testing

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

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

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

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

Compliance	☑ Pass	☐ Fail
Performance by	Suwarot.	
Date	05/08/2567	

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

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

Results Integrated System Testing

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

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

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

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

Compliance	☑ Pass	☐ Fail
Performance by	Suwarot.	
Date	05/08/2024	

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

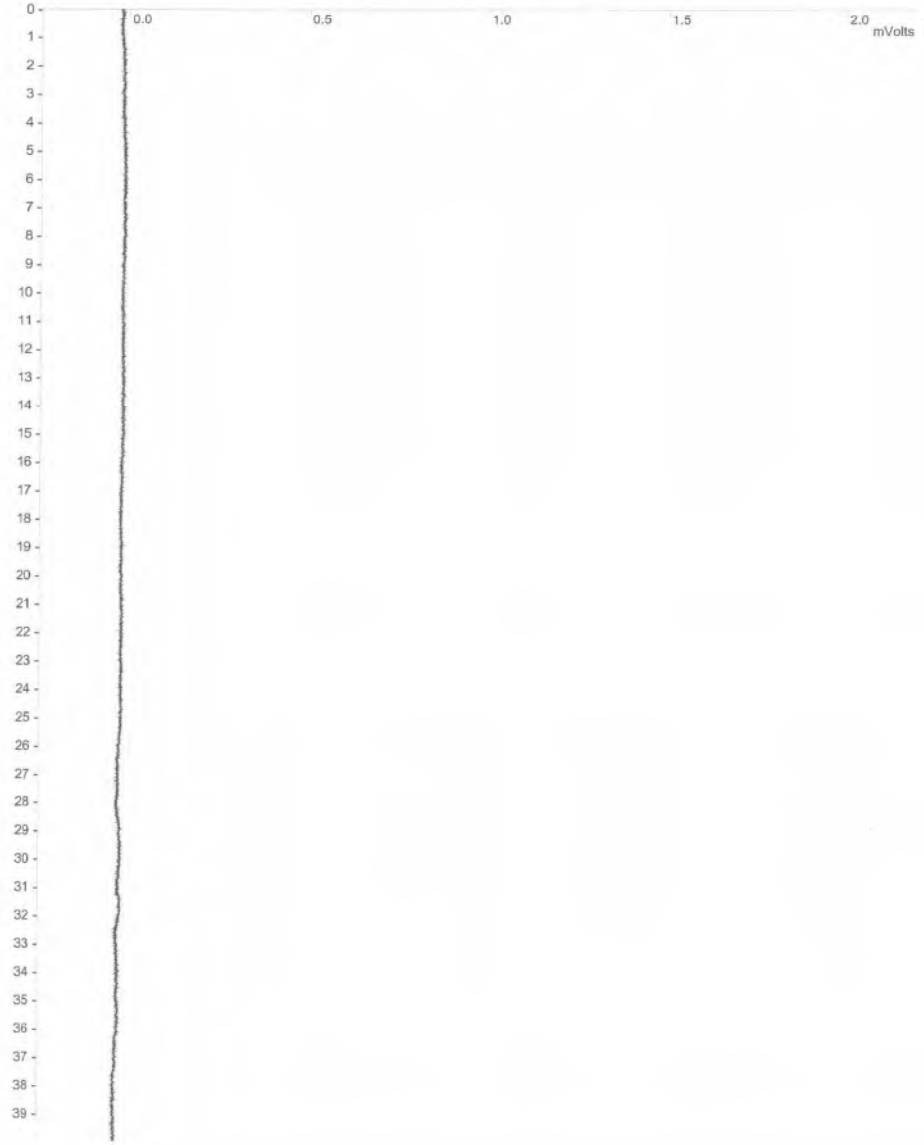
Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

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

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

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

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



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

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

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

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

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

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

Total Unidentified Counts : 0 counts

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

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -16 microVolts LSB: 1 microVolts

Noise (used): 22 microVolts - monitored before this run

Manual injection

Data Handling: No peaks

****

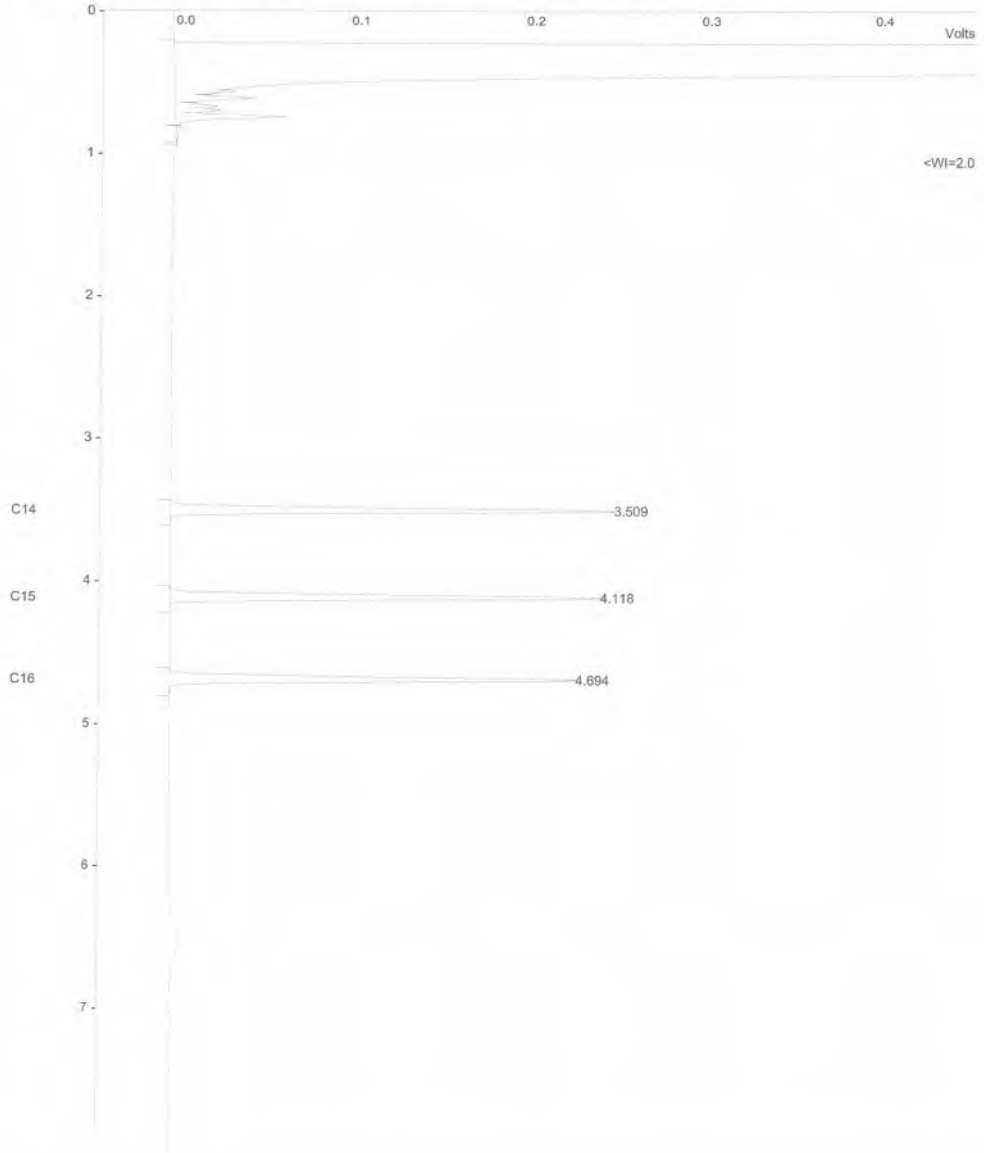
Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\cafid2024003-front.mth
Sample ID : FID2024

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

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

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

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



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

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

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

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

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

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

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

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

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts LSB: 1 microVolts

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

Manual injection

Calib. out of range; No Recovery Action Specified

****

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

Sample ID: **fid std**

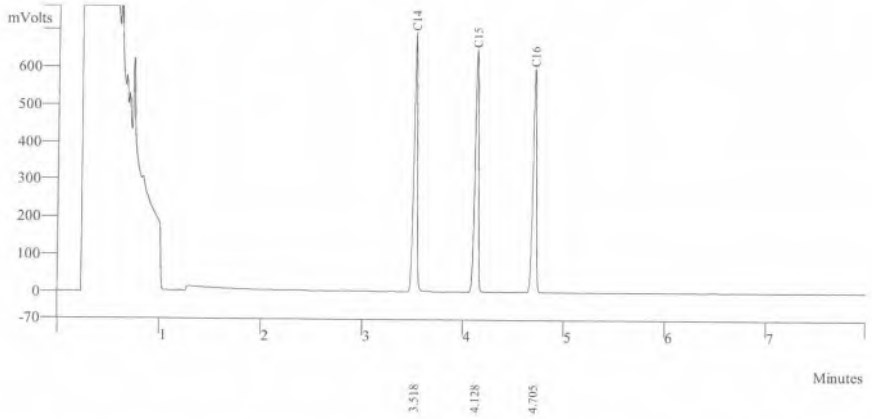
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

VARIAN

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

c:\star\data\tu\cal2024\fid2024001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.6865	3.518	163565	BB	2.2
2	C15	147.1889	4.128	157309	BB	2.3
3	C16	138.7997	4.705	146804	BB	2.3
	Totals	**438.6751**		**467678**		

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

Sample ID: fid std

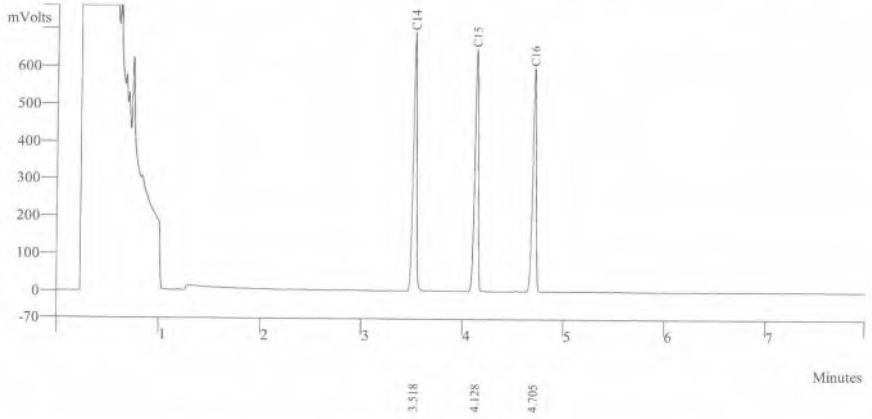
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

VARIAN

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

c:\star\data\tu\cal2024\fid2024002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.6865	3.518	168565	BB	2.2
2	C15	137.1189	4.128	159359	BB	2.3
3	C16	128.7997	4.705	147834	BB	2.3
	Totals	**418.6042**		**475758**		

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

Sample ID: **fid std**

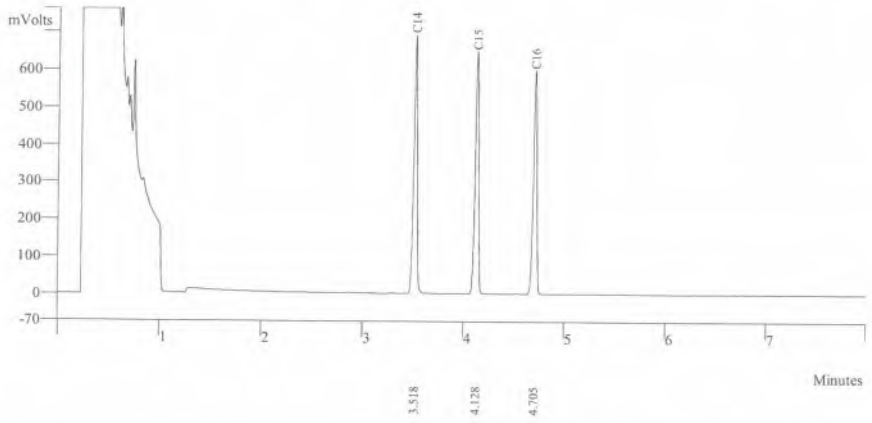
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

