

ภาคผนวกที่ 5

เอกสารสอบเทียบความถูกต้องของเครื่องมือ

| | |
|----------------|--|
| เอกสารแนบ 5-1 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศบริเวณชุมชน |
| เอกสารแนบ 5-2 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศบริเวณอุตสาหกรรมบางปู |
| เอกสารแนบ 5-3 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศจากปล่องเตาเผา |
| เอกสารแนบ 5-4 | เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงโดยทั่วไป |
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| เอกสารแนบ 5-6 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำเสียจากบ่อกักน้ำเสีย |
| เอกสารแนบ 5-7 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำฝน |
| เอกสารแนบ 5-8 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำในบ่อสังเกตการณ์การรั่วซึมของถังเก็บน้ำเสีย |
| เอกสารแนบ 5-9 | เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพดินและน้ำใต้ดิน |
| เอกสารแนบ 5-10 | เอกสารสอบเทียบเครื่องมือการตรวจวัดฝุ่นละอองในสถานที่ทำงาน |
| เอกสารแนบ 5-11 | เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงในสถานที่ทำงาน |
| เอกสารแนบ 5-12 | เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงที่ลูกจ้างได้รับเฉลี่ยตลอดเวลาการทำงานในแต่ละวัน (TWA) |
| เอกสารแนบ 5-13 | เอกสารสอบเทียบเครื่องมือการตรวจวัดความร้อนบริเวณพื้นที่ปฏิบัติงาน (WBGT) |
| เอกสารแนบ 5-14 | เอกสารสอบเทียบเครื่องมือการตรวจวัดความร้อนที่พนักงานได้รับการปฏิบัติงาน |
| เอกสารแนบ 5-15 | เอกสารสอบเทียบเครื่องมือการตรวจวัดสารเคมีในบรรยากาศของสถานที่ทำงาน |

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์

| รายการตรวจวัด | เครื่องมือเก็บตัวอย่าง | เครื่องมือตรวจวิเคราะห์ |
|--|--|--|
| | ชื่อเครื่องมือ | ชื่อเครื่องมือ |
| คุณภาพอากาศในบรรยากาศ บริเวณชุมชน | | |
| SO ₂ | SO ₂ Analyzer No. B02, B05, B08, R01 | SO ₂ Analyzer No. B02, B05, B08, R01 |
| NO ₂ | NO ₂ Analyzer No. B11, B18, B19, R09 | NO ₂ Analyzer No. B11, B18, B19, R09 |
| TSP | High Volume Air Sampler No. B02, B37, B39, B42 | Digital Balance |
| PM ₁₀ | High Volume PM10 Air Sampler No. B08, B09, B10, B18 | Digital Balance |
| Cadmium | High Volume Air Sampler No. B02, B37, B39, B42 | ICP |
| Arsenic | High Volume Air Sampler No. B02, B37, B39, B42 | AAS |
| Lead | High Volume Air Sampler No. B02, B37, B39, B42 | ICP |
| Mercury | High Volume Air Sampler No. B02, B37, B39, B42 | AAS |
| Beryllium | High Volume Air Sampler No. B02, B37, B39, B42 | ICP |
| Nickel | High Volume Air Sampler No. B02, B37, B39, B42 | ICP |
| คุณภาพอากาศในบรรยากาศ บริเวณอุตสาหกรรมบางปู | | |
| Arsenic | High Volume Air Sampler No. B44 | AAS |
| Nickel | High Volume Air Sampler No. B44 | ICP |
| คุณภาพอากาศจากปล่อง | | |
| Particulate | Console No. B05 Pitot Tube No. B04 | Digital Balance |
| HCl | Console No. B05 Pitot Tube No. B04 | IC |
| CO | Personal Pump SKC No. B17 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. B05 Pitot Tube No. B04 | GC/MS |

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่างและตรวจวิเคราะห์ (ต่อ)

| รายการตรวจวัด | เครื่องมือเก็บตัวอย่าง | เครื่องมือตรวจวิเคราะห์ |
|-------------------------------|--|-------------------------|
| | ชื่อเครื่องมือ | ชื่อเครื่องมือ |
| คุณภาพอากาศจากปล่อง (ต่อ) | | |
| Mercury | Console No. B05 Pitot Tube No. B04 | AAS |
| Cadmium | Console No. B05 Pitot Tube No. B04 | ICP |
| Lead | Console No. B05 Pitot Tube No. B04 | ICP |
| Arsenic | Console No. B05 Pitot Tube No. B04 | AAS |
| Beryllium | Console No. B05 Pitot Tube No. B04 | ICP |
| Chromium | Console No. B05 Pitot Tube No. B04 | ICP |
| HF | Console No. B05 Pitot Tube No. B04 | IC |
| Dichlorodifluoromethane | Personal Pump SKC No. B17 Rotameter No. L-B09 | GC/FID |
| ระดับเสียงโดยทั่วไป | | - |
| LAeq 24 hr | Acoustic Calibrator No. 130006 | |
| LAeq 1 hr | Sound Level Meter | |
| LA90 | No. ACO-B16, R17, C1-B04, C1-B05 | |
| LAmx | | |
| LAdn | | |
| ระดับเสียงของเครื่องจักร | | - |
| LAeq 5 min | Acoustic Calibrator No. 130006 | |
| | Sound Level Meter No. ACO-B41, B43 | |
| คุณภาพน้ำเสียจากบ่อกักน้ำเสีย | | |
| 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 |
| คุณภาพน้ำเสียจากบ่อกักน้ำเสีย (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 |
| คุณภาพน้ำในบ่อสังเกตรณ | | |
| การรั่วซึมของถังเก็บน้ำเสีย | | |
| pH | - | pH Meter |
| EC | - | Conductivity Meter |
| Total Dissolved Solids | - | Digital balances |
| BOD ₅ | - | DO Meter |
| COD | - | COD Reactor |
| คุณภาพดินและน้ำใต้ดิน | | |
| 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-B36, B41, B43, R40, R41, R50, R52 | |
| ระดับเสียงที่ลูกจ้างได้รับเฉลี่ยตลอด เวลาการทำงานในแต่ละวัน | | |
| Noise Dose | Acoustic Calibrator No. 83820 | - |
| | Noise Dosimeter No. NMD-B09, B10, B11, B12, B13, B14 | |

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. B09 Rotameter No. H-B01 | - |
| Hydrogen Chloride | Personal Pump No. B52 Rotameter No. H-B01 | IC |
| Ammonia | Personal Pump No. B56, B58 Rotameter No. L-B01 | IC |
| Benzene | Personal Pump No. B21 Rotameter No. L-B01 | GC/FID |
| Toluene | Personal Pump No. B21 Rotameter No. L-B01 | GC/FID |
| Xylene | Personal Pump No. B21 Rotameter No. L-B01 | GC/FID |
| Thinners as Methanol | Personal Pump No. B37 Rotameter No. L-B01 | GC/FID |

เอกสารแนบ 5-1

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศบริเวณชุมชน




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

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|--------------------------------|--------------------------------|-------|
| SO ₂ FLUORESCENT ANALYZER | | | | | |
| DATE : | 20 August 2025 | BRAND : | API | MODEL : | 100A |
| NO. | SO ₂ -802 | SERIAL NO. | 1847 | | |
| Calibrator (Dilution System) | | | | | |
| Brand : Teledyne | | | Model : 700 | | |
| Last Cal. Date : 29 October 2024 | | | Serial No. : 421 | | |
| Reference Standard Gas | | | | | |
| Standard Gas : Sulphur Dioxide (SO ₂) | | | Cylinder No. : A00814SK | | |
| Certified Date : 21 June 2021 | | | Cylinder Conc. : 49.8 ppm | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.6 | °C |
| | | % 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 | 400.1 | 0.025 | 400.0 | 1.010 |
| API Model 100A SO ₂ Analyzer Check list | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 0-500 | | |
| SAMPLE PRESS | 28.5 | in-Hg | 25-35 | | |
| SAMPLE FLOW | 658 | cc/min | 650 ± 10% | | |
| PMT | 103.1 | mV | -20-150 with Zero Air | | |
| UV LAMP | 3018.6 | mV | 1000-4900 | | |
| STR. LGT | 61.4 | PPB | <100 | | |
| DRK PMT | 62.9 | mV | -50 - 200 | | |
| DRK LMP | 57.6 | mV | -50 - 200 | | |
| HVPS | 671 | V | 550-900 constant | | |
| DCPS | 2523 | mV | 2500 ± 200 | | |
| RCELL TEMP | 50.2 | °C | 50 ± 1 | | |
| BOX TEMP | 29.4 | °C | 5-40 | | |
| PMT TEMP | 7.3 | °C | 7 ± 2.0 | | |
| SO ₂ Span Conc | 400 | PPB | 20-20,000 | | |
| SO ₂ Slope | 1.010 | - | 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)




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

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|--------------------------------|--------------------------------|-------|
| SO ₂ FLUORESCENT ANALYZER | | | | | |
| DATE : | 20 August 2025 | BRAND : | API | MODEL : | 100E |
| NO. | SO ₂ -805 | SERIAL NO. | 3270 | | |
| Calibrator (Dilution System) | | | | | |
| Brand : Teledyne | | | Model : 700 | | |
| Last Cal. Date : 29 October 2024 | | | Serial No. : 421 | | |
| Reference Standard Gas | | | | | |
| Standard Gas : Sulphur Dioxide (SO ₂) | | | Cylinder No. : A00814SK | | |
| Certified Date : 21 June 2021 | | | Cylinder Conc. : 49.8 ppm | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 | mmbar | Temp. | 24.6 | °C |
| | | % 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 | 399.6 | -0.100 | 400.0 | 1.005 |
| API Model 100E SO ₂ Analyzer Check list | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 0-500 | | |
| SAMPLE PRESS | 28.7 | in-Hg | 25-35 | | |
| SAMPLE FLOW | 660 | cc/min | 650 ± 10% | | |
| PMT | 103.3 | mV | -20-150 with Zero Air | | |
| UV LAMP | 3039.8 | mV | 1000-4900 | | |
| STR. LGT | 61.8 | PPB | <100 | | |
| DRK PMT | 63.4 | mV | -50 - 200 | | |
| DRK LMP | 58.2 | mV | -50 - 200 | | |
| HVPS | 672 | V | 550-900 constant | | |
| DCPS | 2517 | mV | 2500 ± 200 | | |
| RCELL TEMP | 50.3 | °C | 50 ± 1 | | |
| BOX TEMP | 29.2 | °C | 5-40 | | |
| PMT TEMP | 7.1 | °C | 7 ± 2.0 | | |
| SO ₂ Span Conc | 400 | PPB | 20-20,000 | | |
| SO ₂ Slope | 1.005 | - | 1.0 ± 0.3 | | |
| SO ₂ Offset | 21.8 | mV | <250 | | |
| Stability at Zero | 0.1 | PPB | <0.2 | | |
| Stability at Span | 0.2 | PPB | 0.5% of reading (above 50 ppb) | | |

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :


(Mr.Peera Detudom)



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

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|------------------------|--------------------------------|--------------------------------|-------|
| SO ₂ FLUORESCENT ANALYZER | | | | | |
| DATE : | 20 August 2025 | BRAND : | API | MODEL : | 100A |
| NO. | SO ₂ -808 | SERIAL NO. | 1003 | | |
| Calibrator (Dilution System) | | | | | |
| Brand : Teledyne | | | Model : 700 | | |
| Last Cal. Date : 29 October 2024 | | | Serial No. : 421 | | |
| Reference Standard Gas | | | | | |
| Standard Gas : Sulphur Dioxide (SO ₂) | | | Cylinder No. : A00814SK | | |
| Certified Date : 21 June 2021 | | | Expired Date : 21 June 2029 | | |
| | | | Cylinder Conc. : 49.8 ppm | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 mmbar | Temp. | 24.6 °C | % RH | 50 |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| | Set Point | Expected Concentration | Analyzer Response | %Dif | Slope |
| Zero | 0 | 0.11 | - | 0 | - |
| SO ₂ Span | 400.0 | 400.2 | 0.050 | 400.0 | 1.012 |
| API Model 100A SO ₂ Analyzer Check list | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 0-500 | | |
| SAMPLE PRESS | 28.6 | in-Hg | 25-35 | | |
| SAMPLE FLOW | 657 | cc/min | 650 ± 10% | | |
| PMT | 103.2 | mV | -20-150 with Zero Air | | |
| UV LAMP | 3027.3 | mV | 1000-4900 | | |
| STR. LGT | 61.5 | PPB | <100 | | |
| DRK PMT | 63.0 | mV | -50 - 200 | | |
| DRK LMP | 57.8 | mV | -50 - 200 | | |
| HVPS | 674 | V | 550-900 constant | | |
| DCPS | 2525 | mV | 2500 ± 200 | | |
| RCELL TEMP | 50.4 | °C | 50 ± 1 | | |
| BOX TEMP | 29.1 | °C | 5-40 | | |
| PMT TEMP | 7.2 | °C | 7 ± 2.0 | | |
| SO ₂ Span Conc | 400 | PPB | 20-20,000 | | |
| SO ₂ Slope | 1.012 | - | 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 : (Signature)
(Mr.Peera Detudom)



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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

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|------------------------|--------------------------------|--------------------------------|-------|
| SO ₂ FLUORESCENT ANALYZER | | | | | |
| DATE : | 20 August 2025 | BRAND : | API | MODEL : | 100E |
| NO. | SO ₂ -R01 | SERIAL NO. | 3415 | | |
| Calibrator (Dilution System) | | | | | |
| Brand : Teledyne | | | Model : 700 | | |
| Last Cal. Date : 29 October 2024 | | | Serial No. : 421 | | |
| Reference Standard Gas | | | | | |
| Standard Gas : Sulphur Dioxide (SO ₂) | | | Cylinder No. : A00814SK | | |
| Certified Date : 21 June 2021 | | | Expired Date : 21 June 2029 | | |
| | | | Cylinder Conc. : 49.8 ppm | | |
| CALIBRATING CONDITION | | | | | |
| Pressure | 1011 mmbar | Temp. | 24.6 °C | % RH | 50 |
| CALIBRATION SETTING | | | | | |
| Span | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| | Set Point | Expected Concentration | Analyzer Response | %Dif | Slope |
| Zero | 0 | 0.10 | - | 0 | - |
| SO ₂ Span | 400.0 | 399.8 | -0.050 | 400.0 | 1.008 |
| API Model 100E SO ₂ Analyzer Check list | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 0-500 | | |
| SAMPLE PRESS | 28.4 | in-Hg | 25-35 | | |
| SAMPLE FLOW | 653 | cc/min | 650 ± 10% | | |
| PMT | 102.9 | mV | -20-150 with Zero Air | | |
| UV LAMP | 3010.5 | mV | 1000-4900 | | |
| STR. LGT | 61.7 | PPB | <100 | | |
| DRK PMT | 63.3 | mV | -50 - 200 | | |
| DRK LMP | 58.1 | mV | -50 - 200 | | |
| HVPS | 675 | V | 550-900 constant | | |
| DCPS | 2518 | mV | 2500 ± 200 | | |
| RCELL TEMP | 50.1 | °C | 50 ± 1 | | |
| BOX TEMP | 29.3 | °C | 5-40 | | |
| PMT TEMP | 7.0 | °C | 7 ± 2.0 | | |
| SO ₂ Span Conc | 400 | PPB | 20-20,000 | | |
| SO ₂ Slope | 1.008 | - | 1.0 ± 0.3 | | |
| SO ₂ Offset | 22.2 | mV | <250 | | |
| Stability at Zero | 0.1 | PPB | <0.2 | | |
| Stability at Span | 0.2 | PPB | 0.5% of reading (above 50 ppb) | | |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