VARIAN

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

c:\star\data\tu\cal2024\fid2024003.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.7865	3.518	169535	BB	2.2
2	C15	197.1159	4.128	157349	BB	2.3
3	C16	128.5997	4.705	149834	BB	2.3
	Totals	**478.5021**		**476718**		

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

Sample ID: **fid std**

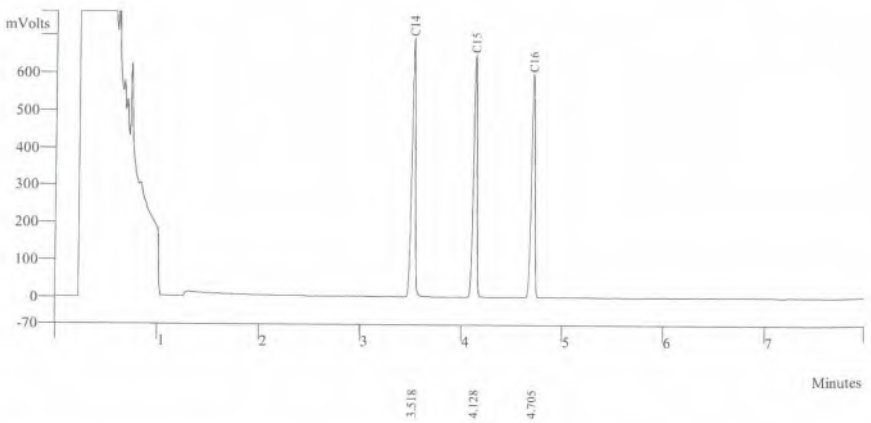
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

VARIAN

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

c:\star\data\tu\cal2024\fid2024004.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	162.7865	3.518	165521	BB	2.2
2	C15	157.1159	4.128	152379	BB	2.3
3	C16	138.5997	4.705	146834	BB	2.3
	Totals	**458.5021**		**464734**		

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

Sample ID: **fid std**

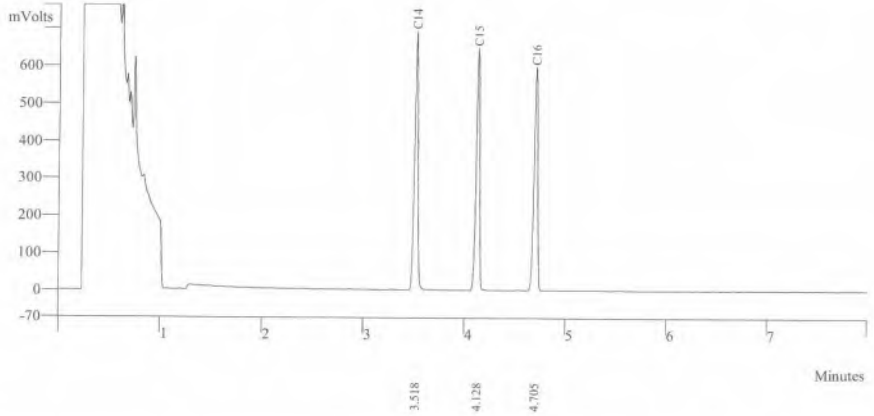
VARIAN

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

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

c:\star\data\tu\cal2024\fid2024005.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	162.7965	3.518	164521	BB	2.2
2	C15	137.1159	4.128	158379	BB	2.3
3	C16	128.1947	4.705	149834	BB	2.3
	Totals	**428.1071**		**472734**		

THAI UNIQUE CO.,LTD.

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 (± 0.5%)	0.033 w/w %
n-pentadecane	0.218 g/L (± 0.5%)	0.033 w/w %
n-hexadecane	0.218 g/L (± 0.5%)	0.033 w/w %

Solvent: hexane

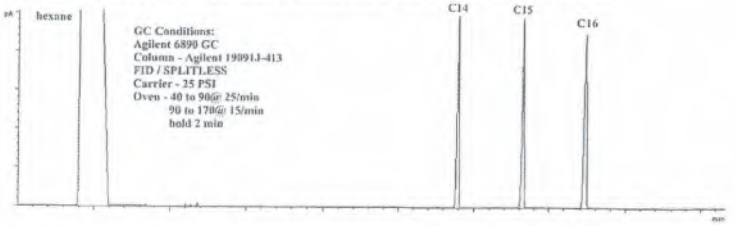
Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NCSL Z-540-1 and ISO 9001.

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
QMS Representative

WK Electric Co.,Ltd.
68/242 Moo 5, Sawaipracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, 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.: WK2312-031-1

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

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

Reference standard instruments :

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

MIT : Miracle International Technology Co.,Ltd.
This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha
Authorized Signatory

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

WK Electric Co.,Ltd.
68/242 Moo 5, Sawaipracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, Pathumthani 12150
Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com

Calibration Results

Certificate No. : WK2312-031-1

Calibration Result of the Accuracy

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

Unit : ml/min

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

(X) Without Adjustment ( ) After Adjustment

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

**** End of Certificate****

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

NSC-TISI-TIS 17025
CALIBRATION 0210

Certificate of Calibration

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

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

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

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

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

Calibrated by

Nanthiya Ngampring

Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

Mrs. Arunee Bamrungtham
Cal-Lab Manager

Measuretronix Limited

Calibration Report

UUC : Fluke 51 Thermometer
Serial No. : 5910857
Asset No. : 5910857
Procedure : CP-LF-04:Rev.02
Note : Refer to Fluke 51,52 Operator's Manual Rev 1 3/86, Oct 1985

Customer : Thai Unique Co., Ltd.
Address : 80-82 Prachathipatai Road, Bangkhunphrom, Pranakorn, Bangkok 10200

Certificate No. : LF24-0278
Report data type : As-Found
Date of Calibrate : 26-Jun-2024
Date of Receive : 17-Jun-2024

Environment condition
Temperature : 23 °C ± 3 °C
Humidity : 50 %RH ± 20 %RH

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

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

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

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

Remark : *The units of uncertainty values in this report are referred to the below details :*
*"**Volt**" or "V' for voltage, "**Ampere**" or "**A**" for current, "**Ohm**" or "□" for resistance, "**Farad**" or "**F**"for capacitance, "**Hertz**" or "**Hz**" for frequency, "**deg C**" or "**°C**" for degree Celsius, "**deg F**" or "**°F**" for degree Fahrenheit, etc.*

Standard Used

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

Test Data

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

End of Calibration Report

Certificate

It is hereby certified that

Suwarot Trikainut

Has successfully completed the Application Training for

Basic Gas Chromatography and Sampler

Training Contents were:

Hardware Operation, Software Operation, Data analysis and Troubleshooting : Model

CP-3800, 3900, 450-GC, 430-GC, 456-GC, 436-GC

At Thai Unique Co., Ltd, Bangkok, Thailand

On 15th March, 2019

S. Pohtongkam

Service Manager

เอกสารแนบ 5-10

เอกสารสอบเทียบเครื่องมือการตรวจวัดฝุ่นละอองในสถานที่ทำงาน

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter | Model : Defender 510-H | S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
					Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
No.	Brand	Model	Serial No.	Date	1	2	3	1	2	3	y	R^2
B01	SKC	224-PCXR4	262101	03/01/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x – 5.913	1.000
B02	SKC	224-PCXR4	626166	03/01/2025	1,000	1,500	2,000	997	1,499	1,996	0.998x - 0.140	1.000
B03	SKC	224-PCXR4	612968	06/01/2025	1,000	1,500	2,000	1,008	1,504	1,998	0.999x + 1.131	0.999
B04	SKC	224-PCXR4	602804	06/01/2025	1,000	1,500	2,000	994	1,505	2,004	1.010x - 17.826	1.000
B05	SKC	224-PCXR4	612693	07/01/2025	1,000	1,500	2,000	997	1,508	1,997	1.009x – 14.660	0.999
B06	SKC	224-PCXR4	262188	07/01/2025	1,000	1,500	2,000	1,005	1,493	2,002	0.995x + 7.108	1.000
B07	SKC	224-PCXR4	626262	07/01/2025	1,000	1,500	2,000	994	1,498	2,004	1.006x - 10.434	1.000
B08	SKC	224-PCXR4	626100	03/01/2025	1,000	1,500	2,000	1,014	1,505	2,010	1.004x - 2.659	0.999
B09	SKC	224-PCXR4	626479	06/01/2025	1,000	1,500	2,000	998	1,491	2,006	1.012x - 22.408	1.000
B10	SKC	224-PCXR4	091950	06/01/2025	1,000	1,500	2,000	999	1,507	2,007	1.010x – 15.236	1.000
B11	SKC	224-PCXR8	564315	06/01/2025	1,000	1,500	2,000	997	1,496	1,996	1.001x - 3.394	1.000
B12	SKC	224-PCXR4	034656	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,004	1.011x – 19.282	0.999
B13	SKC	224-PCXR4	602073	07/01/2025	1,000	1,500	2,000	995	1,505	1,998	1.006x - 12.605	1.000
B14	SKC	224-PCXR4	626313	03/01/2025	1,000	1,500	2,000	1,003	1,506	2,007	1.007x - 8.152	1.000
B15	SKC	224-PCXR4	626474	06/01/2025	1,000	1,500	2,000	1,010	1,498	2,001	0.994x + 9.807	1.000
B16	SKC	224-PCXR4	626477	06/01/2025	1,000	1,500	2,000	998	1,507	2,002	1.013x - 22.572	0.999
B17	SKC	224-PCXR4	626860	06/01/2025	1,000	1,500	2,000	1,005	1,499	2,001	0.995x + 7.368	1.000
B18	SKC	224-PCXR4	691484	06/01/2025	1,000	1,500	2,000	1,008	1,494	2,002	0.993x + 10.346	1.000
B19	SKC	224-PCXR4	691599	06/01/2025	1,000	1,500	2,000	1,010	1,505	2,010	1.000x + 6.532	1.000
B20	SKC	224-PCXR4	691587	07/01/2025	1,000	1,500	2,000	1,006	1,512	2,009	1.002x – 1.671	0.999
B21	SKC	224-PCXR4	691531	07/01/2025	1,000	1,500	2,000	1,001	1,510	2,007	1.007x – 10.035	1.000
B22	SKC	224-PCXR4	691654	07/01/2025	1,000	1,500	2,000	1,015	1,513	2,012	0.999x + 8.423	0.999
B23	SKC	224-PCXR4	798393	07/01/2025	1,000	1,500	2,000	999	1,498	2,001	1.001x - 0.856	1.000
B24	SKC	224-PCXR4	626363	06/01/2025	1,000	1,500	2,000	1,001	1,506	2,006	1.007x – 12.177	0.999
B25	SKC	224-PCXR4	798489	06/01/2025	1,000	1,500	2,000	996	1,514	2,005	1.011x + 13.301	1.000
B26	SKC	224-PCXR4	798479	03/01/2025	1,000	1,500	2,000	998	1,509	2,002	1.005x - 9.187	1.000
B27	SKC	224-PCXR4	691673	03/01/2025	1,000	1,500	2,000	1,001	1,511	1,995	0.998x - 0.700	0.999
B28	SKC	224-PCXR4	691570	03/01/2025	1,000	1,500	2,000	1,004	1,513	2,006	1.001x + 1.779	1.000
B29	SKC	224-PCXR4	626472	03/01/2025	1,000	1,500	2,000	998	1,508	2,007	1.009x – 13.557	1.000
B30	SKC	224-PCXR4	691489	03/01/2025	1,000	1,500	2,000	1,003	1,503	2,012	1.008x – 10.099	1.000
B31	SKC	224-PCXR4	691509	06/01/2025	1,000	1,500	2,000	997	1,510	2,009	1.012x - 18.438	1.000
B32	SKC	224-PCXR4	091567	06/01/2025	1,000	1,500	2,000	1,014	1,517	2,007	0.995x + 11.654	0.999
B33	SKC	224-PCXR4	091756	06/01/2025	1,000	1,500	2,000	999	1,510	2,003	1.003x – 4.801	1.000
B34	SKC	224-PCXR4	612962	07/01/2025	1,000	1,500	2,000	1,001	1,511	2,008	1.008x – 11.354	0.999
B35	SKC	224-PCXR4	602682	07/01/2025	1,000	1,500	2,000	1,008	1,514	1,996	0.993x + 11.338	0.999
B36	SKC	224-PCXR4	626164	07/01/2025	1,000	1,500	2,000	1,005	1,506	2,007	1.003x - 2.339	1.000
B37	SKC	224-PCXR4	626256	07/01/2025	1,000	1,500	2,000	1,003	1,503	2,005	1.011x - 16.311	0.999
B38	SKC	224-PCXR4	626167	03/01/2025	1,000	1,500	2,000	1,006	1,514	2,007	1.000x + 0.712	0.999
B39	SKC	224-PCXR4	034637	06/01/2025	1,000	1,500	2,000	1,013	1,515	2,013	1.002x + 3.638	0.999
B40	SKC	224-PCXR4	798349	07/01/2025	1,000	1,500	2,000	999	1,508	2,001	1.000x - 1.691	1.000