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

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|--------------------------------|--------------------------------|-------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 20 August 2025 | BRAND : | API | MODEL : | 200E |
| NO. | NOX-B11 | SERIAL NO. | 4467 | | |
| Calibrator (Dilution System) | | | | | |
| Brand : Teledyne | | | Model : 700 | | |
| Last Cal. Date : 29 October 2024 | | | Serial No. : 421 | | |
| 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 | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | 0.10 | - | 0 | - |
| NO Span | 400 | 400.1 | 0.025 | 400.0 | 1.009 |
| NO _x Span | 400 | 400.2 | 0.050 | 400.0 | 1.013 |
| API Model 200E NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 512 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 79 | cc/min | 80 ± 15 | | |
| PMT | 103.1 | mV | -20 - 150 | | |
| AZERO | 93.7 | mV | -20 - 150 | | |
| HVPS | 674 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.1 | °C | 50 ± 1 | | |
| BOX TEMP | 29.0 | °C | 8 - 48 | | |
| PMT TEMP | 7.2 | °C | 7 ± 2 | | |
| MOLY TEMP | 315.3 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.2 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.4 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.009 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.013 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.7 | mV | -20 to +150 | | |
| NO _x Offset | 1.0 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|--------------------------------|--------------------------------|---------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 20 August 2025 | BRAND : | API | MODEL : | TML-41M |
| NO. | NOX-B18 | SERIAL NO. | N07543 | | |
| Calibrator (Dilution System) | | | | | |
| Brand : Teledyne | | | Model : 700 | | |
| Last Cal. Date : 29 October 2024 | | | Serial No. : 421 | | |
| 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 | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | -0.10 | - | 0 | - |
| NO Span | 400 | 399.6 | -0.100 | 400.0 | 1.004 |
| NO _x Span | 400 | 399.8 | -0.050 | 400.0 | 1.007 |
| API Model TML-41M 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 | 103.2 | mV | -20 - 150 | | |
| AZERO | 93.8 | 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 | 7.0 | °C | 7 ± 2 | | |
| MOLY TEMP | 315.1 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.3 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.5 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.004 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.007 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.1 | mV | -20 to +150 | | |
| NO _x Offset | 0.6 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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



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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 : | 20 August 2025 | BRAND : | API | MODEL : | 200E |
| NO. | NOX-B19 | SERIAL NO. | 353 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | Teledyne | | Model | 700 | |
| Last Cal. Date | 29 October 2024 | | Serial No. | 421 | |
| 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 | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | -0.10 | - | 0 | - |
| NO Span | 400 | 399.7 | -0.075 | 400.0 | 1.005 |
| NO _x Span | 400 | 400.1 | 0.025 | 400.0 | 1.009 |
| API Model 200E NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 505 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 78 | cc/min | 80 ± 15 | | |
| PMT | 103.4 | mV | -20 - 150 | | |
| AZERO | 94.2 | mV | -20 - 150 | | |
| HVPS | 675 | V | 420 - 900 constant | | |
| RCCELL TEMP | 50.0 | °C | 50 ± 1 | | |
| BOX TEMP | 28.9 | °C | 8 - 48 | | |
| PMT TEMP | 7.1 | °C | 7 ± 2 | | |
| MOLY TEMP | 314.7 | °C | 315 ± 5 | | |
| RCCELL PRESS | 8.4 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.6 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.005 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.009 | - | 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 Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|-------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 20 August 2025 | BRAND : | API | MODEL : | 200E |
| NO. | NOX-R09 | SERIAL NO. | 252 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | Teledyne | | Model | 700 | |
| Last Cal. Date | 29 October 2024 | | Serial No. | 421 | |
| 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 | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | 0.10 | - | 0 | - |
| NO Span | 400 | 399.9 | -0.025 | 400.0 | 1.008 |
| NO _x Span | 400 | 400.2 | 0.050 | 400.0 | 1.012 |
| API Model 200E NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 508 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 78 | cc/min | 80 ± 15 | | |
| PMT | 103.0 | mV | -20 - 150 | | |
| AZERO | 93.6 | mV | -20 - 150 | | |
| HVPS | 672 | V | 420 - 900 constant | | |
| RCCELL TEMP | 50.4 | °C | 50 ± 1 | | |
| BOX TEMP | 29.2 | °C | 8 - 48 | | |
| PMT TEMP | 7.3 | °C | 7 ± 2 | | |
| MOLY TEMP | 314.9 | °C | 315 ± 5 | | |
| RCCELL PRESS | 8.5 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.7 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _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 | 1.6 | mV | -20 to +150 | | |
| NO _x Offset | 1.0 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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Tel : (662) 939-4370-72 Fax : (662) 513-4321 E-mail : sales@spscon.com www.spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3440

Calibration Data

| High Volume Air Sampler Data | | Calibration Data | | |
|------------------------------|------------|------------------|--|----------------|
| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
| B01 | B01 | 01/08/2025 | y = 1.099x-3.517 | 0.999 |
| B02 | B02 | 01/08/2025 | y = 1.142x-3.995 | 0.999 |
| B03 | B03 | 01/08/2025 | y = 1.127x-5.756 | 0.997 |
| B04 | B04 | 01/08/2025 | y = 1.137x-4.695 | 0.999 |
| B05 | B05 | 01/08/2025 | y = 1.128x-5.472 | 0.999 |
| B06 | B06 | 01/08/2025 | y = 1.177x-5.925 | 0.996 |
| B07 | B07 | 01/08/2025 | y = 1.147x-5.407 | 0.999 |
| B08 | B08 | 01/08/2025 | y = 1.152x-6.011 | 0.997 |
| B09 | B09 | 01/08/2025 | y = 1.132x-4.325 | 0.998 |
| B10 | B10 | 07/08/2025 | y = 1.123x-5.255 | 0.998 |
| B11 | B11 | 01/08/2025 | y = 1.131x-3.867 | 0.997 |
| B12 | B12 | 01/08/2025 | y = 1.128x-2.501 | 0.997 |
| B13 | B13 | 01/08/2025 | y = 1.162x-4.037 | 0.996 |
| B14 | B14 | 01/08/2025 | y = 1.144x-4.295 | 0.997 |
| B15 | B15 | 01/08/2025 | y = 1.101x-3.061 | 0.998 |
| B16 | B16 | 07/08/2025 | y = 1.039x-1.195 | 0.999 |
| B17 | B17 | 01/08/2025 | y = 1.056x+0.573 | 0.998 |
| B18 | B18 | 01/08/2025 | y = 1.176x-6.349 | 0.998 |
| B19 | B19 | 01/08/2025 | y = 1.150x-4.805 | 0.996 |
| B20 | B20 | 04/08/2025 | y = 1.043x+2.427 | 0.999 |
| B21 | B21 | 01/08/2025 | y = 1.064x+0.460 | 0.997 |
| B22 | B22 | 01/08/2025 | y = 1.146x-4.084 | 0.998 |
| B23 | B23 | 01/08/2025 | y = 1.118x-2.441 | 0.999 |
| B24 | B24 | 01/08/2025 | y = 1.085x-1.292 | 0.999 |
| B25 | B25 | 01/08/2025 | y = 1.074x+0.323 | 0.999 |
| B26 | B26 | 04/08/2025 | y = 1.098x-3.782 | 0.997 |
| B27 | B27 | 01/08/2025 | y = 1.173x-7.561 | 0.997 |
| B28 | B28 | 01/08/2025 | y = 1.128x-5.410 | 0.998 |
| B29 | B29 | 01/08/2025 | y = 1.134x-3.750 | 0.998 |
| B30 | B30 | 01/08/2025 | y = 1.050x+1.266 | 0.999 |
| B31 | B31 | 04/08/2025 | y = 1.166x-5.291 | 0.999 |
| B32 | B32 | 01/08/2025 | y = 1.159x-4.739 | 0.996 |
| B33 | B33 | 01/08/2025 | y = 1.173x-5.447 | 0.997 |
| B34 | B34 | 01/08/2025 | y = 1.148x-4.099 | 0.999 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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S.P.S. CONSULTING SERVICE CO., LTD.
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Tel : (662) 939-4370-72 Fax : (662) 513-4321 E-mail : sales@spscon.com www.spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3440

Calibration Data

| High Volume Air Sampler Data | | Calibration Data | | |
|------------------------------|------------|------------------|--|----------------|
| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
| B35 | B35 | 01/08/2025 | y = 1.126x-2.314 | 0.997 |
| B36 | B36 | 01/08/2025 | y = 1.158x-3.625 | 0.999 |
| B37 | B37 | 01/08/2025 | y = 1.071x-0.714 | 0.998 |
| B38 | B38 | 07/08/2025 | y = 1.138x-6.470 | 0.999 |
| B39 | B39 | 07/08/2025 | y = 1.074x-2.233 | 0.999 |
| B40 | B40 | 01/08/2025 | y = 1.137x-4.281 | 0.998 |
| B41 | B41 | 01/08/2025 | y = 1.124x-3.061 | 0.999 |
| B42 | B42 | 01/08/2025 | y = 1.130x-3.831 | 0.998 |
| B43 | B43 | 04/08/2025 | y = 1.098x-1.647 | 0.999 |
| B44 | B44 | 07/08/2025 | y = 1.107x-2.029 | 0.997 |
| R01 | R01 | 01/08/2025 | y = 1.027x+1.685 | 0.998 |
| R02 | R02 | 01/08/2025 | y = 1.154x-5.444 | 0.998 |
| R03 | R03 | 01/08/2025 | y = 1.174x-5.934 | 0.999 |
| R04 | R04 | 04/08/2025 | y = 1.125x-3.465 | 0.997 |
| R05 | R05 | 01/08/2025 | y = 1.097x+0.437 | 0.999 |
| R06 | R06 | 04/08/2025 | y = 1.138x-2.560 | 0.997 |
| R07 | R07 | 01/08/2025 | y = 1.046x-0.699 | 0.999 |
| R08 | R08 | 01/08/2025 | y = 1.109x-3.582 | 0.997 |
| R09 | R09 | 01/08/2025 | y = 1.088x-1.852 | 0.999 |
| R10 | R10 | 01/08/2025 | y = 1.134x-4.535 | 0.996 |
| R11 | R11 | 01/08/2025 | y = 1.170x-6.929 | 0.998 |
| R12 | R12 | 01/08/2025 | y = 1.151x-4.183 | 0.999 |
| R13 | R13 | 01/08/2025 | y = 1.117x-4.198 | 0.999 |
| R14 | R14 | 01/08/2025 | y = 1.109x-2.662 | 0.998 |
| R15 | R15 | 01/08/2025 | y = 1.126x-5.806 | 0.996 |
| R16 | R16 | 01/08/2025 | y = 1.149x-7.086 | 0.996 |
| R17 | R17 | 01/08/2025 | y = 1.120x-5.050 | 0.997 |
| R18 | R18 | 04/08/2025 | y = 1.155x-5.737 | 0.997 |
| R19 | R19 | 04/08/2025 | y = 1.131x-5.715 | 0.997 |
| R20 | R20 | 01/08/2025 | y = 1.152x-5.912 | 0.996 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ซอยพหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompru, Chulachak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sales@spscn.com, www.spscn.com

High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3440

Calibration Data

High Volume PM-10 Data

Calibration Data

| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
|--------------|------------|------------|--|----------------|
| B01 | B01 | 01/08/2025 | y = 1.114x-2.914 | 0.997 |
| B02 | B02 | 07/08/2025 | y = 1.013x+1.223 | 0.998 |
| B03 | B03 | 01/08/2025 | y = 1.161x-6.637 | 0.997 |
| B04 | B04 | 01/08/2025 | y = 1.104x-4.741 | 0.999 |
| B05 | B05 | 01/08/2025 | y = 1.139x-4.983 | 0.999 |
| B06 | B06 | 07/08/2025 | y = 1.115x-4.334 | 0.997 |
| B07 | B07 | 01/08/2025 | y = 1.134x-5.274 | 0.999 |
| B08 | B08 | 07/08/2025 | y = 1.118x-2.369 | 0.999 |
| B09 | B09 | 01/08/2025 | y = 1.043x-0.834 | 0.999 |
| B10 | B10 | 01/08/2025 | y = 1.096x-2.892 | 0.998 |
| B11 | B11 | 01/08/2025 | y = 1.114x-3.605 | 0.997 |
| B12 | B12 | 06/08/2025 | y = 1.096x-2.892 | 0.998 |
| B13 | B13 | 04/08/2025 | y = 1.112x-4.752 | 0.996 |
| B14 | B14 | 01/08/2025 | y = 1.104x-3.418 | 0.997 |
| B15 | B15 | 01/08/2025 | y = 1.119x-2.509 | 0.996 |
| B16 | B16 | 01/08/2025 | y = 1.012x+1.776 | 0.996 |
| B17 | B17 | 04/08/2025 | y = 1.094x-0.874 | 0.999 |
| B18 | B18 | 07/08/2025 | y = 1.140x-5.779 | 0.997 |
| B19 | B19 | 04/08/2025 | y = 1.087x-0.543 | 0.999 |
| B20 | B20 | 01/08/2025 | y = 1.108x-3.582 | 0.997 |
| B21 | B21 | 01/08/2025 | y = 1.138x-4.442 | 0.996 |
| B22 | B22 | 01/08/2025 | y = 1.097x-3.833 | 0.999 |
| B23 | B23 | 01/08/2025 | y = 1.127x-4.713 | 0.999 |
| B24 | B24 | 01/08/2025 | y = 1.117x-4.019 | 0.999 |
| B25 | B25 | 01/08/2025 | y = 1.137x-5.745 | 0.996 |
| B26 | B26 | 01/08/2025 | y = 1.029x-0.023 | 0.998 |
| B27 | B27 | 01/08/2025 | y = 1.136x-6.732 | 0.996 |
| B28 | B28 | 01/08/2025 | y = 1.114x-4.531 | 0.999 |
| B29 | B29 | 01/08/2025 | y = 1.126x-5.420 | 0.999 |
| B30 | B30 | 01/08/2025 | y = 1.119x-4.736 | 0.998 |
| B31 | B31 | 01/08/2025 | y = 1.011x+2.394 | 0.998 |
| B32 | B32 | 01/08/2025 | y = 1.047x-0.534 | 0.999 |
| B33 | B33 | 01/08/2025 | y = 1.052x-0.474 | 0.998 |
| B34 | B34 | 07/08/2025 | y = 1.028x+2.008 | 0.997 |

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sales@spscn.com, www.spscn.com

High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3440

Calibration Data

High Volume PM-10 Data

Calibration Data

| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
|--------------|------------|------------|--|----------------|
| R01 | R01 | 01/08/2025 | y = 1.104x-5.304 | 0.998 |
| R02 | R02 | 01/08/2025 | y = 1.064x-2.883 | 0.998 |
| R03 | R03 | 01/08/2025 | y = 1.108x-4.353 | 0.999 |
| R04 | R04 | 01/08/2025 | y = 1.101x-5.579 | 0.998 |
| R05 | R05 | 01/08/2025 | y = 1.119x-5.074 | 0.996 |
| R06 | R06 | 04/08/2025 | y = 1.127x-3.817 | 0.998 |
| R07 | R07 | 04/08/2025 | y = 1.037x+1.136 | 0.998 |
| R08 | R08 | 01/08/2025 | y = 1.042x+0.842 | 0.998 |
| R09 | R09 | 01/08/2025 | y = 1.083x-2.007 | 0.997 |
| R10 | R10 | 01/08/2025 | y = 1.041x-0.474 | 0.997 |
| R11 | R11 | 01/08/2025 | y = 1.085x-1.404 | 0.997 |
| R12 | R12 | 01/08/2025 | y = 1.062x-1.485 | 0.997 |
| R13 | R13 | 01/08/2025 | y = 1.075x-2.468 | 0.999 |
| R14 | R14 | 01/08/2025 | y = 1.017x+0.519 | 0.999 |
| R15 | R15 | 01/08/2025 | y = 1.138x-6.436 | 0.998 |
| R16 | R16 | 04/08/2025 | y = 1.051x+0.908 | 0.999 |
| R17 | R17 | 04/08/2025 | y = 1.114x-4.329 | 0.998 |
| R18 | R18 | 01/08/2025 | y = 1.098x-5.423 | 0.998 |
| R19 | R19 | 01/08/2025 | y = 1.113x-2.373 | 0.997 |
| R20 | R20 | 01/08/2025 | y = 1.105x-4.058 | 0.998 |

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 07-Mar-25

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

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

F-G010 REV 03



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 07-Mar-25
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 07-Mar-25
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 54%RH \pm 10%RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