Calibrated by : Adul Dangklom (Mr. Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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

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								
					Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
No.	Brand	Model	Serial No.	Date	1	2	3	1	2	3	y	R^2
B41	SKC	224-PCXR4	612669	07/01/2025	1,000	1,500	2,000	996	1,512	2,005	1.008x - 10.246	1.000
B42	SKC	224-PCXR4	626041	07/01/2025	1,000	1,500	2,000	995	1,499	2,002	1.002x - 2.343	1.000
B43	SKC	224-PCXR4	034636	03/01/2025	1,000	1,500	2,000	999	1,495	1,997	0.996x + 2.703	1.000
B44	SKC	224-PCXR8	529341	03/01/2025	1,000	1,500	2,000	998	1,510	2,003	1.009x - 16.871	0.999
B45	SKC	224-PCXR8	529594	03/01/2025	1,000	1,500	2,000	997	1,508	2,004	1.012x - 21.113	0.999
B46	SKC	224-PCXR8	566743	03/01/2025	1,000	1,500	2,000	996	1,497	2,003	1.010x – 16.955	1.000
B47	SKC	224-PCXR8	566747	03/01/2025	1,000	1,500	2,000	1,002	1,504	2,001	1.003x - 2.758	1.000
B48	SKC	224-PCXR8	566753	03/01/2025	1,000	1,500	2,000	998	1,512	2,002	1.008x -13.876	0.999
B49	SKC	224-PCXR8	566780	03/01/2025	1,000	1,500	2,000	997	1,497	1,997	1.002x - 5.465	1.000
B50	SKC	224-PCXR8	500400	03/01/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x – 7.316	1.000
B51	SKC	224-PCXR8	500363	06/01/2025	1,000	1,500	2,000	1,003	1,505	1,998	0.995x + 8.579	1.000
B52	SKC	224-PCXR8	093186	06/01/2025	1,000	1,500	2,000	1,002	1,496	1,999	0.999x - 0.396	1.000
B53	SKC	224-PCXR8	707670	07/01/2025	1,000	1,500	2,000	997	1,505	2,005	1.010x - 19.569	0.999
B54	SKC	224-PCXR3	509821	07/01/2025	1,000	1,500	2,000	1,004	1,506	2,002	1.002x - 0.736	1.000
B55	SKC	224-PCXR3	510710	07/01/2025	1,000	1,500	2,000	998	1,501	2,001	1.003x - 5.629	1.000
B56	SKC	224-PCXR3	511450	07/01/2025	1,000	1,500	2,000	995	1,509	2,007	1.013x – 22.400	0.999
B57	SKC	224-PCXR3	510798	07/01/2025	1,000	1,500	2,000	999	1,498	1,996	0.996x + 4.985	1.000
B58	SKC	224-PCXR3	509852	06/01/2025	1,000	1,500	2,000	1,002	1,503	2,005	1.009x - 13.249	1.000
B59	SKC	224-PCXR3	509862	06/01/2025	1,000	1,500	2,000	996	1,506	2,007	1.015x - 25.718	0.999
B60	SKC	224-PCXR3	512655	06/01/2025	1,000	1,500	2,000	1,012	1,504	2,001	0.995x + 10.338	1.000
B61	SKC	224-PCXR3	503915	03/01/2025	1,000	1,500	2,000	1,003	1,507	2,010	1.010x - 13.769	1.000
B62	SKC	224-PCXR3	505975	03/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.012x - 17.586	0.999
B63	SKC	224-PCXR3	511432	03/01/2025	1,000	1,500	2,000	999	1,503	2,003	1.013x - 21.568	0.999
B64	SKC	224-PCXR3	508302	06/01/2025	1,000	1,500	2,000	996	1,506	2,006	1.010x - 15.623	1.000
B65	SKC	224-PCXR3	508310	06/01/2025	1,000	1,500	2,000	1,003	1,502	2,002	1.001x + 1.279	1.000
B66	SKC	224-PCXR3	509861	06/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.004x - 7.200	1.000
B67	SKC	224-PCXR3	506295	06/01/2025	1,000	1,500	2,000	997	1,497	2,007	1.011x – 22.995	0.999
B68	SKC	224-PCXR3	505872	07/01/2025	1,000	1,500	2,000	1,001	1,493	1,999	0.998x - 1.515	1.000
B69	SKC	224-PCXR3	508375	07/01/2025	1,000	1,500	2,000	995	1,508	2,003	1.013x – 23.639	0.999
B70	SKC	224-PCXR3	510623	07/01/2025	1,000	1,500	2,000	1,004	1,502	2,007	1.011x – 17.470	0.999
B71	SKC	224-PCXR3	508367	06/01/2025	1,000	1,500	2,000	1,003	1,504	2,008	1.016x – 24.787	0.999
B72	SKC	224-PCXR3	505977	06/01/2025	1,000	1,500	2,000	1,008	1,496	2,007	1.001x + 0.904	1.000
B73	SKC	224-PCXR3	512606	06/01/2025	1,000	1,500	2,000	1,003	1,502	2,003	1.007x – 15.456	0.999
B74	SKC	224-PCXR3	505993	06/01/2025	1,000	1,500	2,000	1,004	1,501	1,999	1.000x – 0.624	1.000
B75	SKC	224-PCXR3	509820	06/01/2025	1,000	1,500	2,000	996	1,510	2,003	1.010x - 17.886	0.999
B76	SKC	224-PCXR3	509811	07/01/2025	1,000	1,500	2,000	994	1,509	2,008	1.013x - 21.308	1.000
B77	SKC	224-PCXR3	508301	07/01/2025	1,000	1,500	2,000	1,002	1,491	2,006	1.006x – 10.302	1.000
B78	SKC	224-PCXR3	510677	07/01/2025	1,000	1,500	2,000	1,005	1,504	2,007	1.012x – 19.957	0.999
B79	SKC	224-PCXR3	510920	06/01/2025	1,000	1,500	2,000	1,003	1,503	2,006	1.015x – 24.223	0.999

Calibrated by : Adul Dangklom (Mr. Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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

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
B80	SKC	224-PCXR3	504569	06/01/2025	1,000	1,500	2,000	999	1,497	2,011	1.009x – 11.282	1.000
B81	SKC	224-PCXR3	503480	03/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.010x - 16.107	0.999
B82	SKC	224-PCXR3	505673	03/01/2025	1,000	1,500	2,000	995	1,509	2,005	1.014x – 24.323	0.999
B83	SKC	224-PCXR3	510785	07/01/2025	1,000	1,500	2,000	999	1,506	1,998	0.998x + 5.669	1.000
B84	SKC	224-PCXR3	508333	07/01/2025	1,000	1,500	2,000	993	1,492	2,004	1.009x - 21.129	1.000
B85	SKC	224-PCXR3	505757	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,008	1.007x - 9.639	1.000
B86	SKC	224-PCXR3	512625	06/01/2025	1,000	1,500	2,000	996	1,495	2,001	1.005x - 11.406	1.000
B87	SKC	224-PCXR3	504324	06/01/2025	1,000	1,500	2,000	997	1,498	1,999	1.004x – 12.097	1.000
B88	SKC	224-PCXR3	508307	06/01/2025	1,000	1,500	2,000	994	1,502	1,994	0.999x - 1.619	1.000
B89	SKC	224-PCXR3	509860	06/01/2025	1,000	1,500	2,000	995	1,507	2,003	1.008x – 14.844	1.000
B90	SKC	224-PCXR3	508366	07/01/2025	1,000	1,500	2,000	997	1,496	1,995	0.999x – 1.143	1.000
B91	SKC	224-PCXR3	510919	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,012	1.008x - 11.670	0.999
B92	SKC	224-PCXR3	510987	03/01/2025	1,000	1,500	2,000	999	1,494	2,010	1.013x - 24.882	0.999
B93	SKC	224-PCXR3	509845	03/01/2025	1,000	1,500	2,000	997	1,507	1,998	1.002x – 3.102	1.000

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Calibration Data											
Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R^2
H-B01	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	498.1	999.3	2001.2	0.997x + 4.404	1.000
H-B02	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	499.2	998.1	2012.5	1.003x - 8.556	0.999
H-B03	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	502.4	1002.9	2008.6	1.000x - 2.203	1.000
H-B04	Dwyer	VFB-65	07/01/2025	500	1,000	2,000	501.7	997.4	1993.2	0.996x + 5.850	1.000
H-B05	Dwyer	VFB-65	07/01/2025	500	1,000	2,000	500.9	994.7	1984.4	0.985x + 17.991	0.999
H-B06	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	502.5	997.1	1993.6	0.993x + 7.901	1.000
H-B07	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	501.4	998.8	2009.5	1.001x + 0.428	1.000
H-B08	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	500.9	999.4	1993.8	0.997x + 2.266	0.999
H-B09	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	502.3	1004.1	2009.7	0.996x + 11.111	1.000
H-B10	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	498.6	999.5	2010.3	1.001x - 0.553	0.999

Calibrated by :	Approved by :
Adul Dangklom	
(Mr.Adul Dangklom)	(Mr. Peera Detudom)

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

NSC-TISI-TIS17025 CALIBRATION 0149

CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

Certificate of Calibration

EQUIPMENT	:	DIGITAL BALANCE
MANUFACTURER	:	METTLER TOLEDO
MODEL	:	XS105DU
SERIAL No	:	1126422905
ID No	:	BA05/50
CONDITION AS RECEIVED	:	USED ITEM
SUBMITTED BY	:	S.P.S. CONSULTING SERVICE CO., LTD. 7 SOI PHAHOLYOTHIN 24, PHAHOLYOTHIN RD., JOMPOL, CHATUCHAK, BANGKOK 10900
CALIBRATED BY	:	ATSAWIN Y.
CALIBRATION DATE	:	08-Mar-24
APPROVED BY	:	PONGSAK J.
ISSUED DATE	:	14-Mar-24
RECEIVED DATE	:	08-Mar-24

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

QUALITY CALIBRATION CO.,LTD.
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Tel (662) 421-5402, (662) 444-0152-3, Fax (662) 809-4584
www.qcalibration.com