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

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm g) |
|-------------------|---------------------|----------------|------------------------|
| 0.00 | 0.00000 | 0.00000 | 0.000065 |
| 0.02 | 0.01999 | 0.00001 | 0.000065 |
| 0.10 | 0.10001 | -0.00001 | 0.000066 |
| 0.20 | 0.20001 | -0.00001 | 0.000066 |
| 0.50 | 0.50002 | -0.00002 | 0.000065 |
| 1.00 | 1.00003 | -0.00003 | 0.000066 |
| 2.00 | 2.00001 | -0.00001 | 0.000067 |
| 5.00 | 5.00002 | -0.00002 | 0.000068 |
| 10.00 | 10.00000 | 0.00000 | 0.000070 |
| 20.00 | 20.00004 | -0.00004 | 0.000078 |
| 50.00 | 50.00000 | 0.00000 | 0.00013 |
| 100.00 | 100.0001 | -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



F-G010 REV 03



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|-------------------|----------------------------------|---------------------------------------|---------------------|
| Customer : | S.P.S.Consulting Service Co.,Ltd | Date Tested: | July 1, 2025 |
| | | Recommendation Recertification | |
| Address : | 7 Soi Phaholyothin 24 | Period | 6 Months |
| | Paholyothin Road | Recertification Due: | January 1, 2026 |
| | Jompoi Chatuchak, Bangkok 1090 | Date Last Certified: | January 6, 2025 |
| User Name: | K.Phenpha Viphashtawat | Visit Number: | 1of 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, 2024 |
| Wavecal Solution | N058-2152 | March 30, 2024 |
| VIS Wavecal solution | N930-2946 | February 28, 2024 |
| Instrument Cal. STD4 | N930-0221 | November 30, 2024 |
| CUSTOMER SUPPLIED | COMMENTS | CUSTOMER INITIALS |
| 2 % HNO3 | | |
| 10 % HNO3 | | |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| SERIAL NUMBER : <u>077C7042401</u> | | DATE TESTED : <u>July 1, 2025</u> | |
|------------------------------------|---------------|-----------------------------------|-------------|
| PARAMETER | SPECIFICATION | | FINAL VALUE |
| Spectral Resolution : UV | As 193.696 nm | ≤ 0.007 | 0.00570 |
| | Ni 231.604 nm | ≤ 0.008 | 0.00734 |
| | Ni 341.476 nm | ≤ 0.012 | 0.00763 |
| Spectral Resolution : VIS | La 408.672 nm | ≤ 0.020 | 0.01627 |
| | Ba 455.403 nm | ≤ 0.025 | 0.02428 |
| Precision | As 193.656 nm | % RSD < 1.0 | 0.82 % |
| | Zn 213.856 nm | % RSD < 1.0 | 0.83 % |
| | Mn 257.610 nm | % RSD < 1.0 | 0.20 % |
| | La 379.478 nm | % RSD < 1.0 | 0.89 % |
| | Ba 455.403 nm | % RSD < 1.0 | 0.92 % |
| | Ba 493.408 nm | % RSD < 1.0 | 0.75 % |
| 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) | 331.50 ppb |
| | Zn 213.856 nm | 3(sd) | 0.98 ppb |
| | Mn 257.610 nm | 3(sd) | 0.34 ppb |
| | La 379.478 nm | 3(sd) | 2.54 ppb |
| | Ba 455.403 nm | 3(sd) | 2.19 ppb |
| | Ba 493.408 nm | 3(sd) | 4.32 ppb |
| BEC : Axial (IB X 500)/(IS-IB) | Cd 226.502 nm | ≤ 150 ppb | 140.03 |
| BEC : Radial (IB X 1000)/(IS-IB) | Mn 257.610 nm | ≤ 45 ppb | 24.17 |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|---------------|--------------------|-------------|---------------------|
| SERIAL NUMBER | <u>077C7042401</u> | DATE TESTED | <u>July 1, 2025</u> |
|---------------|--------------------|-------------|---------------------|

Remarks :

Commissioning follow as commissioning performance sheets.

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

☒ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative: *Wiphan Promlumda*

(Wiphan Promlumda)

Service Engineer

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | |
|-------------------|---|---------------------------------------|--------------------------|
| Customer : | <u>S.P.S.Consulting Service Co.,Ltd</u> | Date Tested: | <u>July 1, 2025</u> |
| | | Recommendation Recertification | |
| Address : | <u>7 Soi Phaholyothin 24</u> <u>Paholyothin Road</u> <u>Jompol Chatuchak, Bangkok 10900</u> | Period | <u>6</u> Months |
| | | Recertification Due: | <u>January 1, 2026</u> |
| | | Date Last Certified: | <u>January 6, 2025</u> |
| User Name: | <u>K.Phenpha Viphasthawat</u> | Visit Number: | <u>1 of 2</u> |
| Phone: | <u>083-9269252</u> | PerkinElmer Phone: | <u>02-719-6420 ext 8</u> |
| Fax: | <u>02-513-4221</u> | PerkinElmer Fax: | <u>02-318-5597</u> |

| CONFIGURATION TESTED | | |
|----------------------|---------------|-----------------------|
| MODEL | SERIAL NUMBER | SOFTWARE |
| FIAS 100 | 100S14090404 | Syngistix version 7.3 |
| | | |
| | | |
| | | |
| | | |
| | | |
| TEST STANDARD USED | PART NUMBER | EXPIRATION DATE |
| Mercury (Hg) Std | N9300174 | JUN 30, 2026 |
| | | |
| | | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | |
|--|--------------------|---------------------|
| SERIAL NUMBER <u>100S14090404</u> | DATE TESTED | <u>July 1, 2025</u> |
|--|--------------------|---------------------|

1. INSTRUMENT CHECKS

| | |
|---|---|
| A. The light part, quartz windows and detector. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect the mercury lamp. Alignment if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect the mercury filter. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect and clean or replace the dust filter. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| E. Inspect peristaltic pump tubes. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

2. ELECTRONICS CHECKS

| | | |
|------------------------------|-------------------|-------|
| A. Electronic power supplies | | |
| + 5 Volts (\pm 0.3) | <u> </u> | Volts |
| + 15 Volts (\pm 1.0) | <u> </u> | Volts |
| - 15 Volts (\pm 1.0) | <u> </u> | Volts |
| + 40 Volts (\pm 1.0) | <u> </u> | Volts |

3. GAS SYSTEM CHECK

| | |
|---|---|
| A. Leak test all internal and external gas box joints. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect solenoid valve and pressure switch. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect non return valve. Replace sleeve if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect flow meter and needle valve. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

4. MECHANICAL CHECKS

| | |
|---|---|
| A. Inspect pump motor and pump roller. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect and clean switching valve. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect, clean and lubricant autosample. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

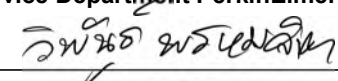
FIAS 100

| | | | | | |
|---|-----------------|---------------|---------------|------------------|--|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| PARAMETER | | | SPECIFICATION | ACTUAL VALUE | |
| 5. PERFORMANCE TEST | | | | | |
| A. Baseline Noise Test | | | | | |
| (measure peak area at 10 replicates without any sample) | | | | | |
| | SD | ≤ 0.0015 A*s | | 0.0025 A*s | |
| B. Sensitivity Check | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | Mean Absorbance | ≥ 0.0800 Abs. | | 0.1201 Abs. | |
| C. Characteristic mass(m_0) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | m_0 | ≤ 314 pg | | 183.2 pg/0.0044A | |
| D. Precision Check (%RSD) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | %RSD | ≤ 2.5 % | | 1.65 % | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | | | |
|--|--------------|--|-------------|--------------|--|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| Remarks : | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| This is to certify that the above tests have been performed and the configuration tested | | | | | |
| <input checked="" type="checkbox"/> meets | | | | | |
| <input type="checkbox"/> does not meet | | | | | |
| the PerkinElmer Specifications listed on this certificate. | | | | | |
| This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms. | | | | | |
| Service Department PerkinElmer Ltd. | | | | | |
| Customer Service Engineer:  | | | | | |
| (Wiphan Promlumda) | | | | | |
| Service Engineer | | | | | |

เอกสารแนบ 5-2

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพอากาศในบรรยากาศ
บริเวณอุตสาหกรรมบางปู



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพมหานคร 10900
Tel : (662) 939-0370-72 Fax : (662) 513-4321 E-mail : sales@spscon.com www.spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3440

Calibration Data

| High Volume Air Sampler Data | | Calibration Data | | |
|------------------------------|------------|------------------|--|----------------|
| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
| B01 | B01 | 01/08/2025 | y = 1.099x-3.517 | 0.999 |
| B02 | B02 | 01/08/2025 | y = 1.142x-3.995 | 0.999 |
| B03 | B03 | 01/08/2025 | y = 1.127x-5.756 | 0.997 |
| B04 | B04 | 01/08/2025 | y = 1.137x-4.695 | 0.999 |
| B05 | B05 | 01/08/2025 | y = 1.128x-5.472 | 0.999 |
| B06 | B06 | 01/08/2025 | y = 1.177x-5.925 | 0.996 |
| B07 | B07 | 01/08/2025 | y = 1.147x-5.407 | 0.999 |
| B08 | B08 | 01/08/2025 | y = 1.152x-6.011 | 0.997 |
| B09 | B09 | 01/08/2025 | y = 1.132x-4.325 | 0.998 |
| B10 | B10 | 07/08/2025 | y = 1.123x-5.255 | 0.998 |
| B11 | B11 | 01/08/2025 | y = 1.131x-3.867 | 0.997 |
| B12 | B12 | 01/08/2025 | y = 1.128x-2.501 | 0.997 |
| B13 | B13 | 01/08/2025 | y = 1.162x-4.037 | 0.996 |
| B14 | B14 | 01/08/2025 | y = 1.144x-4.295 | 0.997 |
| B15 | B15 | 01/08/2025 | y = 1.101x-3.061 | 0.998 |
| B16 | B16 | 07/08/2025 | y = 1.039x-1.195 | 0.999 |
| B17 | B17 | 01/08/2025 | y = 1.056x+0.573 | 0.998 |
| B18 | B18 | 01/08/2025 | y = 1.176x-6.349 | 0.998 |
| B19 | B19 | 01/08/2025 | y = 1.150x-4.805 | 0.996 |
| B20 | B20 | 04/08/2025 | y = 1.043x+2.427 | 0.999 |
| B21 | B21 | 01/08/2025 | y = 1.064x+0.460 | 0.997 |
| B22 | B22 | 01/08/2025 | y = 1.146x-4.084 | 0.998 |
| B23 | B23 | 01/08/2025 | y = 1.118x-2.441 | 0.999 |
| B24 | B24 | 01/08/2025 | y = 1.085x-1.292 | 0.999 |
| B25 | B25 | 01/08/2025 | y = 1.074x+0.323 | 0.999 |
| B26 | B26 | 04/08/2025 | y = 1.098x-3.782 | 0.997 |
| B27 | B27 | 01/08/2025 | y = 1.173x-7.561 | 0.997 |
| B28 | B28 | 01/08/2025 | y = 1.128x-5.410 | 0.998 |
| B29 | B29 | 01/08/2025 | y = 1.134x-3.750 | 0.998 |
| B30 | B30 | 01/08/2025 | y = 1.050x+1.266 | 0.999 |
| B31 | B31 | 04/08/2025 | y = 1.166x-5.291 | 0.999 |
| B32 | B32 | 01/08/2025 | y = 1.159x-4.739 | 0.996 |
| B33 | B33 | 01/08/2025 | y = 1.173x-5.447 | 0.997 |
| B34 | B34 | 01/08/2025 | y = 1.148x-4.099 | 0.999 |

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Tel : (662) 939-0370-72 Fax : (662) 513-4321 E-mail : sales@spscon.com www.spscon.com

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard Model : TE 5025A S/N : 3440

Calibration Data

| High Volume Air Sampler Data | | Calibration Data | | |
|------------------------------|------------|------------------|--|----------------|
| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
| B35 | B35 | 01/08/2025 | y = 1.126x-2.314 | 0.997 |
| B36 | B36 | 01/08/2025 | y = 1.158x-3.625 | 0.999 |
| B37 | B37 | 01/08/2025 | y = 1.071x-0.714 | 0.998 |
| B38 | B38 | 07/08/2025 | y = 1.138x-6.470 | 0.999 |
| B39 | B39 | 07/08/2025 | y = 1.074x-2.233 | 0.999 |
| B40 | B40 | 01/08/2025 | y = 1.137x-4.281 | 0.998 |
| B41 | B41 | 01/08/2025 | y = 1.124x-3.061 | 0.999 |
| B42 | B42 | 01/08/2025 | y = 1.130x-3.831 | 0.998 |
| B43 | B43 | 04/08/2025 | y = 1.098x-1.647 | 0.999 |
| B44 | B44 | 07/08/2025 | y = 1.107x-2.029 | 0.997 |
| R01 | R01 | 01/08/2025 | y = 1.027x+1.685 | 0.998 |
| R02 | R02 | 01/08/2025 | y = 1.154x-5.444 | 0.998 |
| R03 | R03 | 01/08/2025 | y = 1.174x-5.934 | 0.999 |
| R04 | R04 | 04/08/2025 | y = 1.125x-3.465 | 0.997 |
| R05 | R05 | 01/08/2025 | y = 1.097x+0.437 | 0.999 |
| R06 | R06 | 04/08/2025 | y = 1.138x-2.560 | 0.997 |
| R07 | R07 | 01/08/2025 | y = 1.046x-0.699 | 0.999 |
| R08 | R08 | 01/08/2025 | y = 1.109x-3.582 | 0.997 |
| R09 | R09 | 01/08/2025 | y = 1.088x-1.852 | 0.999 |
| R10 | R10 | 01/08/2025 | y = 1.134x-4.535 | 0.996 |
| R11 | R11 | 01/08/2025 | y = 1.170x-6.929 | 0.998 |
| R12 | R12 | 01/08/2025 | y = 1.151x-4.183 | 0.999 |
| R13 | R13 | 01/08/2025 | y = 1.117x-4.198 | 0.999 |
| R14 | R14 | 01/08/2025 | y = 1.109x-2.662 | 0.998 |
| R15 | R15 | 01/08/2025 | y = 1.126x-5.806 | 0.996 |
| R16 | R16 | 01/08/2025 | y = 1.149x-7.086 | 0.996 |
| R17 | R17 | 01/08/2025 | y = 1.120x-5.050 | 0.997 |
| R18 | R18 | 04/08/2025 | y = 1.155x-5.737 | 0.997 |
| R19 | R19 | 04/08/2025 | y = 1.131x-5.715 | 0.997 |
| R20 | R20 | 01/08/2025 | y = 1.152x-5.912 | 0.996 |

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | |
|---------------------------------|----------------------------------|--------------------------------|-------------------|
| Customer : | S.P.S.Consulting Service Co.,Ltd | Date Tested: | July 1, 2025 |
| | | Recommendation Recertification | |
| Address : | 7 Soi Phaholyothin 24 | Period | 6 Months |
| Paholyothin Road | | Recertification Due: | January 1, 2026 |
| Jompol Chatuchak, Bangkok 10900 | | Date Last Certified: | January 6, 2025 |
| User Name: | K.Phenpa Vipasthawat | Visit Number: | 1 of 2 |
| Phone: | 083-9269252 | PerkinElmer Phone: | 02-719-6420 ext 8 |
| Fax: | 02-513-4221 | PerkinElmer Fax: | 02-318-5597 |

| CONFIGURATION TESTED | | |
|----------------------|---------------|-----------------------|
| MODEL | SERIAL NUMBER | SOFTWARE |
| FIAS 100 | 100S14090404 | Syngistix version 7.3 |
| | | |
| | | |
| | | |
| | | |
| | | |
| TEST STANDARD USED | PART NUMBER | EXPIRATION DATE |
| Mercury (Hg) Std | N9300174 | JUN 30, 2026 |
| | | |
| | | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | |
|----------------------|---------------------|--------------------|---------------------|
| SERIAL NUMBER | <u>100S14090404</u> | DATE TESTED | <u>July 1, 2025</u> |
|----------------------|---------------------|--------------------|---------------------|

1. INSTRUMENT CHECKS

| | |
|---|---|
| A. The light part, quartz windows and detector. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect the mercury lamp. Alignment if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect the mercury filter. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect and clean or replace the dust filter. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| E. Inspect peristaltic pump tubes. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

2. ELECTRONICS CHECKS

| | | |
|------------------------------|-----------------|-------|
| A. Electronic power supplies | | |
| + 5 Volts (\pm 0.3) | <u> 4.98 </u> | Volts |
| + 15 Volts (\pm 1.0) | <u> 15.03 </u> | Volts |
| - 15 Volts (\pm 1.0) | <u> 15.07 </u> | Volts |
| + 40 Volts (\pm 1.0) | <u>40.02 </u> | Volts |

3. GAS SYSTEM CHECK

| | |
|---|---|
| A. Leak test all internal and external gas box joints. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect solenoid valve and pressure switch. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect non return valve. Replace sleeve if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect flow meter and needle valve. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

4. MECHANICAL CHECKS

| | |
|---|---|
| A. Inspect pump motor and pump roller. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect and clean switching valve. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect, clean and lubricant autosample. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

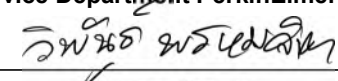
FIAS 100

| | | | | | |
|---|-----------------|--|--------------------|--------------|------------------|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| PARAMETER | | | SPECIFICATION | ACTUAL VALUE | |
| 5. PERFORMANCE TEST | | | | | |
| A. Baseline Noise Test | | | | | |
| (measure peak area at 10 replicates without any sample) | | | | | |
| | SD | | ≤ 0.0015 A*s | | 0.0025 A*s |
| B. Sensitivity Check | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | Mean Absorbance | | ≥ 0.0800 Abs. | | 0.1201 Abs. |
| C. Characteristic mass(m_0) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | m_0 | | ≤ 314 pg | | 183.2 pg/0.0044A |
| D. Precision Check (%RSD) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | %RSD | | ≤ 2.5 % | | 1.65 % |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | | | |
|--|--------------|--|-------------|--------------|--|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| Remarks : | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| This is to certify that the above tests have been performed and the configuration tested | | | | | |
| <input checked="" type="checkbox"/> meets | | | | | |
| <input type="checkbox"/> does not meet | | | | | |
| the PerkinElmer Specifications listed on this certificate. | | | | | |
| This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms. | | | | | |
| Service Department PerkinElmer Ltd. | | | | | |
| Customer Service Engineer:  | | | | | |
| (Wiphan Promlumda) | | | | | |
| Service Engineer | | | | | |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|-------------------|----------------------------------|---------------------------------------|---------------------|
| Customer : | S.P.S.Consulting Service Co.,Ltd | Date Tested: | July 1, 2025 |
| | | Recommendation Recertification | |
| Address : | 7 Soi Phaholyothin 24 | Period | 6 Months |
| | Paholyothin Road | Recertification Due: | January 1, 2026 |
| | Jompoi Chatuchak, Bangkok 1090 | Date Last Certified: | January 6, 2025 |
| User Name: | K.Phenpha Viphashtawat | Visit Number: | 1of 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, 2024 |
| Wavecal Solution | N058-2152 | March 30, 2024 |
| VIS Wavecal solution | N930-2946 | February 28, 2024 |
| Instrument Cal. STD4 | N930-0221 | November 30, 2024 |
| CUSTOMER SUPPLIED | COMMENTS | CUSTOMER INITIALS |
| 2 % HNO3 | | |
| 10 % HNO3 | | |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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



MAINTENANCE AND TEST CERTIFICATE MODEL

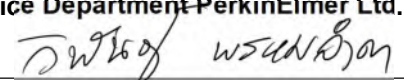
OPTIMA 5300DV

| SERIAL NUMBER : 077C7042401 | | DATE TESTED : July 1, 2025 | |
|----------------------------------|---------------|----------------------------|------------|
| PARAMETER | SPECIFICATION | FINAL VALUE | |
| Spectral Resolution : UV | As 193.696 nm | ≤ 0.007 | 0.00570 |
| | Ni 231.604 nm | ≤ 0.008 | 0.00734 |
| | Ni 341.476 nm | ≤ 0.012 | 0.00763 |
| Spectral Resolution : VIS | La 408.672 nm | ≤ 0.020 | 0.01627 |
| | Ba 455.403 nm | ≤ 0.025 | 0.02428 |
| Precision | As 193.656 nm | % RSD < 1.0 | 0.82 % |
| | Zn 213.856 nm | % RSD < 1.0 | 0.83 % |
| | Mn 257.610 nm | % RSD < 1.0 | 0.20 % |
| | La 379.478 nm | % RSD < 1.0 | 0.89 % |
| | Ba 455.403 nm | % RSD < 1.0 | 0.92 % |
| | Ba 493.408 nm | % RSD < 1.0 | 0.75 % |
| 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) | 331.50 ppb |
| | Zn 213.856 nm | 3(sd) | 0.98 ppb |
| | Mn 257.610 nm | 3(sd) | 0.34 ppb |
| | La 379.478 nm | 3(sd) | 2.54 ppb |
| | Ba 455.403 nm | 3(sd) | 2.19 ppb |
| | Ba 493.408 nm | 3(sd) | 4.32 ppb |
| BEC : Axial (IB X 500)/(IS-IB) | Cd 226.502 nm | ≤ 150 ppb | 140.03 |
| BEC : Radial (IB X 1000)/(IS-IB) | Mn 257.610 nm | ≤ 45 ppb | 24.17 |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| SERIAL NUMBER | 077C7042401 | DATE TESTED | July 1, 2025 |
|--|-------------|-------------|--------------|
| Remarks : | | | |
| Commissioning follow as commissioning performance sheets. | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| This is to certify that the above tests have been performed and the configuration tested | | | |
| <input checked="" type="checkbox"/> meets | | | |
| <input type="checkbox"/> does not meet | | | |
| the PerkinElmer Specifications listed on this certificate. | | | |
| This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms. | | | |
| Service Department PerkinElmer Ltd. | | | |
| Authorized Representative:  | | | |
| (Wiphan Promlumda) | | | |
| Service Engineer | | | |

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 | DH _g (mmH ₂ O) |
| B01 | 1563 | 02/06/2025 | 0.997 | 49.56 |
| B02 | 8002514 | 04/06/2025 | 0.998 | 49.74 |
| B03 | 1503016 | 02/06/2025 | 1.007 | 49.69 |
| B04 | 00006659 | 04/06/2025 | 0.999 | 50.11 |
| B05 | 00007428 | 02/06/2025 | 1.006 | 49.65 |
| R01 | 1561 | 04/06/2025 | 1.003 | 49.70 |
| R02 | 8002513 | 03/06/2025 | 0.998 | 49.82 |
| R03 | 1570 | 03/06/2025 | 1.005 | 49.88 |
| R04 | 8002519 | 02/06/2025 | 1.004 | 49.76 |
| R05 | 1503015 | 04/06/2025 | 0.997 | 50.04 |

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

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

Calibrated by :

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

Console Calibration Report

Calibration Method

Critical Orifices

Calibration Data

| Console Data | | Calibration Data | | |
|--------------|------------|------------------|-------|--------------------------------------|
| No. | Serial No. | Date | y | ΔH _g (mmH ₂ O) |
| B01 | 1563 | 05/09/2025 | 1.004 | 49.67 |
| B02 | 8002514 | 01/09/2025 | 1.002 | 49.85 |
| B03 | 1503016 | 01/09/2025 | 1.005 | 49.77 |
| B04 | 00006659 | 04/09/2025 | 0.997 | 49.93 |
| B05 | 00007428 | 02/09/2025 | 1.003 | 49.51 |
| R01 | 1561 | 01/09/2025 | 0.999 | 49.82 |
| R02 | 8002513 | 01/09/2025 | 0.996 | 49.94 |
| R03 | 1570 | 04/09/2025 | 0.998 | 50.02 |
| R04 | 8002519 | 04/09/2025 | 1.002 | 49.89 |
| R05 | 1503015 | 02/09/2025 | 0.996 | 50.10 |

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

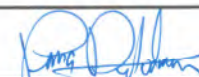
Accept Value of ΔH_g (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



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

Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

| Pitot Tube Data | | | Calibration Data | | |
|-----------------|---------------|-------------------------------|------------------|-------------------|--------|
| No. | Type of Pitot | Coefficient of Standard Pitot | Date | Avg. of Cp (test) | |
| | | | | Side A | Side B |
| B03 | S | 0.99 | 04/08/2025 | 0.84 | 0.84 |
| B04 | S | 0.99 | 01/08/2025 | 0.84 | 0.83 |
| B05 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B07 | S | 0.99 | 04/08/2025 | 0.85 | 0.84 |
| B08 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B09 | S | 0.99 | 04/08/2025 | 0.84 | 0.83 |
| B11 | S | 0.99 | 05/08/2025 | 0.84 | 0.84 |
| B16 | S | 0.99 | 04/08/2025 | 0.84 | 0.83 |
| B18 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B19 | S | 0.99 | 01/08/2025 | 0.84 | 0.83 |
| B21 | S | 0.99 | 04/08/2025 | 0.84 | 0.83 |
| B24 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B27 | S | 0.99 | 04/08/2025 | 0.84 | 0.83 |
| B30 | S | 0.99 | 01/08/2025 | 0.85 | 0.84 |
| B31 | S | 0.99 | 01/08/2025 | 0.84 | 0.85 |
| B33 | S | 0.99 | 01/08/2025 | 0.83 | 0.84 |
| B35 | S | 0.99 | 01/08/2025 | 0.84 | 0.85 |

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

Calibration Data

| Pitot Tube Data | | | Calibration Data | | |
|-----------------|---------------|-------------------------------|------------------|-------------------|--------|
| No. | Type of Pitot | Coefficient of Standard Pitot | Date | Avg. of Cp (test) | |
| | | | | Side A | Side B |
| B36 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B37 | S | 0.99 | 01/08/2025 | 0.84 | 0.85 |
| B38 | S | 0.99 | 01/08/2025 | 0.84 | 0.83 |
| B39 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B40 | S | 0.99 | 04/08/2025 | 0.85 | 0.84 |
| B41 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B44 | S | 0.99 | 05/08/2025 | 0.83 | 0.84 |
| B45 | S | 0.99 | 01/08/2025 | 0.84 | 0.85 |
| B46 | S | 0.99 | 01/08/2025 | 0.85 | 0.84 |
| B47 | S | 0.99 | 01/08/2025 | 0.85 | 0.84 |
| B48 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B49 | S | 0.99 | 04/08/2025 | 0.85 | 0.84 |
| B54 | S | 0.99 | 01/08/2025 | 0.84 | 0.84 |
| B56 | S | 0.99 | 04/08/2025 | 0.84 | 0.84 |
| B57 | S | 0.99 | 04/08/2025 | 0.85 | 0.84 |
| B58 | S | 0.99 | 04/08/2025 | 0.84 | 0.84 |

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.
CALIBRATION DATE : 07-Mar-25

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

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



CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : DIGITAL BALANCE MODEL : XS105DU
MANUFACTURER : METTLER TOLEDO S/N : 1126422905
ID No : BA05/50 RECEIVED DATE : 07-Mar-25
AIR PRESSURE : 1009mbar \pm 1mbar CALIBRATION DATE : 07-Mar-25
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 54%RH \pm 10%RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

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

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm g) |
|-------------------|---------------------|----------------|------------------------|
| 0.00 | 0.00000 | 0.00000 | 0.000065 |
| 0.02 | 0.01999 | 0.00001 | 0.000065 |
| 0.10 | 0.10001 | -0.00001 | 0.000066 |
| 0.20 | 0.20001 | -0.00001 | 0.000066 |
| 0.50 | 0.50002 | -0.00002 | 0.000065 |
| 1.00 | 1.00003 | -0.00003 | 0.000066 |
| 2.00 | 2.00001 | -0.00001 | 0.000067 |
| 5.00 | 5.00002 | -0.00002 | 0.000068 |
| 10.00 | 10.00000 | 0.00000 | 0.000070 |
| 20.00 | 20.00004 | -0.00004 | 0.000078 |
| 50.00 | 50.00000 | 0.00000 | 0.00013 |
| 100.00 | 100.0001 | -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





Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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



บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD.

Operator Signature : Teerapat B

Date : Jun 6, 2025

(Mr. Teerapat Boonla)