CERTIFICATE No : 24M2227

Calibration Report

EQUIPMENT	:	DIGITAL BALANCE	**MODEL**	:	XS105DU
MANUFACTURER	:	METTLER TOLEDO	**S/N**	:	1126422905
ID No	:	BA05/50	**RECEIVED DATE**	:	08-Mar-24
AIR PRESSURE	:	1010mbar ± 1mbar	**CALIBRATION DATE**	:	08-Mar-24
AMBIENT TEMPERATURE	:	25° C ± 1° C	**RELATIVE HUMIDITY**	:	53 %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 LINEARLITY TEST. OFF-CENTER LOADING WAS MEASURED BY USING STANDARD WEIGHTS PLACED ON THE PAN AND MOVED TO VARIOUS POSITIONS ON THE PAN.
2. REFERENCE STANDARD INSTRUMENTS :-

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

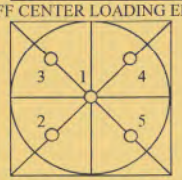
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
   - NATIONAL INSTITUTE OF METROLOGY (THAILAND) THROUGH CENTRAL BUREAU OF WEIGHTS&MEASURES

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

F-G010 REV 03

เอกสารแนบ 5-11

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานที่ทำงาน

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220 **MTC No.** EEL. BP. 44/0268

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 Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

Date of Receipt : 19 Feb. 2025

Date of Calibration : 21 Feb. 2025

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.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan, Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220 **MTC No.** EEL. BP. 44/0268

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	93.81	-0.19	± 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	0.95	± 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 Kluaypa)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 20112680219007390O1

End of Certificate

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

FM.BL.MTC.002 Rev.5

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
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Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan, Changwat Samutprakan 10280, Thailand
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E-mail : mtc@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatuchak, Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

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

Noise B_077/25

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	21 February 2025
		Due Date	21 February 2026

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
ACO-B18	ACO	6236	00172048	10 March 2025	94.1	93.9
ACO-B29	ACO	6236	00182011	10 March 2025	94.0	93.9
ACO-B33	ACO	6236	00182015	10 March 2025	93.9	93.9
ACO-B36	ACO	6236	00192027	10 March 2025	93.9	93.9
ACO-B41	ACO	6236	00192032	10 March 2025	93.9	93.9
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					93.81 ± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

เอกสารแนบ 5-12

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงที่ลูกจ้างได้รับเฉลี่ย
ตลอดเวลาการทำงานในแต่ละวัน (TWA)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0562 **MTC No.** EEL. BP. 72/0767

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : SVANTEK

Model : SV34

Serial No. : 83820

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 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 : 31 Jul. 2024

Date of Calibration : 6 Aug. 2024

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.

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
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E-mail : rumpai@tistr.or.th Website:www.tistr.or.th

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

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

NSC-TISI-TIS 17025
CALIBRATION 0037

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0562 **MTC No.** EEL. BP. 72/0767

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

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

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

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	114.03	0.03	± 0.10	±0.75 dB

2. Frequency

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

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	0.27	± 0.50	±4.0%

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Mr.Weerachai Deechaiyae)

Approved by :

(Mr.Prawate Khuaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011267073102836003

Date of Calibration : 6 Aug. 2024

Date of Issue : 7 Aug. 2024

End of Certificate

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

FM.BL.MTC.002 Rev.4

Head Office
35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang, Changwat Pathumthani 12120, Thailand
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Fax. (66) 0 2323 9165
E-mail : mtc@tistr.or.th

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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
Fax. (66) 0 2579 8592
E-mail : sumalee@tistr.or.th

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

Noise Dose B_077_1/25

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	06 August 2024
		Due Date	06 August 2025

Calibration Data

Sound Level Meter Data				Calibration Data		
SLM No.	Brand	Model	Serial No.	Date	Actual Reading [dB]	
					Before Adjustment	After Adjustment
NMD-B06	SVANTEK	SV-104IS	80816	10 March 2025	114.0	114.0
NMD-B07	SVANTEK	SV-104IS	80817	10 March 2025	114.0	114.0
NMD-B12	SVANTEK	SV-104IS	80832	10 March 2025	114.0	114.0
NMD-B13	SVANTEK	SV-104IS	80834	10 March 2025	113.9	114.0
NMD-B14	SVANTEK	SV-104IS	80875	10 March 2025	113.9	114.0
Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR)					114.03± 0.10 dB	

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

เอกสารแนบ 5-13

เอกสารสอบเทียบเครื่องมือการตรวจวัดความร้อนบริเวณพื้นที่ปฏิบัติงาน (WBGT)

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.metrologysystem.com

Certificate of Calibration

Certificate Number : SPR24100363-5 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor
Manufacturer : Quest Technologies
Model : QUESTemp 34
Serial Number : TEH060047
ID. Number : B05

Environmental Conditions

Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 21 Oct 2024
Relative Humidity	: 60 % ± 15 %	Calibration Date	: 21 Oct 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 21 Oct 2025
Calibration Procedure	: SP-CPT-04-13	Date of Issue	: 22 Oct 2024

Method of Calibration

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

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

Calibrated by : Mr.Surasak Ritthikaew
Calibration Officer

Approved by :
(Mr.Prayoon Topart)
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.metrologysystem.com

Calibration Report

Reference Standards

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

Traceability

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

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.metrologysystem.com

Result of Calibration

Temperature Accuracy in the Measurement. (WET) Unit : °C

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

Temperature Accuracy in the Measurement. (DRY) Unit : °C

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

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

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

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

Measurement Uncertainty

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

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อ 110 www.spmetrology.co.th

Certificate of Calibration

Certificate Number : SPR24030285-5

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 : TEG040059
ID. Number : B07

Environmental Conditions

Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 19 Mar 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 20 Mar 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 20 Mar 2025
Calibration Procedure	: SP-CPT-04-13	Date of Issue	: 21 Mar 2024

Method of Calibration

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

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

Calibrated by : Mr.Navaporn Uengseng
Calibration Officer

Approved by :
(Ms.Bussakorn Chaikaew)
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อ 110 www.spmetrology.co.th

Calibration Report

Certificate Number : SPR24030285-5

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	6020A	A47046	QR24-0167	26 Jan 2025

Traceability

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

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อ 110 www.spmetrology.co.th

Result of Calibration

Certificate No. : SPR24030285-5

Temperature Accuracy in the Measurement. (WET) Unit : °C

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

Temperature Accuracy in the Measurement. (DRY) Unit : °C

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

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

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

Note :

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

Measurement Uncertainty

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

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24100363-3 Page : 1 of 3

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

Equipment Name	: Area Heat Stress Monitor		
Manufacturer	: Quest Technologies		
Model	: QUESTemp 34		
Serial Number	: TEL080034		
ID. Number	: B11		
Environmental Conditions			
Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 21 Oct 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 21 Oct 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 21 Oct 2025
Calibration Procedure	: SP-CPT-04-13	Date of Issue	: 22 Oct 2024

Method of Calibration

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

Calibrated by : Mr.Chatchai Kittisopha
Calibration Officer

Approved by :
(Mr.Prayoon Topart)
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 www.สอบเทียบเครื่องมือวัด.com

Calibration Report

Certificate Number : SPR24100363-3 Page : 2 of 3

Reference Standards

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

Traceability

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

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate Number : SPR24100363-3 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.021	30.3	0.279	0.20
35.0	35.018	35.3	0.282	0.20
40.0	40.019	40.3	0.281	0.20

Temperature Accuracy in the Measurement. (DRY) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.021	30.2	0.179	0.20
35.0	35.018	35.2	0.182	0.20
40.0	40.019	40.2	0.181	0.20

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.021	30.2	0.179	0.20
35.0	35.018	35.2	0.182	0.20
40.0	40.019	40.2	0.181	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 -

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24100363-4 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor
Manufacturer : Quest Technologies
Model : QUESTemp 32
Serial Number : TPA100010
ID. Number : B12

Environmental Conditions

Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 21 Oct 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 21 Oct 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 21 Oct 2025
Calibration Procedure	: SP-CPT-04-13	Date of Issue	: 22 Oct 2024

Method of Calibration

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

Calibrated by : Mr.Surasak Ritthikaew
Calibration Officer

Approved by :
(Mr.Prayoon Topart)
Authorized Signatory

SP-FM-04-15 rev.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

Calibration Report

Certificate Number : SPR24100363-4 Page : 2 of 3

Reference Standards

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

Traceability

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

SP-FM-04-15 rev.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate Number : SPR24100363-4 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.019	30.2	0.181	0.20
35.0	35.017	35.2	0.183	0.20
40.0	40.019	40.2	0.181	0.20

Temperature Accuracy in the Measurement. (DRY) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.019	30.2	0.181	0.20
35.0	35.017	35.2	0.183	0.20
40.0	40.019	40.2	0.181	0.20

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.019	30.2	0.181	0.20
35.0	35.017	35.2	0.183	0.20
40.0	40.019	40.2	0.181	0.20

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

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

- End of Certificate -

SP-FM-04-15 REV.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สอบเทียบดีดีจัง.com

Certificate of Calibration

Certificate Number : SPR24090395-9 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	:	TEF050029			
ID. Number	:	B17-TEF050029			
Environmental Conditions					
Ambient Temperature	:	23 °C ± 2 °C	Received Date	:	20 Sep 2024
Relative Humidity	:	50 % ± 15 %	Calibration Date	:	23 Sep 2024
Location of Calibration	:	In-Lab	Recommend Due Date	:	23 Sep 2025
Calibration Procedure	:	SP-CPT-04-13	Date of Issue	:	24 Sep 2024

Method of Calibration

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

Calibrated by : Mr.Navaporn Uengseng
Calibration Officer

Approved by :
(Mr.Poothipong A.)
Authorized Signatory

SP-FM-04-15 rev.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สอบเทียบดีดีจัง.com

Calibration Report

Certificate Number : SPR24090395-9 Page : 2 of 3

Reference Standards

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

Traceability

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

SP-FM-04-15 rev.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สอบเทียบดีดีจัง.com

Result of Calibration

Certificate Number : SPR24090395-9 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET) Unit : °C

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

Temperature Accuracy in the Measurement. (DRY) Unit : °C

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

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

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

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

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

– End of Certificate –

SP-FM-04-15 REV.0

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 B_078_1

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B05	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°34	Barometric Pressure	: 1011	mmbar	
Serial No.	: TEH060047	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.5	-0.2	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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

Heat B_078_2

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B07	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°34	Barometric Pressure	: 1011	mmbar	
Serial No.	: TEG040059	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	46.9	0.2	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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

Heat B_078_3

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B11	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°34	Barometric Pressure	: 1011	mmbar	
Serial No.	: TEL080034	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.7	-0.2	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5

Globe Probe Temperature Measurement

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

UUC* = UNIT UNDER CALIBRATION

Verified by : Adul Dangklom (Mr.Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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

Heat B_078_4

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B12	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°32	Barometric Pressure	: 1011	mmbar	
Serial No.	: TPA100010	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.7	-0.2	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	46.9	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 : Adul Dangklom (Mr.Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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

Heat B_078_5

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B17	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°34	Barometric Pressure	: 1011	mmbar	
Serial No.	: TEF050029	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.5	0.0	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

เอกสารแนบ 5-14

เอกสารสอบเทียบเครื่องมือการตรวจวัดความร้อนที่พนักงาน

ได้รับจากการปฏิบัติงาน

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.metrologysystem.com

Certificate of Calibration

Certificate Number : SPR24100363-5 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor
Manufacturer : Quest Technologies
Model : QUESTemp 34
Serial Number : TEH060047
ID. Number : B05

Environmental Conditions

Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 21 Oct 2024
Relative Humidity	: 60 % ± 15 %	Calibration Date	: 21 Oct 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 21 Oct 2025
Calibration Procedure	: SP-CPT-04-13	Date of Issue	: 22 Oct 2024

Method of Calibration

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

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

Calibrated by : Mr.Surasak Ritthikaew
Calibration Officer

Approved by :
(Mr.Prayoon Topart)
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.metrologysystem.com

Calibration Report

Reference Standards

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

Traceability

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

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.metrologysystem.com

Result of Calibration

Temperature Accuracy in the Measurement. (WET) Unit : °C

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

Temperature Accuracy in the Measurement. (DRY) Unit : °C

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

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

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

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

Measurement Uncertainty

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

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อ 110 www.spmetrology.co.th

Certificate of Calibration

Certificate Number : SPR24030285-5

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 : TEG040059
ID. Number : B07