Application Chemist



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ซอยพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
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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.) | | | y | | |
| | | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² | |
| B01 | SKC | 224-PCXR4 | 262101 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,501 | 2,003 | 1.003x - 4.236 | 1.000 | |
| B02 | SKC | 224-PCXR4 | 626166 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,506 | 2,007 | 1.001x + 1.555 | 1.000 | |
| B03 | SKC | 224-PCXR4 | 612968 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,499 | 2,002 | 1.004x - 11.638 | 0.999 | |
| B04 | SKC | 224-PCXR4 | 602804 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,502 | 1,998 | 1.002x - 3.373 | 1.000 | |
| B05 | SKC | 224-PCXR4 | 612693 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,504 | 2,008 | 1.008x - 9.160 | 1.000 | |
| B06 | SKC | 224-PCXR4 | 262188 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,505 | 2,003 | 1.001x - 3.965 | 1.000 | |
| B07 | SKC | 224-PCXR4 | 626262 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,494 | 2,000 | 0.997x + 3.261 | 1.000 | |
| B08 | SKC | 224-PCXR4 | 626100 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,502 | 2,004 | 1.009x - 15.922 | 0.999 | |
| B09 | SKC | 224-PCXR4 | 626479 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,499 | 2,005 | 1.005x - 9.935 | 1.000 | |
| B10 | SKC | 224-PCXR4 | 091950 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,507 | 2,001 | 1.008x - 15.634 | 1.000 | |
| B11 | SKC | 224-PCXR8 | 564315 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,495 | 2,002 | 1.004x - 7.274 | 1.000 | |
| B12 | SKC | 224-PCXR4 | 034656 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,507 | 2,005 | 1.007x - 13.608 | 0.999 | |
| B13 | SKC | 224-PCXR4 | 602073 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,504 | 2,007 | 1.006x - 6.161 | 1.000 | |
| B14 | SKC | 224-PCXR4 | 626313 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,503 | 2,004 | 1.001x - 3.361 | 1.000 | |
| B15 | SKC | 224-PCXR4 | 626474 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,506 | 2,002 | 1.008x - 12.821 | 0.999 | |
| B16 | SKC | 224-PCXR4 | 626477 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,509 | 1,995 | 0.999x - 0.595 | 1.000 | |
| B17 | SKC | 224-PCXR4 | 626860 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,497 | 1,996 | 1.000x - 1.613 | 1.000 | |
| B18 | SKC | 224-PCXR4 | 691484 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,499 | 1,995 | 1.003x - 9.955 | 0.999 | |
| B19 | SKC | 224-PCXR4 | 691599 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,508 | 1,994 | 1.001x - 1.127 | 1.000 | |
| B20 | SKC | 224-PCXR4 | 691587 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,505 | 1,997 | 1.004x - 9.596 | 1.000 | |
| B21 | SKC | 224-PCXR4 | 691531 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,504 | 1,999 | 1.002x - 3.125 | 1.000 | |
| B22 | SKC | 224-PCXR4 | 691654 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,505 | 1,992 | 1.003x - 9.240 | 0.999 | |
| B23 | SKC | 224-PCXR4 | 798393 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 992 | 1,498 | 1,993 | 0.999x - 3.941 | 1.000 | |
| B24 | SKC | 224-PCXR4 | 626363 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 1,994 | 1.003x - 9.084 | 0.999 | |
| B25 | SKC | 224-PCXR4 | 798489 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,497 | 2,004 | 0.998x + 5.100 | 1.000 | |
| B26 | SKC | 224-PCXR4 | 798479 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,504 | 1,998 | 0.997x + 5.575 | 1.000 | |
| B27 | SKC | 224-PCXR4 | 691673 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,508 | 1,991 | 1.002x - 8.556 | 0.999 | |
| B28 | SKC | 224-PCXR4 | 691570 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,504 | 2,001 | 1.000x + 2.897 | 1.000 | |
| B29 | SKC | 224-PCXR4 | 626472 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,502 | 2,004 | 1.001x - 1.675 | 1.000 | |
| B30 | SKC | 224-PCXR4 | 691489 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,510 | 2,007 | 1.010x - 13.764 | 0.999 | |
| B31 | SKC | 224-PCXR4 | 691509 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,499 | 1,991 | 0.997x + 0.891 | 1.000 | |
| B32 | SKC | 224-PCXR4 | 091567 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,497 | 1,996 | 0.996x + 3.273 | 1.000 | |
| B33 | SKC | 224-PCXR4 | 091756 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,505 | 1,992 | 1.000x - 4.428 | 0.999 | |
| B34 | SKC | 224-PCXR4 | 612962 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,508 | 2,011 | 1.007x - 5.647 | 1.000 | |
| B35 | SKC | 224-PCXR4 | 602682 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 1,991 | 0.997x + 1.603 | 0.999 | |
| B36 | SKC | 224-PCXR4 | 626164 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,498 | 2,002 | 1.004x - 8.113 | 1.000 | |
| B37 | SKC | 224-PCXR4 | 626256 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,508 | 2,001 | 1.005x - 10.431 | 1.000 | |
| B38 | SKC | 224-PCXR4 | 626167 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,000 | 1,497 | 1,993 | 0.999x - 0.639 | 1.000 | |
| B39 | SKC | 224-PCXR4 | 034637 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,503 | 1,991 | 1.002x - 7.186 | 0.999 | |
| B40 | SKC | 224-PCXR4 | 798349 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,494 | 1,990 | 1.000x - 7.405 | 1.000 | |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peers Detudom
(Mr. Peers 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 | |
| B41 | SKC | 224-PCXR4 | 612669 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,498 | 2,001 | 1.001x - 3.597 | 1.000 | |
| B42 | SKC | 224-PCXR4 | 626041 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,499 | 2,007 | 1.005x - 8.012 | 1.000 | |
| B43 | SKC | 224-PCXR4 | 034636 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 1,997 | 0.993x + 10.787 | 1.000 | |
| B44 | SKC | 224-PCXR8 | 529341 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,502 | 2,009 | 1.010x - 14.387 | 1.000 | |
| B45 | SKC | 224-PCXR8 | 529594 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,509 | 1,991 | 0.992x + 12.045 | 1.000 | |
| B46 | SKC | 224-PCXR8 | 566743 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,505 | 2,000 | 1.006x - 13.608 | 0.999 | |
| B47 | SKC | 224-PCXR8 | 566747 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,504 | 1,998 | 1.004x - 7.545 | 1.000 | |
| B48 | SKC | 224-PCXR8 | 566753 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,494 | 1,996 | 0.998x - 0.387 | 1.000 | |
| B49 | SKC | 224-PCXR8 | 566780 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,499 | 1,995 | 1.005x - 13.932 | 0.999 | |
| B50 | SKC | 224-PCXR8 | 500400 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,006 | 1,498 | 2,008 | 1.002x - 1.667 | 1.000 | |
| B51 | SKC | 224-PCXR8 | 500363 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,505 | 2,002 | 1.008x - 17.209 | 0.999 | |
| B52 | SKC | 224-PCXR8 | 093186 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 994 | 1,496 | 1,998 | 1.003x - 7.976 | 1.000 | |
| B53 | SKC | 224-PCXR8 | 707670 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,512 | 2,002 | 1.004x - 6.981 | 1.000 | |
| B54 | SKC | 224-PCXR3 | 509821 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,503 | 2,006 | 1.009x - 17.041 | 0.999 | |
| B55 | SKC | 224-PCXR3 | 510710 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,000 | 1,501 | 1,993 | 0.996x + 2.606 | 1.000 | |
| B56 | SKC | 224-PCXR3 | 511450 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,012 | 1,502 | 2,008 | 0.997x + 9.801 | 1.000 | |
| B57 | SKC | 224-PCXR3 | 510798 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,493 | 2,004 | 1.003x - 2.925 | 1.000 | |
| B58 | SKC | 224-PCXR3 | 509852 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,499 | 1,997 | 1.001x - 8.640 | 0.999 | |
| B59 | SKC | 224-PCXR3 | 509862 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,000 | 1,504 | 2,001 | 0.999x + 4.160 | 1.000 | |
| B60 | SKC | 224-PCXR3 | 512655 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,502 | 2,008 | 1.007x - 9.991 | 1.000 | |
| B61 | SKC | 224-PCXR3 | 503915 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,491 | 1,995 | 1.003x - 8.373 | 1.000 | |
| B62 | SKC | 224-PCXR3 | 505975 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,498 | 2,001 | 1.002x - 4.813 | 1.000 | |
| B63 | SKC | 224-PCXR3 | 511432 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,503 | 1,996 | 1.008x - 19.707 | 0.999 | |
| B64 | SKC | 224-PCXR3 | 508302 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,494 | 1,992 | 0.993x + 6.854 | 1.000 | |
| B65 | SKC | 224-PCXR3 | 508310 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,000 | 1,505 | 2,001 | 1.003x - 8.089 | 0.999 | |
| B66 | SKC | 224-PCXR3 | 509861 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,495 | 1,996 | 0.992x + 10.934 | 1.000 | |
| B67 | SKC | 224-PCXR3 | 506295 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,509 | 1,997 | 1.001x - 4.236 | 1.000 | |
| B68 | SKC | 224-PCXR3 | 505872 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,491 | 2,001 | 1.000x - 1.187 | 1.000 | |
| B69 | SKC | 224-PCXR3 | 508375 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,006 | 1,505 | 1,998 | 1.005x - 11.342 | 0.999 | |
| B70 | SKC | 224-PCXR3 | 510623 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,508 | 1,997 | 1.001x - 1.890 | 1.000 | |
| B71 | SKC | 224-PCXR3 | 508367 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,506 | 2,004 | 1.006x - 12.521 | 0.999 | |
| B72 | SKC | 224-PCXR3 | 505977 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,007 | 1,496 | 1,998 | 0.991x + 11.538 | 1.000 | |
| B73 | SKC | 224-PCXR3 | 512666 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,498 | 1,995 | 0.996x + 0.711 | 1.000 | |
| B74 | SKC | 224-PCXR3 | 505993 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,497 | 1,998 | 1.002x - 6.570 | 1.000 | |
| B75 | SKC | 224-PCXR3 | 509820 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,499 | 1,996 | 0.999x - 0.923 | 1.000 | |
| B76 | SKC | 224-PCXR3 | 509811 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,502 | 2,003 | 1.007x - 11.834 | 1.000 | |
| B77 | SKC | 224-PCXR3 | 508301 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,505 | 1,993 | 1.000x - 3.349 | 0.999 | |
| B78 | SKC | 224-PCXR3 | 510677 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,509 | 1,998 | 1.004x - 9.791 | 0.999 | |
| B79 | SKC | 224-PCXR3 | 510920 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,498 | 1,994 | 0.997x + 2.162 | 1.000 | |



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7 ซอยพหลโยธิน 24 แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10000
Tel : (662) 939-4370-72, Fax : (662) 513-4321, E-mail : sales@spscon.com, www.spscon.com

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

| Personal Pump Data | | | | Calibration Data | | | | | | | | |
|--------------------|-------|-----------|------------|------------------|--------------------|-------|-------|-----------------|-------|-------|------------------------------|----------------|
| No. | Brand | Model | Serial No. | Date | Flow Rate (mL/min) | | | | | | Value From Calibration Curve | |
| | | | | | Setting | | | Actual (Q std.) | | | | |
| | | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² |
| 880 | SKC | 224-PCXR3 | 504569 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,501 | 2,007 | 1.014x - 22.484 | 0.999 |
| 881 | SKC | 224-PCXR3 | 503480 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,494 | 1,995 | 1.005x - 14.583 | 1.000 |
| 882 | SKC | 224-PCXR3 | 505673 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,497 | 2,001 | 1.004 - 6.075 | 1.000 |
| 883 | SKC | 224-PCXR3 | 510785 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,009 | 1,501 | 1,998 | 1.003x - 7.370 | 0.999 |
| 884 | SKC | 224-PCXR3 | 508333 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,502 | 1,997 | 1.000x - 1.894 | 1.000 |
| 885 | SKC | 224-PCXR3 | 505757 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,503 | 2,004 | 1.004x - 7.222 | 1.000 |
| 886 | SKC | 224-PCXR3 | 512625 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,493 | 1,997 | 0.996x + 1.139 | 1.000 |
| 887 | SKC | 224-PCXR3 | 504324 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,498 | 2,002 | 1.001x + 0.607 | 1.000 |
| 888 | SKC | 224-PCXR3 | 508307 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,497 | 1,995 | 0.995x + 5.331 | 1.000 |
| 889 | SKC | 224-PCXR3 | 509860 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,494 | 1,998 | 1.007x - 15.027 | 0.999 |
| 890 | SKC | 224-PCXR3 | 508366 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,510 | 1,992 | 0.998x + 0.332 | 1.000 |
| 891 | SKC | 224-PCXR3 | 510919 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,503 | 1,999 | 0.990x + 13.532 | 1.000 |
| 892 | SKC | 224-PCXR3 | 510987 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 2,002 | 0.999x + 3.737 | 1.000 |
| 893 | SKC | 224-PCXR3 | 509845 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,501 | 2,004 | 1.008x - 12.857 | 1.000 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompet, Chulachak, Bangkok 10900
Tel : (662) 939-4370-72 Fax : (662) 513-4221 E-mail : sale@spscn.com, www.spscn.com

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 | 02/07/2025 | 500 | 1,000 | 2,000 | 498.8 | 1001.4 | 2005.7 | 0.996x + 4.876 | 1.000 | |
| H-B02 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 501.6 | 1001.3 | 1997.6 | 0.997x + 5.643 | 1.000 | |
| H-B03 | Dwyer | VFB-65 | 03/07/2025 | 500 | 1,000 | 2,000 | 499.3 | 1001.9 | 1990.3 | 0.998x + 3.307 | 0.999 | |
| H-B04 | Dwyer | VFB-65 | 04/07/2025 | 500 | 1,000 | 2,000 | 501.3 | 997.3 | 2005.9 | 1.000x + 1.052 | 1.000 | |
| H-B05 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 501.6 | 998.8 | 2005.5 | 1.003x - 1.210 | 1.000 | |
| H-B06 | Dwyer | VFB-65 | 03/07/2025 | 500 | 1,000 | 2,000 | 500.9 | 1001.3 | 1990.6 | 0.997x + 5.814 | 0.999 | |
| H-B07 | Dwyer | VFB-65 | 04/07/2025 | 500 | 1,000 | 2,000 | 501.9 | 1001.7 | 2009.2 | 0.999x - 1.217 | 1.000 | |
| H-B08 | Dwyer | VFB-65 | 04/07/2025 | 500 | 1,000 | 2,000 | 499.0 | 998.4 | 2006.7 | 1.002x - 9.086 | 0.999 | |
| H-B09 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 498.8 | 1000.5 | 1998.8 | 1.001x - 1.402 | 1.000 | |
| H-B10 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 500.2 | 1000.6 | 2001.7 | 0.999x + 3.178 | 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@spscn.com, www.spscn.com

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 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 | 02/07/2025 | 50 | 100 | 200 | 50.3 | 100.2 | 201.1 | 1.001x + 0.271 | 1.000 | |
| L-B02 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 50.5 | 100.3 | 202.2 | 0.996x + 1.427 | 1.000 | |
| L-B03 | Dwyer | VFA-21 | 03/07/2025 | 50 | 100 | 200 | 50.2 | 101.5 | 199.1 | 1.000x + 0.166 | 1.000 | |
| L-B04 | Dwyer | VFA-21 | 04/07/2025 | 50 | 100 | 200 | 50.9 | 99.3 | 201.4 | 0.997x + 1.377 | 0.999 | |
| L-B05 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 50.1 | 101.7 | 199.9 | 0.994x + 1.540 | 1.000 | |
| L-B06 | Dwyer | VFA-21 | 03/07/2025 | 50 | 100 | 200 | 50.8 | 99.0 | 201.4 | 0.999x + 0.969 | 0.999 | |
| L-B07 | Dwyer | VFA-21 | 04/07/2025 | 50 | 100 | 200 | 49.9 | 101.2 | 200.6 | 1.002x + 0.347 | 1.000 | |
| L-B08 | Dwyer | VFA-21 | 04/07/2025 | 50 | 100 | 200 | 50.5 | 99.7 | 199.8 | 1.001x - 0.048 | 1.000 | |
| L-B09 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 50.7 | 99.9 | 199.3 | 0.997x + 1.056 | 0.999 | |
| L-B10 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 49.8 | 99.2 | 199.6 | 0.999x - 0.559 | 1.000 | |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

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

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

Calibration Report

Non-Dispersive Infrared CO Analyzer

Date : 05 August 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 | 39.97 | -0.075 | 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 | 4015.5 | mV | 2500-4800 mV |
| CO Reference | 3948.1 | mV | 2500-4800 mV |
| Measure/Reference Ratio | 1.180 | - | 1.1-1.3 W/Zero Air |
| Sample Pressure | 28.4 | 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 | 30.6 | °C | Ambient Temp + 7 ± 10 |
| Photo-Drive | 3034.8 | mV | 250 mV to 4750 mV |
| Slope | 1.017 | - | 1.0 ± 0.3 |
| Offset | 0.2 | - | 0 ± 0.3 |

Calibrated by :

Adul Dangklom

(Mr.Adul Dangklom)

Approved by :

Peera Detudom

(Mr. Peera Detudom)



CALIBRATION LABORATORY Co.,LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-6353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

| | |
|-----------------|------------------|
| NOMENCLATURE | VACUUM GAUGE |
| MANUFACTURER | HI-LIGHT |
| MODEL/TYPE | N/A |
| SERIAL NO. | N/A[64-220088-1] |
| CLID.NO. | 212301422 |
| JOB CONTROL NO. | 240720076546 |

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

DATE OF RECEIVED : 19 July 2025

DATE OF ISSUED: 24 July 2025

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

Calibrated By : Sittipong Pimdee
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
24 July 2025



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

Certificate No. Q24076546

F3-011-05/12-23

page 1 of 3



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211Q-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-Q353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

| | |
|-------------------------|-------------------|
| NOMENCLATURE | VACUUM GAUGE |
| MANUFACTURER | HI-LIGHT |
| MODEL/TYPE | N/A |
| SERIAL NO. | N/A [64-220088-1] |
| DATE OF CALIBRATION | 23 July 2025 |
| DUE DATE OF CALIBRATION | 23 July 2026 |

ENVIRONMENT CONDITIONS

Temperature : (23 \pm 2) °C

Relative Humidity (55 \pm 10) %RH

PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-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.

UNCERTAINTY :

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

Certificate No. Q24076546

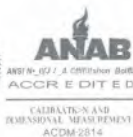
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2/1Q-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax:02-578-2672 www.cal-laboratory.com Email:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM :RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS: (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

| DUC Test point (inHg) | STD Reading (kPa) | | Conversion to inHg | | Correction (inHg) | |
|----------------------------|---------------------|---------|--------------------|-------|--------------------|------|
| | Up | Down | Up | Down | Up | Down |
| 0 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 0.0 |
| -5 | -15.07 | -15.10 | -4.5 | -4.5 | +0.5 | +0.5 |
| -10 | -32.50 | -32.84 | -9.6 | -9.7 | +0.4 | +0.3 |
| -15 | -49.44 | -49.77 | -14.6 | -14.7 | +0.4 | +0.3 |
| -20 | -66.70 | -66.70 | -19.7 | -19.7 | +0.3 | +0.3 |
| -25 | -83.63 | -83.97 | -24.7 | -24.8 | +0.3 | +0.2 |
| -30 | -100.39 | -100.39 | -29.6 | -29.6 | +0.4 | +0.4 |

Uncertainty of measurement \pm 0.2 inHg

Transmitting fluid :Air.

Technical Note. Conversion factor 1 kPa ;0.2953003 inHg

Note. The Scope of Accredited ANAB CertificateNo. ACDM-2814 Version 012 Page 43 of 67

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

End of Certificate

Certificate No. Q24076546

F3-011-05/ 12-23

Cert. No. : SP25026

Pages : 1 of 4

Calibration Certificate

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

Condition As Found : GOOD

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

Location : ORGANIC LABORATORY IV

Ambient Temperature : (22.9 ± 5) °C

Relative Humidity : (53.7 ± 25) %

Received Date : 22 AUGUST 2025

Calibration Date : 22 AUGUST 2025

Date of Issue : 25 AUGUST 2025

Calibrated by : Nitinun Srihawan

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

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

Cert. No. : SP25026

Job No. : VC68SP0019

Pages : 2 of 4

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

| Material | Ref. type | Cell serial No. | Cert. No. | Due Date |
|--------------------------------|---------------|-----------------|------------|------------|
| Holmium liquid | RM-HL | 29706 | 126461 | 24/10/2026 |
| Didymium liquid | RM-DL | 28912 | 126462 | 24/10/2026 |
| Neutral density filter | RM-1N2N3N | 13877 | 126457 | 24/10/2026 |
| Potassium dichromate solutions | RM-0204060810 | 14204 | 126497 | 25/10/2026 |
| Potassium Iodide solution | - | KI-0701-001 | CI-0185-24 | 14/05/2026 |

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

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

3.1 The UK National Physical Laboratory (NPL)

Result of calibration : Wavelength Accuracy

(Without adjustment)

| Material | Certified Values of Reference Material (nm) | UUC* Reading (nm) | Error (nm) | Uncertainty ± (nm) | k Factor |
|----------|---|-------------------|------------|--------------------|----------|
| RM-HL | 278.13 | 278.21 | 0.08 | 0.16 | 2.00 |
| | 361.25 | 361.39 | 0.14 | 0.16 | 2.00 |
| | 467.82 | 467.71 | -0.11 | 0.16 | 2.00 |
| | 536.56 | 536.50 | -0.06 | 0.16 | 2.00 |
| | 640.50 | 640.36 | -0.14 | 0.16 | 2.00 |
| RM-DL | 740.09 | 739.85 | -0.24 | 0.16 | 2.00 |
| | 864.94 | 865.12 | 0.18 | 0.16 | 2.00 |

UUC* = Unit Under Calibration

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

Result of calibration : Photometric Accuracy

| Material | Wavelength (nm) | Filter S/N | Nominal Absorbance (A) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor |
|------------------------------|-----------------|------------|------------------------|--------------------------|-----------------------------|-----------|-------------------|----------|
| Neutral Density glass filter | 440.0 | 29381 | 0.5 | 0.5443 | 0.5413 | -0.0030 | 0.0043 | 2.00 |
| | | 29914 | 0.7 | 0.7484 | 0.7455 | -0.0029 | 0.0054 | 2.00 |
| | | 29360 | 1.0 | 1.0527 | 1.0535 | 0.0008 | 0.0032 | 2.00 |
| | 465.0 | 29381 | 0.5 | 0.4948 | 0.4922 | -0.0026 | 0.0041 | 2.00 |
| | | 29914 | 0.7 | 0.6906 | 0.6877 | -0.0029 | 0.0050 | 2.00 |
| | | 29360 | 1.0 | 0.9695 | 0.9709 | 0.0014 | 0.0031 | 2.00 |
| | 546.1 | 29381 | 0.5 | 0.5090 | 0.5068 | -0.0022 | 0.0036 | 2.00 |
| | | 29914 | 0.7 | 0.6985 | 0.6960 | -0.0025 | 0.0041 | 2.00 |
| | | 29360 | 1.0 | 0.9814 | 0.9825 | 0.0011 | 0.0031 | 2.00 |
| | 590.0 | 29381 | 0.5 | 0.5375 | 0.5353 | -0.0022 | 0.0034 | 2.00 |
| | | 29914 | 0.7 | 0.7256 | 0.7231 | -0.0025 | 0.0037 | 2.00 |
| | | 29360 | 1.0 | 1.0213 | 1.0219 | 0.0006 | 0.0032 | 2.00 |
| | 635.0 | 29381 | 0.5 | 0.5223 | 0.5202 | -0.0021 | 0.0033 | 2.00 |
| | | 29914 | 0.7 | 0.6927 | 0.6901 | -0.0026 | 0.0036 | 2.00 |
| | | 29360 | 1.0 | 0.9744 | 0.9750 | 0.0006 | 0.0032 | 2.00 |

UUC* = Unit Under Calibration

Hichou B.

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

Result of calibration : Photometric Accuracy

(Without adjustment)

| Material | Wavelength (nm) | Solution (mg/l) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor |
|--------------------------------|-----------------|-----------------|--------------------------|-----------------------------|-----------|-------------------|----------|
| Potassium dichromate solutions | 235.0 | 20 | 0.2415 | 0.2443 | 0.0028 | 0.0101 | 2.00 |
| | | 40 | 0.4866 | 0.4871 | 0.0005 | 0.0115 | 2.00 |
| | | 60 | 0.7415 | 0.7295 | -0.0120 | 0.0067 | 2.00 |
| | | 80 | 0.9854 | 0.9844 | -0.0010 | 0.0071 | 2.00 |
| | | 100 | 1.2444 | 1.2425 | -0.0019 | 0.0073 | 2.00 |

UUC* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 190 nm - 1100 nm

Scanning Speed 7.5 nm/min

Band width(Wavelength) 1.0

Band width(Vis) 1.0

Band width(Uv) 1.0

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

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

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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AutoSpec Premier is a trademark of Waters Corporation.

The Science of What's Possible, AutoSpec Premier and MassLynx are trademarks of Waters Corporation.

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All other trademarks are the sole property of their respective owners.

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) ☒
- The CI gas is connected and the pressure is set to ≤ 1 bar (15 psi) ☒
- 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 | 1.00×10^{-2} mbar | 1.91×10^{-2} mbar | 1.82×10^{-2} mbar |
| Fine | 2.88×10^{-7} mbar | 2.63×10^{-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 | 1.00×10^{-2} mbar | 1.91×10^{-2} mbar | 1.86×10^{-2} mbar |
| Fine | 2.63×10^{-7} mbar | 1.05×10^{-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 | 90.80 | 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 | 7 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 $\geq 80,000$:

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 $\geq 10\%$.

Transmission: 9

EI Positive Ion Sensitivity

Using a 200 pg/ μ L solution of methyl stearate in hexane, with 1 μ L 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 $\geq 5 \times 10^{-7}$ C/ μ g:

Measured Value for Ultima Magnet: 6.359×10^{-7} C/ μ g

Optional Tests (Non-Dioxin Instruments Only)

Use Methane gas when performing the GC and probe.

Mass Measurement Accuracy (RMS)

Using 10 ng of n-C₃₆H₇₄ 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) ≤ 1.5 mDa.

RMS Error : _____

Scan Cycle Rate

The scan cycle rate for Ultima Magnet over the range m/z 500-500 is ≥ 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 ≥ 5 × 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 ≥ 5 × 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 $^{13}\text{C}_{12}$ -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 $^{13}\text{C}_{12}$ -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:

- $\geq 125:1$, where noise is a peak-to-peak measurement encompassing 95% of raw noise data points (equivalent to 4 standard deviations, or $\pm 2\sigma$ about the mean).
- or
- $\geq 250:1$, where noise is mean positive to mean negative going noise about the mean (EPA 8290 definition, equivalent to 2 standard deviations, or $\pm \sigma$ about the mean).

Signal-to-Noise Ratio (2σ definition) : 158.72

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 $\geq 400:1$.

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 | Interference 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 | <input checked="" type="checkbox"/> |
| Current hazards | <input checked="" type="checkbox"/> |
| Thermal hazards | <input checked="" type="checkbox"/> |
| Mechanical hazards | <input checked="" type="checkbox"/> |
| Trip hazards | <input checked="" type="checkbox"/> |
| Stray magnetic fields | <input checked="" type="checkbox"/> |
| Chemical hazards | <input checked="" type="checkbox"/> |
| Compressed gases | <input checked="" type="checkbox"/> |

Overview

| | |
|-----------------------------|-------------------------------------|
| Utilities connections | <input checked="" type="checkbox"/> |
| The vacuum system | <input checked="" type="checkbox"/> |
| Covers and panels | <input checked="" type="checkbox"/> |

Starting up the Instrument

| | |
|--|-------------------------------------|
| Connection for power, air and water services | <input checked="" type="checkbox"/> |
| Switch on procedure | <input checked="" type="checkbox"/> |

Establishing Communications with the Embedded PC System

| | |
|-------------------------|-------------------------------------|
| Ping | <input checked="" type="checkbox"/> |
| Telnet connection | <input checked="" type="checkbox"/> |
| Telnet logging | <input checked="" type="checkbox"/> |
| rioMainMenu | <input checked="" type="checkbox"/> |

Starting the Instrument Peripherals

| | |
|-------------------|-------------------------------------|
| GC | <input checked="" type="checkbox"/> |
| Autosampler | <input checked="" type="checkbox"/> |

Basic Operation

| | |
|---|-------------------------------------|
| Starting MassLynx | <input checked="" type="checkbox"/> |
| Pumping down the instrument - manual controls | <input checked="" type="checkbox"/> |
| Pumping down the instrument - software controls | <input checked="" type="checkbox"/> |
| Baking the flight tube | <input checked="" type="checkbox"/> |
| Switching the instrument into operate | <input checked="" type="checkbox"/> |
| Obtaining an EI beam | <input checked="" type="checkbox"/> |
| Optimizing the instrument at 1000 resolving power | <input checked="" type="checkbox"/> |

MassLynx Familiarization

| | |
|--|-------------------------------------|
| MassLynx project creation | <input checked="" type="checkbox"/> |
| Tour of the MassLynx file system | <input checked="" type="checkbox"/> |
| File extensions | <input checked="" type="checkbox"/> |

Hardware Options

| | |
|----------------------------|-------------------------------------|
| Inner source options | <input checked="" type="checkbox"/> |
| Inlet options | <input checked="" type="checkbox"/> |
| Linked scanning | <input checked="" type="checkbox"/> |
| Split Detector | <input checked="" type="checkbox"/> |

Additional Resources

| | |
|---|-------------------------------------|
| Support Center (www.waters.com) | <input checked="" type="checkbox"/> |
| Education and training (www.waters.com) | <input checked="" type="checkbox"/> |
| Obtaining spares at waters.com | <input checked="" type="checkbox"/> |
| Use of Connections INSIGHT and submitting requests (if connected) | <input checked="" type="checkbox"/> |
| The benefits of Total Assurance Warranty (TAW) | <input checked="" type="checkbox"/> |

Advanced Operation

| | |
|--|-------------------------------------|
| Tuning the instrument to beyond 10,000 resolving power | <input checked="" type="checkbox"/> |
| Setting up a SIR experiment | <input checked="" type="checkbox"/> |
| Calibrating a SIR experiment | <input checked="" type="checkbox"/> |
| Setting up a magnet scan | <input checked="" type="checkbox"/> |
| Setting up a voltage scan | <input checked="" type="checkbox"/> |
| Calibrating a magnet and voltage scan | <input checked="" type="checkbox"/> |
| Setting up a sample list | <input checked="" type="checkbox"/> |
| Running a sample list | <input checked="" type="checkbox"/> |
| Configuring a GC inlet | <input checked="" type="checkbox"/> |
| Fitting a GC column to the instrument | <input checked="" type="checkbox"/> |
| Using the inlets | <input checked="" type="checkbox"/> |
| Setting up a GC and autosampler method | <input checked="" type="checkbox"/> |

Data Processing

| | |
|---------------------------------------|-------------------------------------|
| Chromatograph | <input checked="" type="checkbox"/> |
| Spectrum | <input checked="" type="checkbox"/> |
| Applications managers (options) | <input checked="" type="checkbox"/> |
| Libraries (option) | <input checked="" type="checkbox"/> |

Routine Maintenance

| | |
|-----------------------------------|-------------------------------------|
| Venting the source | <input checked="" type="checkbox"/> |
| Venting the analyzer | <input checked="" type="checkbox"/> |
| Changing an inner EI source | <input checked="" type="checkbox"/> |
| Changing an outer EI source | <input checked="" type="checkbox"/> |

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 Shun 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: 余建源
Customer

Date: 2012/10/30

I certify that the installation has been successfully completed.

Signed: Sam Shun Lim
Waters Engineer

Date: 2012/10/30

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | |
|-------------------|---|---------------------------------------|--------------------------|
| Customer : | <u>S.P.S.Consulting Service Co.,Ltd</u> | Date Tested: | <u>July 1, 2025</u> |
| | | Recommendation Recertification | |
| Address : | <u>7 Soi Phaholyothin 24</u> <u>Paholyothin Road</u> <u>Jompol Chatuchak, Bangkok 10900</u> | Period | <u>6</u> Months |
| | | Recertification Due: | <u>January 1, 2026</u> |
| | | Date Last Certified: | <u>January 6, 2025</u> |
| User Name: | <u>K.Phenpha Viphasthawat</u> | Visit Number: | <u>1 of 2</u> |
| Phone: | <u>083-9269252</u> | PerkinElmer Phone: | <u>02-719-6420 ext 8</u> |
| Fax: | <u>02-513-4221</u> | PerkinElmer Fax: | <u>02-318-5597</u> |

| CONFIGURATION TESTED | | |
|----------------------|---------------|-----------------------|
| MODEL | SERIAL NUMBER | SOFTWARE |
| FIAS 100 | 100S14090404 | Syngistix version 7.3 |
| | | |
| | | |
| | | |
| | | |
| | | |
| TEST STANDARD USED | PART NUMBER | EXPIRATION DATE |
| Mercury (Hg) Std | N9300174 | JUN 30, 2026 |
| | | |
| | | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | |
|--|--------------------|---------------------|
| SERIAL NUMBER <u>100S14090404</u> | DATE TESTED | <u>July 1, 2025</u> |
|--|--------------------|---------------------|

1. INSTRUMENT CHECKS

| | |
|---|---|
| A. The light part, quartz windows and detector. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect the mercury lamp. Alignment if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect the mercury filter. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect and clean or replace the dust filter. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| E. Inspect peristaltic pump tubes. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

2. ELECTRONICS CHECKS

| | | |
|------------------------------|-------------------|-------|
| A. Electronic power supplies | | |
| + 5 Volts (\pm 0.3) | <u> </u> | Volts |
| + 15 Volts (\pm 1.0) | <u> </u> | Volts |
| - 15 Volts (\pm 1.0) | <u> </u> | Volts |
| + 40 Volts (\pm 1.0) | <u> </u> | Volts |

3. GAS SYSTEM CHECK

| | |
|---|---|
| A. Leak test all internal and external gas box joints. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect solenoid valve and pressure switch. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect non return valve. Replace sleeve if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect flow meter and needle valve. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

4. MECHANICAL CHECKS

| | |
|---|---|
| A. Inspect pump motor and pump roller. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect and clean switching valve. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect, clean and lubricant autosample. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