Environmental Conditions

Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 19 Mar 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 20 Mar 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 20 Mar 2025
Calibration Procedure	: SP-CPT-04-13	Date of Issue	: 21 Mar 2024

Method of Calibration

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

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

Calibrated by : Mr.Navaporn Uengseng
Calibration Officer

Approved by :
(Ms.Bussakorn Chaikaew)
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อ 110 www.spmetrology.co.th

Calibration Report

Certificate Number : SPR24030285-5

Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Humidity Chamber	TH-80S	N/A	SPR24020149-7	23 Feb 2025
THERMO-HYGROMETER	6020A	A47046	QR24-0167	26 Jan 2025

Traceability

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

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongluang, Klongluang, Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 ต่อ 110 www.spmetrology.co.th

Result of Calibration

Certificate No. : SPR24030285-5

Temperature Accuracy in the Measurement. (WET) Unit : °C

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

Temperature Accuracy in the Measurement. (DRY) Unit : °C

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

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

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

Note :

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

Measurement Uncertainty

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

- End of Certificate -

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24100363-3 Page : 1 of 3

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

Equipment Name	: Area Heat Stress Monitor		
Manufacturer	: Quest Technologies		
Model	: QUESTemp 34		
Serial Number	: TEL080034		
ID. Number	: B11		
Environmental Conditions			
Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 21 Oct 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 21 Oct 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 21 Oct 2025
Calibration Procedure	: SP-CPT-04-13	Date of Issue	: 22 Oct 2024

Method of Calibration

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

Calibrated by : Mr.Chatchai Kittisopha
Calibration Officer

Approved by :
(Mr.Prayoon Topart)
Authorized Signatory

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 www.สอบเทียบเครื่องมือวัด.com

Calibration Report

Certificate Number : SPR24100363-3 Page : 2 of 3

Reference Standards

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

Traceability

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

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate Number : SPR24100363-3 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.021	30.3	0.279	0.20
35.0	35.018	35.3	0.282	0.20
40.0	40.019	40.3	0.281	0.20

Temperature Accuracy in the Measurement. (DRY) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.021	30.2	0.179	0.20
35.0	35.018	35.2	0.182	0.20
40.0	40.019	40.2	0.181	0.20

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.021	30.2	0.179	0.20
35.0	35.018	35.2	0.182	0.20
40.0	40.019	40.2	0.181	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 -

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

Certificate of Calibration

Certificate Number : SPR24100363-4 Page : 1 of 3

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

Equipment Name : Area Heat Stress Monitor
Manufacturer : Quest Technologies
Model : QUESTemp 32
Serial Number : TPA100010
ID. Number : B12

Environmental Conditions

Ambient Temperature	: 23 °C ± 2 °C	Received Date	: 21 Oct 2024
Relative Humidity	: 50 % ± 15 %	Calibration Date	: 21 Oct 2024
Location of Calibration	: In-Lab	Recommend Due Date	: 21 Oct 2025
Calibration Procedure	: SP-CPT-04-13	Date of Issue	: 22 Oct 2024

Method of Calibration

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

Calibrated by : Mr.Surasak Ritthikaew
Calibration Officer

Approved by :
(Mr.Prayoon Topart)
Authorized Signatory

SP-FM-04-15 rev.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

Calibration Report

Certificate Number : SPR24100363-4 Page : 2 of 3

Reference Standards

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

Traceability

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

SP-FM-04-15 rev.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายงาน www.สอบเทียบเครื่องมือวัด.com

Result of Calibration

Certificate Number : SPR24100363-4 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.019	30.2	0.181	0.20
35.0	35.017	35.2	0.183	0.20
40.0	40.019	40.2	0.181	0.20

Temperature Accuracy in the Measurement. (DRY) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.019	30.2	0.181	0.20
35.0	35.017	35.2	0.183	0.20
40.0	40.019	40.2	0.181	0.20

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

Temperature Setting	Standard Reading	UUC Reading	Error	Uncertainty (±)
30.0	30.019	30.2	0.181	0.20
35.0	35.017	35.2	0.183	0.20
40.0	40.019	40.2	0.181	0.20

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

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

- End of Certificate -

SP-FM-04-15 REV.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สอบเทียบดีดีจัง.com

Certificate of Calibration

Certificate Number : SPR24090395-9 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	:	TEF050029			
ID. Number	:	B17-TEF050029			
Environmental Conditions					
Ambient Temperature	:	23 °C ± 2 °C	Received Date	:	20 Sep 2024
Relative Humidity	:	50 % ± 15 %	Calibration Date	:	23 Sep 2024
Location of Calibration	:	In-Lab	Recommend Due Date	:	23 Sep 2025
Calibration Procedure	:	SP-CPT-04-13	Date of Issue	:	24 Sep 2024

Method of Calibration

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

Calibrated by : Mr.Navaporn Uengseng
Calibration Officer

Approved by :
(Mr.Poothipong A.)
Authorized Signatory

SP-FM-04-15 rev.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สอบเทียบดีดีจัง.com

Calibration Report

Certificate Number : SPR24090395-9 Page : 2 of 3

Reference Standards

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

Traceability

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

SP-FM-04-15 rev.0

METROLOGY SYSTEM (THAILAND) CO.,LTD.
ID LINE : IEC17025
69/29 Moo 1 Klongsi Klongluang Pathumthani 12120 (Thailand) Tel: (662) 193-2220 5 สายๆ www.สอบเทียบดีดีจัง.com

Result of Calibration

Certificate Number : SPR24090395-9 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET) Unit : °C

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

Temperature Accuracy in the Measurement. (DRY) Unit : °C

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

Temperature Accuracy in the Measurement. (GLOBE) Unit : °C

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

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

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

– End of Certificate –

SP-FM-04-15 REV.0

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 B_078_1

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B05	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°34	Barometric Pressure	: 1011	mmbar	
Serial No.	: TEH060047	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.4	0.1	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.5	-0.2	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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

Heat B_078_2

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B07	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°34	Barometric Pressure	: 1011	mmbar	
Serial No.	: TEG040059	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.6	-0.1	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	46.9	0.2	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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

Heat B_078_3

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B11	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°34	Barometric Pressure	: 1011	mmbar	
Serial No.	: TEL080034	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.7	-0.2	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5

Globe Probe Temperature Measurement

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

UUC* = UNIT UNDER CALIBRATION

Verified by : Adul Dangklom (Mr.Adul Dangklom)

Approved by : (Mr. Peera Detudom)

บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
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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 B_078_4

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B12	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°32	Barometric Pressure	: 1011	mmbar	
Serial No.	: TPA100010	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.7	-0.2	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	46.9	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 : Adul Dangklom (Mr.Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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

Heat B_078_5

Heat Stress WBGT Meter Verification Report

Verification Data

Heat Stress WBGT Meter No.	: B17	Verification Date	: 10 March 2025		
Brand	: Quest Technologies	Ambient Temp.	: 24.5	°C	
Model	: QUESTemp°34	Barometric Pressure	: 1011	mmbar	
Serial No.	: TEF050029	Relative Humidity	: 49	%	

Verification Module (Electronic Sensor Check) :

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

Result of Verification : Without Adjustment

Wet Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
12.5	12.5	0.0	± 0.5

Dry Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
47.1	47.2	-0.1	± 0.5

Globe Probe Temperature Measurement

Verification Module Reading (°C)	UUC* Reading (°C)	Correction (°C)	Tolerance Limit (°C)
69.3	69.2	0.1	± 0.5

UUC* = UNIT UNDER CALIBRATION

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

เอกสารแนบ 5-15

เอกสารสอบเทียบเครื่องมือการตรวจวัดสารเคมีในบรรยากาศของสถานที่ทำงาน

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

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								
					Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
No.	Brand	Model	Serial No.	Date	1	2	3	1	2	3	y	R^2
B01	SKC	224-PCXR4	262101	03/01/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x – 5.913	1.000
B02	SKC	224-PCXR4	626166	03/01/2025	1,000	1,500	2,000	997	1,499	1,996	0.998x - 0.140	1.000
B03	SKC	224-PCXR4	612968	06/01/2025	1,000	1,500	2,000	1,008	1,504	1,998	0.999x + 1.131	0.999
B04	SKC	224-PCXR4	602804	06/01/2025	1,000	1,500	2,000	994	1,505	2,004	1.010x - 17.826	1.000
B05	SKC	224-PCXR4	612693	07/01/2025	1,000	1,500	2,000	997	1,508	1,997	1.009x – 14.660	0.999
B06	SKC	224-PCXR4	262188	07/01/2025	1,000	1,500	2,000	1,005	1,493	2,002	0.995x + 7.108	1.000
B07	SKC	224-PCXR4	626262	07/01/2025	1,000	1,500	2,000	994	1,498	2,004	1.006x - 10.434	1.000
B08	SKC	224-PCXR4	626100	03/01/2025	1,000	1,500	2,000	1,014	1,505	2,010	1.004x - 2.659	0.999
B09	SKC	224-PCXR4	626479	06/01/2025	1,000	1,500	2,000	998	1,491	2,006	1.012x - 22.408	1.000
B10	SKC	224-PCXR4	091950	06/01/2025	1,000	1,500	2,000	999	1,507	2,007	1.010x – 15.236	1.000
B11	SKC	224-PCXR8	564315	06/01/2025	1,000	1,500	2,000	997	1,496	1,996	1.001x - 3.394	1.000
B12	SKC	224-PCXR4	034656	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,004	1.011x – 19.282	0.999
B13	SKC	224-PCXR4	602073	07/01/2025	1,000	1,500	2,000	995	1,505	1,998	1.006x - 12.605	1.000
B14	SKC	224-PCXR4	626313	03/01/2025	1,000	1,500	2,000	1,003	1,506	2,007	1.007x - 8.152	1.000
B15	SKC	224-PCXR4	626474	06/01/2025	1,000	1,500	2,000	1,010	1,498	2,001	0.994x + 9.807	1.000
B16	SKC	224-PCXR4	626477	06/01/2025	1,000	1,500	2,000	998	1,507	2,002	1.013x - 22.572	0.999
B17	SKC	224-PCXR4	626860	06/01/2025	1,000	1,500	2,000	1,005	1,499	2,001	0.995x + 7.368	1.000
B18	SKC	224-PCXR4	691484	06/01/2025	1,000	1,500	2,000	1,008	1,494	2,002	0.993x + 10.346	1.000
B19	SKC	224-PCXR4	691599	06/01/2025	1,000	1,500	2,000	1,010	1,505	2,010	1.000x + 6.532	1.000
B20	SKC	224-PCXR4	691587	07/01/2025	1,000	1,500	2,000	1,006	1,512	2,009	1.002x – 1.671	0.999
B21	SKC	224-PCXR4	691531	07/01/2025	1,000	1,500	2,000	1,001	1,510	2,007	1.007x – 10.035	1.000
B22	SKC	224-PCXR4	691654	07/01/2025	1,000	1,500	2,000	1,015	1,513	2,012	0.999x + 8.423	0.999
B23	SKC	224-PCXR4	798393	07/01/2025	1,000	1,500	2,000	999	1,498	2,001	1.001x - 0.856	1.000
B24	SKC	224-PCXR4	626363	06/01/2025	1,000	1,500	2,000	1,001	1,506	2,006	1.007x – 12.177	0.999
B25	SKC	224-PCXR4	798489	06/01/2025	1,000	1,500	2,000	996	1,514	2,005	1.011x + 13.301	1.000
B26	SKC	224-PCXR4	798479	03/01/2025	1,000	1,500	2,000	998	1,509	2,002	1.005x - 9.187	1.000
B27	SKC	224-PCXR4	691673	03/01/2025	1,000	1,500	2,000	1,001	1,511	1,995	0.998x - 0.700	0.999
B28	SKC	224-PCXR4	691570	03/01/2025	1,000	1,500	2,000	1,004	1,513	2,006	1.001x + 1.779	1.000
B29	SKC	224-PCXR4	626472	03/01/2025	1,000	1,500	2,000	998	1,508	2,007	1.009x – 13.557	1.000
B30	SKC	224-PCXR4	691489	03/01/2025	1,000	1,500	2,000	1,003	1,503	2,012	1.008x – 10.099	1.000
B31	SKC	224-PCXR4	691509	06/01/2025	1,000	1,500	2,000	997	1,510	2,009	1.012x - 18.438	1.000
B32	SKC	224-PCXR4	091567	06/01/2025	1,000	1,500	2,000	1,014	1,517	2,007	0.995x + 11.654	0.999
B33	SKC	224-PCXR4	091756	06/01/2025	1,000	1,500	2,000	999	1,510	2,003	1.003x – 4.801	1.000
B34	SKC	224-PCXR4	612962	07/01/2025	1,000	1,500	2,000	1,001	1,511	2,008	1.008x – 11.354	0.999
B35	SKC	224-PCXR4	602682	07/01/2025	1,000	1,500	2,000	1,008	1,514	1,996	0.993x + 11.338	0.999
B36	SKC	224-PCXR4	626164	07/01/2025	1,000	1,500	2,000	1,005	1,506	2,007	1.003x - 2.339	1.000
B37	SKC	224-PCXR4	626256	07/01/2025	1,000	1,500	2,000	1,003	1,503	2,005	1.011x - 16.311	0.999
B38	SKC	224-PCXR4	626167	03/01/2025	1,000	1,500	2,000	1,006	1,514	2,007	1.000x + 0.712	0.999
B39	SKC	224-PCXR4	034637	06/01/2025	1,000	1,500	2,000	1,013	1,515	2,013	1.002x + 3.638	0.999
B40	SKC	224-PCXR4	798349	07/01/2025	1,000	1,500	2,000	999	1,508	2,001	1.000x - 1.691	1.000

Calibrated by : Adul Dangklom (Mr. Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter | Model : Defender 510-H | S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data								
					Flow Rate (ml/min)						Value From Calibration Curve	
					Setting			Actual (Q std.)				
No.	Brand	Model	Serial No.	Date	1	2	3	1	2	3	y	R^2
B41	SKC	224-PCXR4	612669	07/01/2025	1,000	1,500	2,000	996	1,512	2,005	1.008x - 10.246	1.000
B42	SKC	224-PCXR4	626041	07/01/2025	1,000	1,500	2,000	995	1,499	2,002	1.002x - 2.343	1.000
B43	SKC	224-PCXR4	034636	03/01/2025	1,000	1,500	2,000	999	1,495	1,997	0.996x + 2.703	1.000
B44	SKC	224-PCXR8	529341	03/01/2025	1,000	1,500	2,000	998	1,510	2,003	1.009x - 16.871	0.999
B45	SKC	224-PCXR8	529594	03/01/2025	1,000	1,500	2,000	997	1,508	2,004	1.012x - 21.113	0.999
B46	SKC	224-PCXR8	566743	03/01/2025	1,000	1,500	2,000	996	1,497	2,003	1.010x – 16.955	1.000
B47	SKC	224-PCXR8	566747	03/01/2025	1,000	1,500	2,000	1,002	1,504	2,001	1.003x - 2.758	1.000
B48	SKC	224-PCXR8	566753	03/01/2025	1,000	1,500	2,000	998	1,512	2,002	1.008x -13.876	0.999
B49	SKC	224-PCXR8	566780	03/01/2025	1,000	1,500	2,000	997	1,497	1,997	1.002x - 5.465	1.000
B50	SKC	224-PCXR8	500400	03/01/2025	1,000	1,500	2,000	996	1,503	1,999	1.003x – 7.316	1.000
B51	SKC	224-PCXR8	500363	06/01/2025	1,000	1,500	2,000	1,003	1,505	1,998	0.995x + 8.579	1.000
B52	SKC	224-PCXR8	093186	06/01/2025	1,000	1,500	2,000	1,002	1,496	1,999	0.999x - 0.396	1.000
B53	SKC	224-PCXR8	707670	07/01/2025	1,000	1,500	2,000	997	1,505	2,005	1.010x - 19.569	0.999
B54	SKC	224-PCXR3	509821	07/01/2025	1,000	1,500	2,000	1,004	1,506	2,002	1.002x - 0.736	1.000
B55	SKC	224-PCXR3	510710	07/01/2025	1,000	1,500	2,000	998	1,501	2,001	1.003x - 5.629	1.000
B56	SKC	224-PCXR3	511450	07/01/2025	1,000	1,500	2,000	995	1,509	2,007	1.013x – 22.400	0.999
B57	SKC	224-PCXR3	510798	07/01/2025	1,000	1,500	2,000	999	1,498	1,996	0.996x + 4.985	1.000
B58	SKC	224-PCXR3	509852	06/01/2025	1,000	1,500	2,000	1,002	1,503	2,005	1.009x - 13.249	1.000
B59	SKC	224-PCXR3	509862	06/01/2025	1,000	1,500	2,000	996	1,506	2,007	1.015x - 25.718	0.999
B60	SKC	224-PCXR3	512655	06/01/2025	1,000	1,500	2,000	1,012	1,504	2,001	0.995x + 10.338	1.000
B61	SKC	224-PCXR3	503915	03/01/2025	1,000	1,500	2,000	1,003	1,507	2,010	1.010x - 13.769	1.000
B62	SKC	224-PCXR3	505975	03/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.012x - 17.586	0.999
B63	SKC	224-PCXR3	511432	03/01/2025	1,000	1,500	2,000	999	1,503	2,003	1.013x - 21.568	0.999
B64	SKC	224-PCXR3	508302	06/01/2025	1,000	1,500	2,000	996	1,506	2,006	1.010x - 15.623	1.000
B65	SKC	224-PCXR3	508310	06/01/2025	1,000	1,500	2,000	1,003	1,502	2,002	1.001x + 1.279	1.000
B66	SKC	224-PCXR3	509861	06/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.004x - 7.200	1.000
B67	SKC	224-PCXR3	506295	06/01/2025	1,000	1,500	2,000	997	1,497	2,007	1.011x – 22.995	0.999
B68	SKC	224-PCXR3	505872	07/01/2025	1,000	1,500	2,000	1,001	1,493	1,999	0.998x - 1.515	1.000
B69	SKC	224-PCXR3	508375	07/01/2025	1,000	1,500	2,000	995	1,508	2,003	1.013x – 23.639	0.999
B70	SKC	224-PCXR3	510623	07/01/2025	1,000	1,500	2,000	1,004	1,502	2,007	1.011x – 17.470	0.999
B71	SKC	224-PCXR3	508367	06/01/2025	1,000	1,500	2,000	1,003	1,504	2,008	1.016x – 24.787	0.999
B72	SKC	224-PCXR3	505977	06/01/2025	1,000	1,500	2,000	1,008	1,496	2,007	1.001x + 0.904	1.000
B73	SKC	224-PCXR3	512606	06/01/2025	1,000	1,500	2,000	1,003	1,502	2,003	1.007x – 15.456	0.999
B74	SKC	224-PCXR3	505993	06/01/2025	1,000	1,500	2,000	1,004	1,501	1,999	1.000x – 0.624	1.000
B75	SKC	224-PCXR3	509820	06/01/2025	1,000	1,500	2,000	996	1,510	2,003	1.010x - 17.886	0.999
B76	SKC	224-PCXR3	509811	07/01/2025	1,000	1,500	2,000	994	1,509	2,008	1.013x - 21.308	1.000
B77	SKC	224-PCXR3	508301	07/01/2025	1,000	1,500	2,000	1,002	1,491	2,006	1.006x – 10.302	1.000
B78	SKC	224-PCXR3	510677	07/01/2025	1,000	1,500	2,000	1,005	1,504	2,007	1.012x – 19.957	0.999
B79	SKC	224-PCXR3	510920	06/01/2025	1,000	1,500	2,000	1,003	1,503	2,006	1.015x – 24.223	0.999

Calibrated by : Adul Dangklom (Mr. Adul Dangklom)

Approved by : (Mr. Peera Detudom)

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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Environmental Conditions

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

Personal Pump Data				Calibration Data							
No.	Brand	Model	Serial No.	Date	Flow Rate (ml/min)						Value From Calibration Curve
					Setting			Actual (Q std.)			
					1	2	3	1	2	3	y	R^2
B80	SKC	224-PCXR3	504569	06/01/2025	1,000	1,500	2,000	999	1,497	2,011	1.009x – 11.282	1.000
B81	SKC	224-PCXR3	503480	03/01/2025	1,000	1,500	2,000	1,004	1,505	2,008	1.010x - 16.107	0.999
B82	SKC	224-PCXR3	505673	03/01/2025	1,000	1,500	2,000	995	1,509	2,005	1.014x – 24.323	0.999
B83	SKC	224-PCXR3	510785	07/01/2025	1,000	1,500	2,000	999	1,506	1,998	0.998x + 5.669	1.000
B84	SKC	224-PCXR3	508333	07/01/2025	1,000	1,500	2,000	993	1,492	2,004	1.009x - 21.129	1.000
B85	SKC	224-PCXR3	505757	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,008	1.007x - 9.639	1.000
B86	SKC	224-PCXR3	512625	06/01/2025	1,000	1,500	2,000	996	1,495	2,001	1.005x - 11.406	1.000
B87	SKC	224-PCXR3	504324	06/01/2025	1,000	1,500	2,000	997	1,498	1,999	1.004x – 12.097	1.000
B88	SKC	224-PCXR3	508307	06/01/2025	1,000	1,500	2,000	994	1,502	1,994	0.999x - 1.619	1.000
B89	SKC	224-PCXR3	509860	06/01/2025	1,000	1,500	2,000	995	1,507	2,003	1.008x – 14.844	1.000
B90	SKC	224-PCXR3	508366	07/01/2025	1,000	1,500	2,000	997	1,496	1,995	0.999x – 1.143	1.000
B91	SKC	224-PCXR3	510919	07/01/2025	1,000	1,500	2,000	1,005	1,503	2,012	1.008x - 11.670	0.999
B92	SKC	224-PCXR3	510987	03/01/2025	1,000	1,500	2,000	999	1,494	2,010	1.013x - 24.882	0.999
B93	SKC	224-PCXR3	509845	03/01/2025	1,000	1,500	2,000	997	1,507	1,998	1.002x – 3.102	1.000

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

Rotameter Data			Calibration Data								
No.	Brand	Model	Date	Flow Rate (ml/min)						Value From Calibration Curve	
				Flow Rate (Reading)			Actual (Q std.)				
				1	2	3	1	2	3	y	R^2
H-B01	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	498.1	999.3	2001.2	0.997x + 4.404	1.000
H-B02	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	499.2	998.1	2012.5	1.003x - 8.556	0.999
H-B03	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	502.4	1002.9	2008.6	1.000x - 2.203	1.000
H-B04	Dwyer	VFB-65	07/01/2025	500	1,000	2,000	501.7	997.4	1993.2	0.996x + 5.850	1.000
H-B05	Dwyer	VFB-65	07/01/2025	500	1,000	2,000	500.9	994.7	1984.4	0.985x + 17.991	0.999
H-B06	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	502.5	997.1	1993.6	0.993x + 7.901	1.000
H-B07	Dwyer	VFB-65	06/01/2025	500	1,000	2,000	501.4	998.8	2009.5	1.001x + 0.428	1.000
H-B08	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	500.9	999.4	1993.8	0.997x + 2.266	0.999
H-B09	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	502.3	1004.1	2009.7	0.996x + 11.111	1.000
H-B10	Dwyer	VFB-65	03/01/2025	500	1,000	2,000	498.6	999.5	2010.3	1.001x - 0.553	0.999

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

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Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter	Model : Defender 510-H	S/N : 136164

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-B01	Dwyer	VFA-21	03/01/2025	50	100	200	50.2	100.1	199.4	0.997x + 0.962	0.999
L-B02	Dwyer	VFA-21	06/01/2025	50	100	200	49.3	99.2	201.5	0.994x + 0.453	1.000
L-B03	Dwyer	VFA-21	03/01/2025	50	100	200	49.6	99.8	199.7	0.996x + 0.107	1.000
L-B04	Dwyer	VFA-21	07/01/2025	50	100	200	50.5	100.6	200.4	0.995x + 1.286	1.000
L-B05	Dwyer	VFA-21	07/01/2025	50	100	200	50.4	101.1	202.5	0.994x + 1.572	1.000
L-B06	Dwyer	VFA-21	06/01/2025	50	100	200	50.9	99.2	198.7	1.000x + 0.411	0.999
L-B07	Dwyer	VFA-21	06/01/2025	50	100	200	49.7	99.1	201.4	0.997x + 0.176	1.000
L-B08	Dwyer	VFA-21	03/01/2025	50	100	200	50.6	99.8	200.2	0.998x + 1.116	0.999
L-B09	Dwyer	VFA-21	03/01/2025	50	100	200	49.8	101.9	198.3	1.000x + 0.229	1.000
L-B10	Dwyer	VFA-21	03/01/2025	50	100	200	49.6	99.3	200.2	1.002x - 0.688	1.000

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by :
(Mr. Peera Detudom)

ARCHEMICA

Certificate of Calibration

Aquion: Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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

ARCHEMICA LAB
บริษัท อาร์เคมีก้า แลบ จำกัด
ARCHEMICA LAB CO.,LTD.