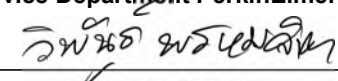
FIAS 100

| | | | | | |
|---|-----------------|---------------|---------------|------------------|--|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| PARAMETER | | | SPECIFICATION | ACTUAL VALUE | |
| 5. PERFORMANCE TEST | | | | | |
| A. Baseline Noise Test | | | | | |
| (measure peak area at 10 replicates without any sample) | | | | | |
| | SD | ≤ 0.0015 A*s | | 0.0025 A*s | |
| B. Sensitivity Check | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | Mean Absorbance | ≥ 0.0800 Abs. | | 0.1201 Abs. | |
| C. Characteristic mass(m_0) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | m_0 | ≤ 314 pg | | 183.2 pg/0.0044A | |
| D. Precision Check (%RSD) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | %RSD | ≤ 2.5 % | | 1.65 % | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | | | |
|--|--------------|--|-------------|--------------|--|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| Remarks : | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| This is to certify that the above tests have been performed and the configuration tested | | | | | |
| <input checked="" type="checkbox"/> meets | | | | | |
| <input type="checkbox"/> does not meet | | | | | |
| the PerkinElmer Specifications listed on this certificate. | | | | | |
| This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms. | | | | | |
| Service Department PerkinElmer Ltd. | | | | | |
| Customer Service Engineer:  | | | | | |
| (Wiphan Promlumda) | | | | | |
| Service Engineer | | | | | |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|-------------------|----------------------------------|---------------------------------------|---------------------|
| Customer : | S.P.S.Consulting Service Co.,Ltd | Date Tested: | July 1, 2025 |
| | | Recommendation Recertification | |
| Address : | 7 Soi Phaholyothin 24 | Period | 6 Months |
| | Paholyothin Road | Recertification Due: | January 1, 2026 |
| | Jompoi Chatuchak, Bangkok 1090 | Date Last Certified: | January 6, 2025 |
| User Name: | K.Phenpha Viphashtawat | Visit Number: | 1of 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, 2024 |
| Wavecal Solution | N058-2152 | March 30, 2024 |
| VIS Wavecal solution | N930-2946 | February 28, 2024 |
| Instrument Cal. STD4 | N930-0221 | November 30, 2024 |
| CUSTOMER SUPPLIED | COMMENTS | CUSTOMER INITIALS |
| 2 % HNO3 | | |
| 10 % HNO3 | | |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| SERIAL NUMBER : <u>077C7042401</u> | | DATE TESTED : <u>July 1, 2025</u> | |
|------------------------------------|---------------|-----------------------------------|-------------|
| PARAMETER | SPECIFICATION | | FINAL VALUE |
| Spectral Resolution : UV | As 193.696 nm | ≤ 0.007 | 0.00570 |
| | Ni 231.604 nm | ≤ 0.008 | 0.00734 |
| | Ni 341.476 nm | ≤ 0.012 | 0.00763 |
| Spectral Resolution : VIS | La 408.672 nm | ≤ 0.020 | 0.01627 |
| | Ba 455.403 nm | ≤ 0.025 | 0.02428 |
| Precision | | | |
| | As 193.656 nm | % RSD < 1.0 | 0.82 % |
| | Zn 213.856 nm | % RSD < 1.0 | 0.83 % |
| | Mn 257.610 nm | % RSD < 1.0 | 0.20 % |
| | La 379.478 nm | % RSD < 1.0 | 0.89 % |
| | Ba 455.403 nm | % RSD < 1.0 | 0.92 % |
| | Ba 493.408 nm | % RSD < 1.0 | 0.75 % |
| 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) | 331.50 ppb |
| | Zn 213.856 nm | 3(sd) | 0.98 ppb |
| | Mn 257.610 nm | 3(sd) | 0.34 ppb |
| | La 379.478 nm | 3(sd) | 2.54 ppb |
| | Ba 455.403 nm | 3(sd) | 2.19 ppb |
| | Ba 493.408 nm | 3(sd) | 4.32 ppb |
| BEC : Axial (IB X 500)/(IS-IB) | Cd 226.502 nm | ≤ 150 ppb | 140.03 |
| BEC : Radial (IB X 1000)/(IS-IB) | Mn 257.610 nm | ≤ 45 ppb | 24.17 |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|---------------|--------------------|-------------|---------------------|
| SERIAL NUMBER | <u>077C7042401</u> | DATE TESTED | <u>July 1, 2025</u> |
|---------------|--------------------|-------------|---------------------|

Remarks :

Commissioning follow as commissioning performance sheets.

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

☒ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative: *[Signature]*

(Wiphan Promlumda)

Service Engineer



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

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

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

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0825/23032

Instrument Type : Gas Chromatography

Model : 3800

Serial Number : 00734

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

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

Date : 02/08/2025

ELECTRONIC TEST

| | | |
|----------------------|--|-------------------------------|
| CPU | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |
| DISPLAY & LED TEST | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |
| VENT TEST | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |
| KEY ECHO TEST | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |
| DESTRUCTION RAM TEST | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detectors (FID Channel-Front)

INJECTOR : 1079 Injector

GC CONDITION:

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

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

Sample: 1 µL Injection FID Test Sample 0.218g/L C14,C15,C16 in hexane (diluted to 30ppm)

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



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

Detector Sensitivity (FID)

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


Temperature Specification

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

Relative Standard Deviation % (%RSD)

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

APPROVAL:

Signature: 

Engineer : Somchai Pohtongkam

Date : 02/08/2025



VARIAN

1/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



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THAI UNIQUE CO., LTD.

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

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

Results Integrated System Testing

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

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

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

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

| | | |
|----------------|--|-------------------------------|
| Compliance | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| Performance by | Sachul P. | |
| Date | 02/08/2025 | |



| | | | |
|-------------|------|------|------------|
| Comments | | | |
| Reviewed by | Watt | Date | 02/08/2025 |



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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 | 3.874 |
| C15 RT 2 | 3.880 |
| C15 RT 3 | 3.875 |
| C15 RT 4 | 3.872 |
| C15 RT 5 | 3.878 |
| C15 RT Average | 3.876 |
| * % RSD (< 0.5 %) | 0.08 |

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

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

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

| | | |
|----------------|--|-------------------------------|
| Compliance | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| Performance by | Sachul P. | |
| Date | 02/08/2025 | |



| | | | |
|-------------|------|------|------------|
| Comments | | | |
| Reviewed by | Watt | Date | 02/08/2025 |



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

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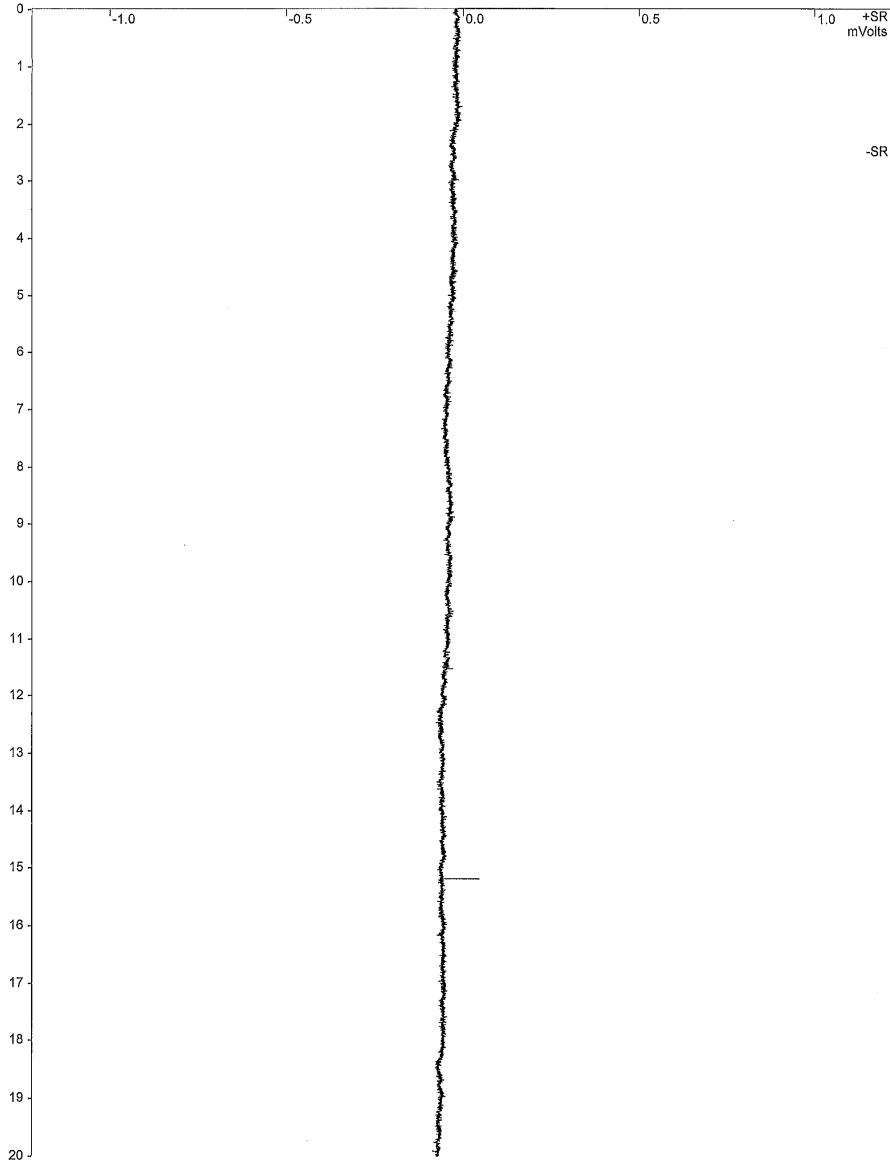
Title :
Run File : e:\sps2025\blk001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : blk

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

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

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

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



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

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

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

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

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

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

Total Unidentified Counts : 0 counts

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

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -14 microVolts LSB: 1 microVolts

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

Manual injection

Data Handling: No peaks

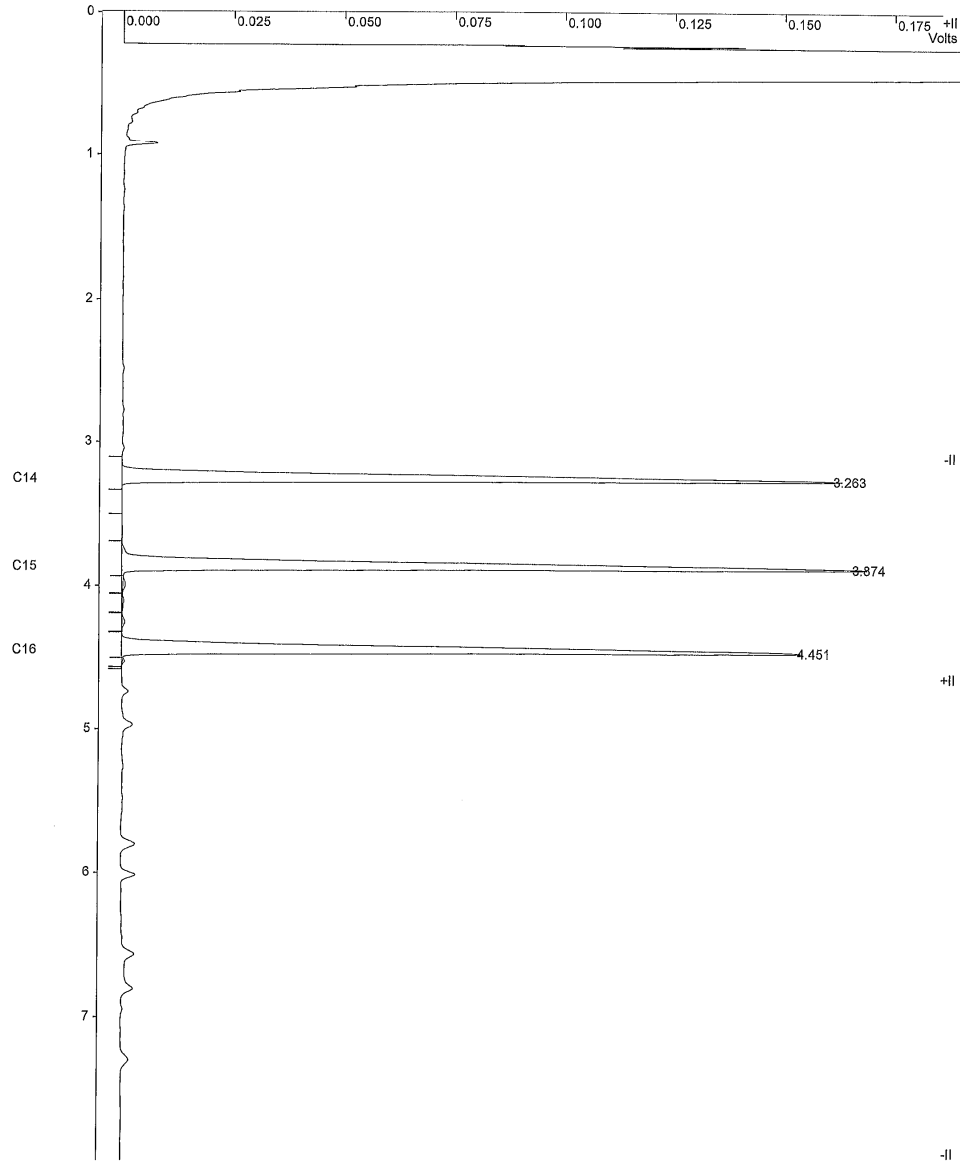
Title :
Run File : e:\sps2025\fidstd001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : fidstd

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

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

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

Chart Speed = 2.83 cm/min Attenuation = 79 Zero Offset = 2%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



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

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

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

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


Run Mode : Calibration
Peak Measurement: Peak Area
Calculation Type: External Standard
Level : 1

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

Total Unidentified Counts : 0 counts
Detected Peaks: 8 Rejected Peaks: 5 Identified Peaks: 3
Multiplier: N/A Divisor: N/A Unidentified Peak Factor: 0
Baseline Offset: 6 microVolts LSB: 1 microVolts
Noise (used): 2 microVolts - monitored before this run
Manual injection

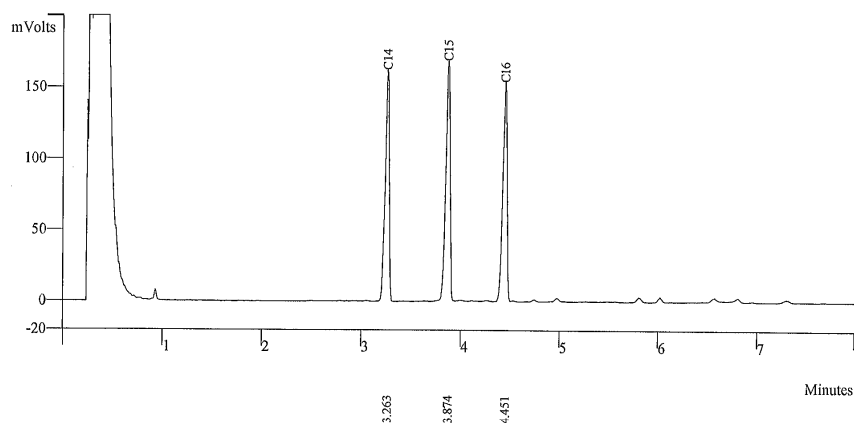
Sample ID: fid std

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


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

e:\sps2025\fidstd001.run

A = FID 10 V RESULTS




| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.263 | 458627 | BB | 2.7 |
| 2 | C15 | 0.0000 | 3.874 | 506043 | VV | 2.8 |
| 3 | C16 | 0.0000 | 4.451 | 460610 | VB | 2.8 |
| Totals | | 0.0000 | | 1425280 | | |



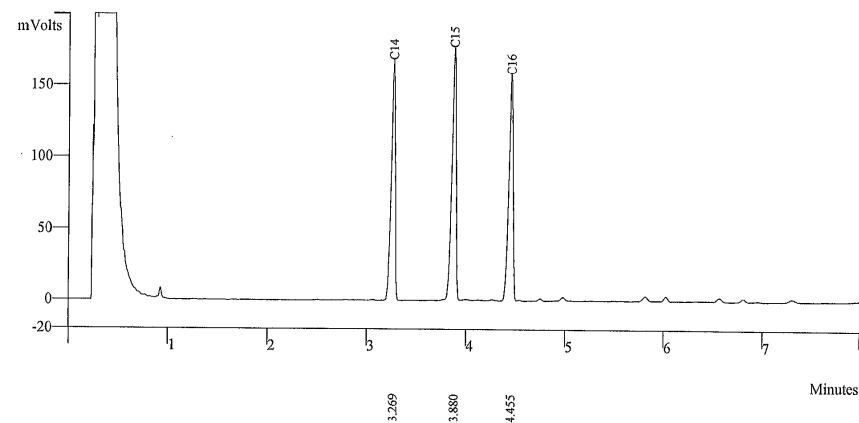
Sample ID: fid std

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


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

e:\sps2025\fidstd002.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.269 | 472338 | BB | 2.6 |
| 2 | C15 | 0.0000 | 3.880 | 520497 | VV | 2.7 |
| 3 | C16 | 0.0000 | 4.455 | 471916 | VB | 2.8 |
| Totals | | 0.0000 | | 1464751 | | |