Operator Signature: _____ **Date: June 24, 2024**

(Mr. Ponwut Kornthongnimit)

Test Engineer

บริษัท ไทยยูนีค จำกัด THAI UNIQUE CO., LTD.
80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

Model : CP-3800

Serial Number : 00734

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

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

Date : 05/08/2024

ELECTRONIC TEST

CPU	☑ PASS	☐ FAIL
LCD TEST	☑ PASS	☐ FAIL
VENT TEST	☑ PASS	☐ FAIL
KEY ECHO TEST	☑ PASS	☐ FAIL
DESTRUCTION RAM TEST	☑ PASS	☐ FAIL

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

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

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

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

SENSITIVITY TEST: C15. (Area count) = 156,955 Counts.

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Detector Sensitivity (FID)

Detector Response	Result	Specification
Baseline Noise (µV)	2.85	≤ 50
Baseline Drift (%)	0.09	≤ 1
Sensitivity (S/N for C15)	16,400	≥ 1,024

Temperature Specification

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

Relative Standard Deviation % (% RSD)

Checkout Procedure	Result	Specification
Area C15 (%)	1.71	≤ 5
Retention Time C15(%)	0	≤ 0.5

APPROVAL :

Signature: Suwarot.

Engineer : Suwarot Trikainut

Date : 05/08/2024

บริษัท ไทยยูนีค จำกัด THAI UNIQUE CO., LTD.
80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

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

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

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

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

Compliance	☑ Pass	☐ Fail
Performance by	Suwarot.	
Date	05/08/2567	

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

บริษัท ไทยยูนีค จำกัด THAI UNIQUE CO., LTD.
80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200
80-82 Prachathipatai Rd., Bangkhunphrom, Pranakorn, Bangkok 10200
Tel. 0-2629-0191-6, 0-2280-1787, Fax. 0-2280-1788, E-mail : thawatt@thaiunique.com, Website : www.thaiunique.com

Results Integrated System Testing

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

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

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

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

Compliance	☑ Pass	☐ Fail
Performance by	Suwarot.	
Date	05/08/2024	

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

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

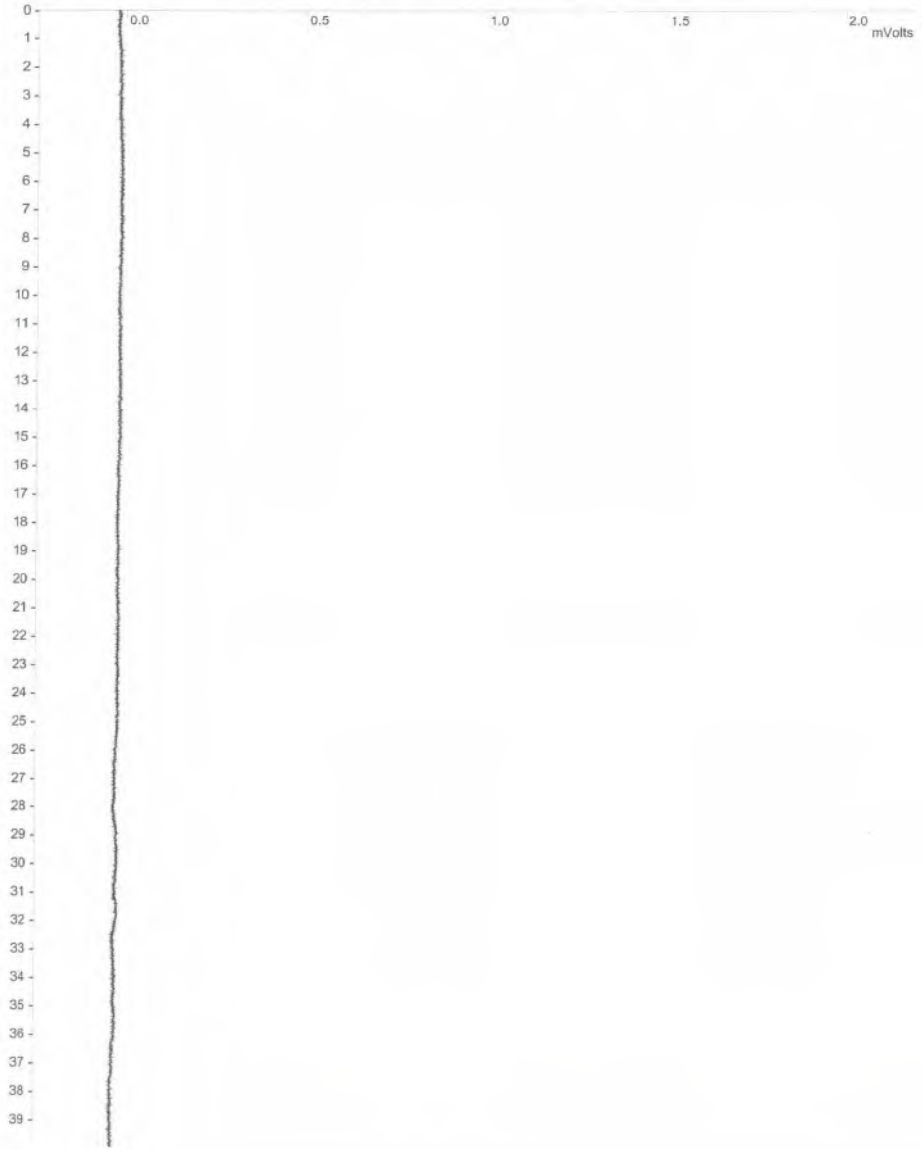
Injection Date: 5/8/2567 14:01 Calculation Date: 5/8/2567 14:41

Operator : watsamon
Workstation: Local Disk
Instrument :
Channel : Front = FID

Detector Type: 3800 (10 Volts)
Bus Address : 44
Sample Rate : 10.00 Hz
Run Time : 39.960 min

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

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



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

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

Operator : suwarot
Workstation: Local Disk
Instrument :
Channel : Front = FID

Detector Type: 3800 (10 Volts)
Bus Address : 44
Sample Rate : 10.00 Hz
Run Time : 39.960 min

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

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

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

Total Unidentified Counts : 0 counts

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

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -16 microVolts LSB: 1 microVolts

Noise (used): 22 microVolts - monitored before this run

Manual injection

Data Handling: No peaks

****

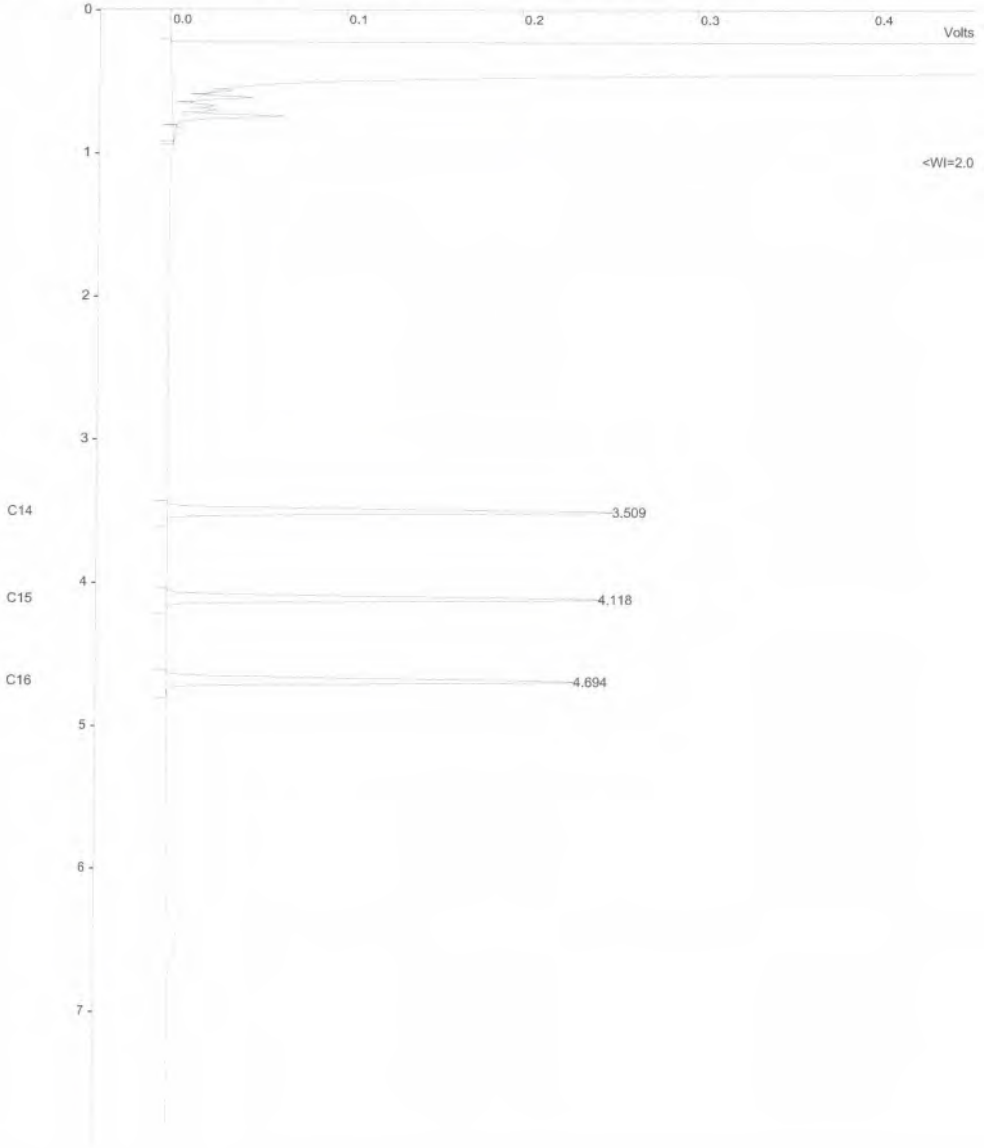
Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\cafid2024003-front.mth
Sample ID : FID2024

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

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

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

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



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

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

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

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

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

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

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

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

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

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts LSB: 1 microVolts

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

Manual injection

Calib. out of range; No Recovery Action Specified

****

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

Sample ID: **fid std**

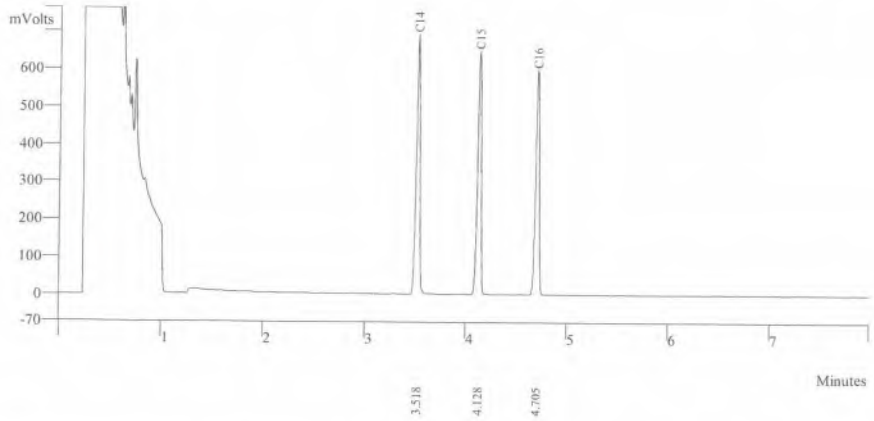
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

VARIAN

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

c:\star\data\tu\cal2024\fid2024001.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.6865	3.518	163565	BB	2.2
2	C15	147.1889	4.128	157309	BB	2.3
3	C16	138.7997	4.705	146804	BB	2.3
	Totals	**438.6751**		**467678**		

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

Sample ID: **fid std**

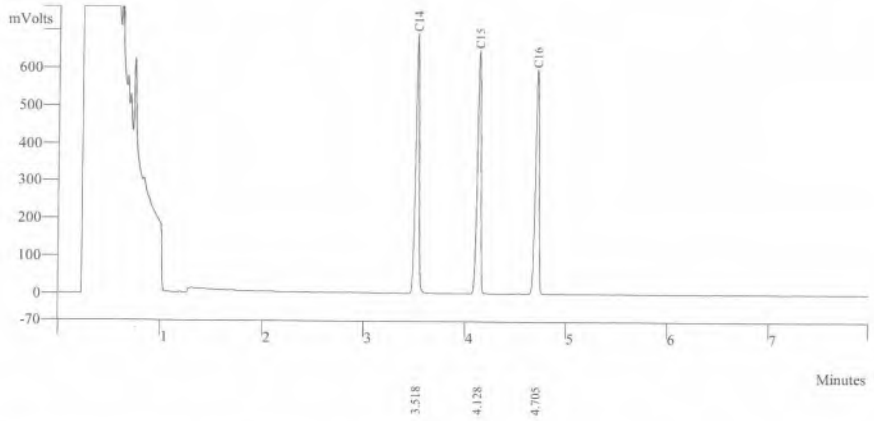
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

VARIAN

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

c:\star\data\tu\cal2024\fid2024002.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.6865	3.518	168565	BB	2.2
2	C15	137.1189	4.128	159359	BB	2.3
3	C16	128.7997	4.705	147834	BB	2.3
	Totals	**418.6042**		**475758**		

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

Sample ID: **fid std**

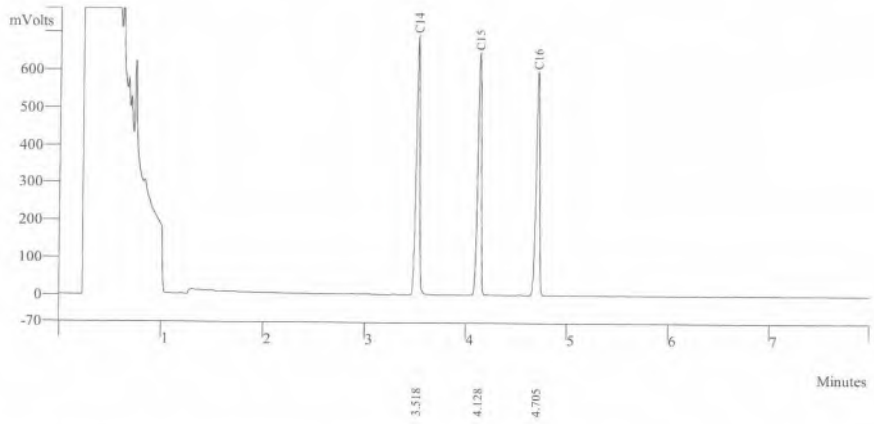
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

VARIAN

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

c:\star\data\tu\cal2024\fid2024003.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	152.7865	3.518	169535	BB	2.2
2	C15	197.1159	4.128	157349	BB	2.3
3	C16	128.5997	4.705	149834	BB	2.3
	Totals	**478.5021**		**476718**		

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

Sample ID: **fid std**

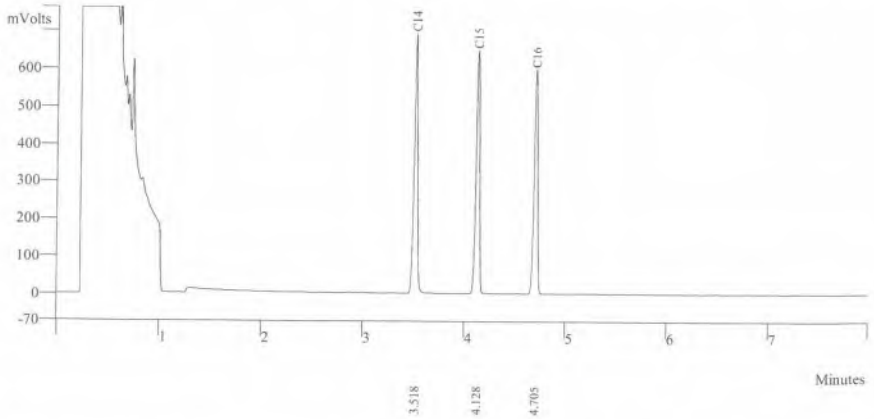
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

VARIAN

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

c:\star\data\tu\cal2024\fid2024004.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	162.7865	3.518	165521	BB	2.2
2	C15	157.1159	4.128	152379	BB	2.3
3	C16	138.5997	4.705	146834	BB	2.3
	Totals	**458.5021**		**464734**		

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

Sample ID: **fid std**

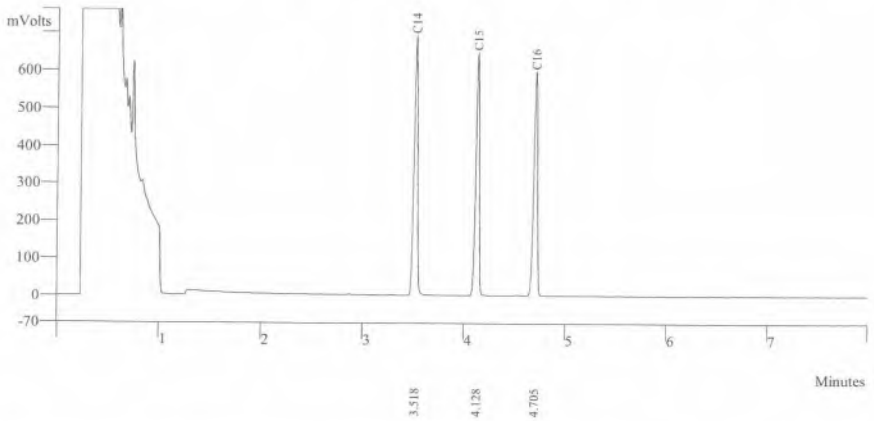
VARIAN

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

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

c:\star\data\tu\cal2024\fid2024005.run

A = FID 10 V RESULTS



Peak No	Peak Name	Result ()	Ret Time (min)	Peak Area (counts)	Sep. Code	Width 1/2 (sec)
1	C14	162.7965	3.518	164521	BB	2.2
2	C15	137.1159	4.128	158379	BB	2.3
3	C16	128.1947	4.705	149834	BB	2.3
	Totals	**428.1071**		**472734**		

THAI UNIQUE CO.,LTD.

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 (± 0.5%)	0.033 w/w %
n-pentadecane	0.218 g/L (± 0.5%)	0.033 w/w %
n-hexadecane	0.218 g/L (± 0.5%)	0.033 w/w %

Solvent: hexane

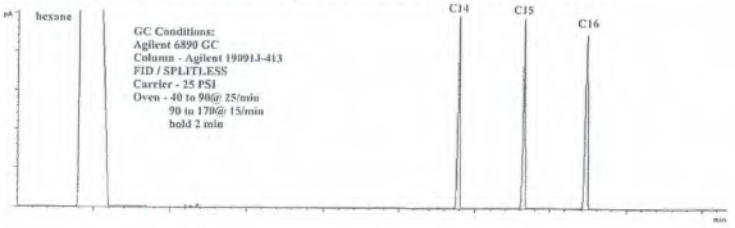
Calibrated Class A glassware and clean bottles were used in the manufacture of this standard. Balances used in the manufacture of this standard are calibrated with weights traceable to NIST in compliance with ANSI/NCSL Z-540-1 and ISO 9001.

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
QMS Representative

WK Electric Co.,Ltd.

68/242 Moo 5, Sawaipracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, 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.: WK2312-031-1

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

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

Reference standard instruments :

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

MIT : Miracle International Technology Co.,Ltd.
This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr.Taywanat Hansuwankul Approved by :

Ms. Budsagorn Patcha
Authorized Signatory

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

WK Electric Co.,Ltd.

68/242 Moo 5, Sawaipracharaj Rd., Tumbol Ladsawai, Amphur Lamlukka, Pathumthani 12150
Tel. +66 2993 4773, +66 2153 7132-3 Fax. +66 2994 5509 E-mail : wk.calibrations@gmail.com www.wk-etc.com

Calibration Results

Certificate No. : WK2312-031-1

Calibration Result of the Accuracy

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

Unit : ml/min

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

(X) Without Adjustment ( ) After Adjustment

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

**** End of Certificate****

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

NSC-TISI-TIS 17025
CALIBRATION 0210

Certificate of Calibration

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

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

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

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

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

Calibrated by

Nanthiya Ngampring

Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

Mrs. Arunee Bamrungtham
Cal-Lab Manager

Measuretronix Limited

Calibration Report

UUC : Fluke 51 Thermometer
Serial No. : 5910857
Asset No. : 5910857
Procedure : CP-LF-04:Rev.02
Note : Refer to Fluke 51,52 Operator's Manual Rev 1 3/86, Oct 1985

Customer : Thai Unique Co., Ltd.
Address : 80-82 Prachathipatai Road, Bangkhunphrom, Pranakorn, Bangkok 10200

Certificate No. : LF24-0278
Report data type : As-Found
Date of Calibrate : 26-Jun-2024
Date of Receive : 17-Jun-2024

Environment condition
Temperature : 23 °C ± 3 °C
Humidity : 50 %RH ± 20 %RH

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

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

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

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

Remark : *The units of uncertainty values in this report are referred to the below details :*
*"**Volt**" or "V" for voltage, "**Ampere**" or "**A**" for current, "**Ohm**" or "Ω" for resistance, "**Farad**" or "**F**" for capacitance, "**Hertz**" or "**Hz**" for frequency, "**deg C**" or "°**C**" for degree Celsius, "**deg F**" or "°**F**" for degree Fahrenheit, etc.*

Standard Used

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

Test Data

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

End of Calibration Report

Certificate

It is hereby certified that

Suwarot Trikainut

Has successfully completed the Application Training for

Basic Gas Chromatography and Sampler

Training Contents were:

Hardware Operation, Software Operation, Data analysis and Troubleshooting : Model

CP-3800, 3900, 450-GC, 430-GC, 456-GC, 436-GC

At Thai Unique Co., Ltd, Bangkok, Thailand

On 15th March, 2019

S. Pohtongkam

Service Manager