Sample ID: **fid std**

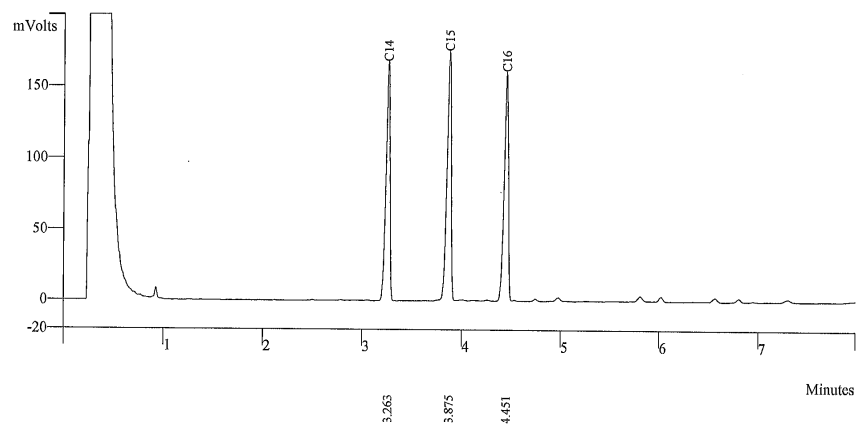
Operator (Inj): watsamon
Injection Date: 02/08/2025
Calc Date: 02/08/2025
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd003.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.263 | 469265 | BB | 2.6 |
| 2 | C15 | 0.0000 | 3.875 | 522154 | VV | 2.8 |
| 3 | C16 | 0.0000 | 4.451 | 478526 | VB | 2.8 |
| Totals | | 0.0000 | | 1469945 | | |

Sample ID: **fid std**

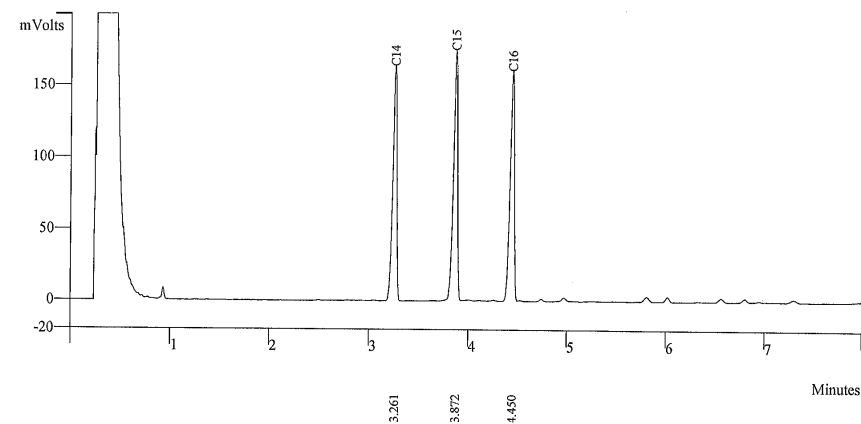
Operator (Inj): watsamon
Injection Date: 02/08/2025
Calc Date: 02/08/2025
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd004.run

A = FID 10 V RESULTS




| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.261 | 468907 | BB | 2.7 |
| 2 | C15 | 0.0000 | 3.872 | 521664 | VV | 2.8 |
| 3 | C16 | 0.0000 | 4.450 | 478772 | VB | 2.8 |
| Totals | | 0.0000 | | 1469343 | | |



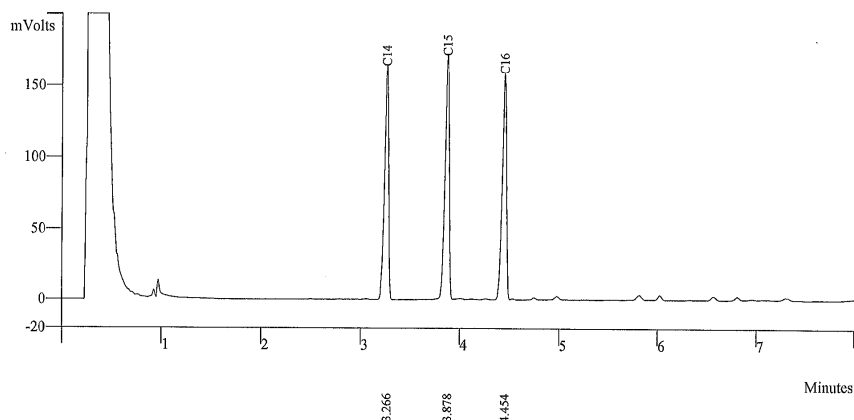
Sample ID: **fid std**

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


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

e:\sps2025\fidstd005.run

A = FID 10 V RESULTS



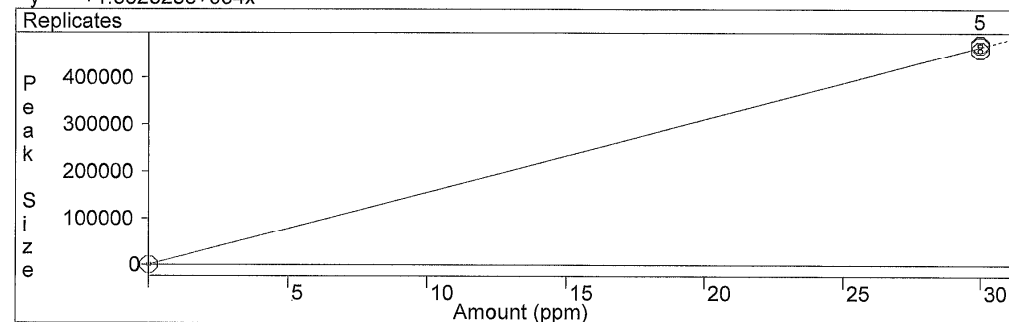
| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.266 | 459351 | BB | 2.6 |
| 2 | C15 | 0.0000 | 3.878 | 509340 | VV | 2.8 |
| 3 | C16 | 0.0000 | 4.454 | 468353 | VB | 2.8 |
| Totals | | 0.0000 | | 1437044 | | |



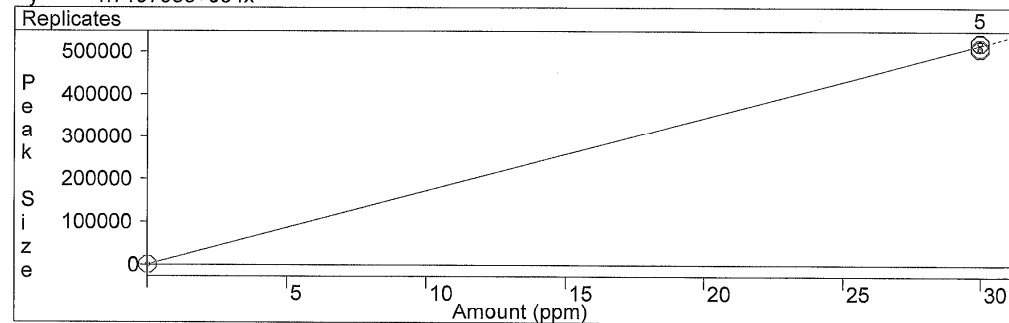
THAI UNIQUE CO.,LTD.

1 Of 1

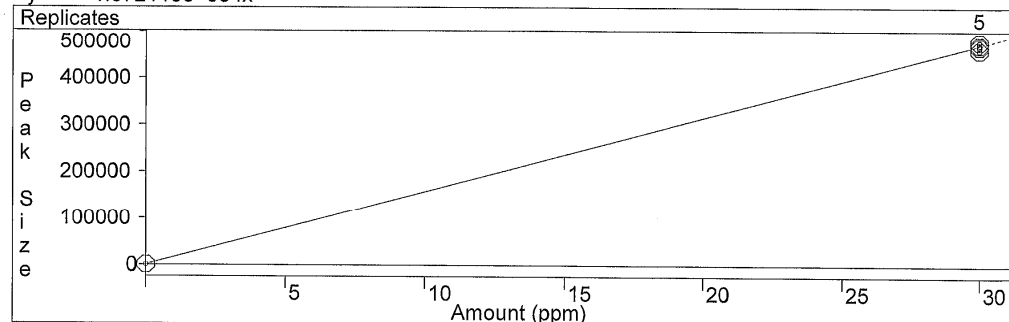
C14
External Standard Analysis
Curve Type: Linear
Origin: Force
 $y = +1.552325e+004x$
Resp. Fact. RSD: 1.347%
Coeff. Det.(r²): 0.999130



C15
External Standard Analysis
Curve Type: Linear
Origin: Force
 $y = +1.719798e+004x$
Resp. Fact. RSD: 1.481%
Coeff. Det.(r²): 0.998948



C16
External Standard Analysis
Curve Type: Linear
Origin: Force
 $y = +1.572118e+004x$
Resp. Fact. RSD: 1.611%
Coeff. Det.(r²): 0.998756



CERTIFICATE

This is to certify, that

Somchai Pohthongkham

has participated the course

Basic GC and Sampler training

Date: **24 – 27 May 2004**

Location: **Middelburg**

Instructor: **W.J. Buys**

Signature instructor: 



Varian Analytical Instruments
Varian Chrompack International BV
Herculesweg 8
P.O. Box 8033
4330 EA Middelburg
The Netherlands

Tel.: +31 118 671000
Fax: +31 118 633118
www.varianinc.com



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.: WK2412-053-1

Page 1 of 2

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

Instrument : AMD Flow Meter
Manufacturer : Agilent Technologies
Model : G6691A
Serial No. : MY16470347
Identity No. : SV-DF-001
Range : 0 ml/min to 750 ml/min
Resolution : See to Data
Calibration Method : CP-WK-M10

Ambient Temperature : (23 ± 2) °C
Humidity : (50 ± 15) %RH
Received Date : 4-Dec-24
Calibrated Date : 11-Dec-24
Issued Date : 13-Dec-24
Calibrated Location : In Lab

Reference standard instruments :


| Instrument | Serial No. | Certificate No. | Due Date | Traceability to |
|-------------------------|------------|-----------------|-----------|-----------------------|
| Flow Calibrator | 140215-134 | L202304114-001 | 18-Apr-25 | MIT |
| Primary Flow Calibrator | 1107-S | WK2405-049-5 | 22-May-25 | WK Electric Co., Ltd. |

MIT : Miracle International Technology Co., Ltd.

This result calibrate was found accurate as shown on date place of calibrate only
This certificate is traceability to the International System of Unit (SI)

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

Calibrated by : Mr.Thippatai Mungpungklang

Approved by : 

Ms. Budsagorn Patcha

Authorized Signatory

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



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



Certificate of Calibration

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

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

This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written 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

Samak

Mr. Samak Uaonkaonoi
Metrology Technician

Approved by

Miss Juthamas Sukhathainirun

Miss Juthamas Sukhathainirun
Cal-Lab Manager



Agilent Technologies

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

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

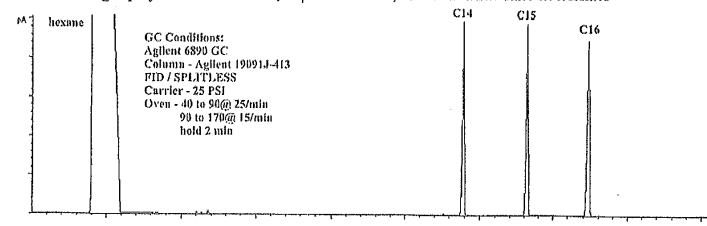
| | | |
|-----------------|---------------------------|-------------|
| Concentrations: | | |
| n-tetradecane | 0.218 g/L ($\pm 0.5\%$) | 0.033 w/w % |
| n-pentadecane | 0.218 g/L ($\pm 0.5\%$) | 0.033 w/w % |
| n-hexadecane | 0.218 g/L ($\pm 0.5\%$) | 0.033 w/w % |

Solvent: hexane

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

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

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



Date of release: 30 June 2023

Date of expiration: 31 July 2025

Monica Bourgeois

Monica Bourgeois
QMS Representative

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

1 / 2

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

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

FM.BLMTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

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
(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 : 2011268021900739001

End of Certificate

2 / 2

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

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FM.BLMTC.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 Bangpoornai, 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

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

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668 Mu 2 Tambon Bangpoornai, Amphoe Muang Samutprakan,
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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



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_415/25

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-B16 | ACO | 6236 | 00172039 | 20 August 2025 | 93.8 | 93.9 |
| ACO-R17 | ACO | 6236 | 00172064 | 20 August 2025 | 93.9 | 93.9 |
| ACO-C1-B04 | ACO | 6238 | 00223041 | 20 August 2025 | 93.9 | 93.9 |
| ACO-C1-B05 | ACO | 6238 | 00223042 | 20 August 2025 | 93.7 | 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 :

Peera Detudom
(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

1 / 2

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

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FM.BLMTC.002 Rev.5



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
(Mr.Weerachai Deechaiyae)

Approved by :

Mr. Prawate Kluaypa
Director
Electrical and Electronic Standards Laboratory

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011268021900739001

End of Certificate

2 / 2

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

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FM.BLMTC.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 Bangpoornai, Amphoe Muang Samutprakan,
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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 : Peera Detudom
(Mr. Peera Detudom)

เอกสารแนบ 5-6

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำเสียจากบ่อกักน้ำเสีย



CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

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

Calibrated By : Sukgasem Seehanart
Wenick 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)

Certificate No. Q25070523

F3-011-05/12-23

page 1 of 4



@clccalibration



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



REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

1. pH Standard Solution, NIMT TRM CODE TRM-S-2003, TRM CODE TRM-S-2007.
2. pH Standard Solution, Control Company Catalog Number 06664260,11754256, Lot Number CC787362.
3. Calibration Bath, 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.

Certificate No. Q25070523

F3-011-05/12-23

page 2 of 4



@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



TRACEABILITY :

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

UNCERTAINTY :

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

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

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

page 3 of 4



CALIBRATION LABORATORY Co.,LTD.

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

| Standard pH Buffer Solution (pH) | pH Meter Reading (pH) | pH Meter Reading (mV) | Correction (pH) | Uncertainty of pH Measurement (\pm pH) | k Factor |
|--|-----------------------------|-----------------------------|--------------------|---|----------|
| 4.003 | 4.005 | 168.2 | -0.002 | 0.010 | 2,00 |
| 7.005 | 7.010 | -8.1 | -0.005 | 0.013 | 2,00 |
| 10.015 | 10.010 | -177.7 | +0.005 | 0.014 | 2,00 |

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

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

2. TEMPERATURE RESULT

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

Technical Note. Type of sensor : Thermistor

Probe \varnothing 3 mm

Materials : Metal Sheath.

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

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

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

End of Certificate

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

page 4 of 4



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 :

(Permon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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%

- o0o -



Cert. No. : SP24020

Pages 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

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

Location : WET CHEMISTRY LABORATORY IV

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

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

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 2 of 3

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

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

UUC* = Unit Under Calibration

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

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

Parameter Setting
 Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm
 Scanning Speed 7.5 nm/min
 Data Pitch 0.1 nm
 Band width(Wavelength) 1.0 nm
 Band width(Vis) 1.0 nm
 Band width(Uv) 1.0 nm

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

T. Petch

Cert. No. : SP25026

Pages : 1 of 4

Calibration Certificate

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

Condition As Found : GOOD

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

Location : ORGANIC LABORATORY IV

Ambient Temperature : (22.9 ± 5) °C

Relative Humidity : (53.7 ± 25) %

Received Date : 22 AUGUST 2025

Calibration Date : 22 AUGUST 2025

Date of Issue : 25 AUGUST 2025

Calibrated by : Nitinun Srihawan

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

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

Cert. No. : SP25026

Job No. : VC68SP0019

Pages : 2 of 4

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

| Material | Ref. type | Cell serial No. | Cert. No. | Due Date |
|--------------------------------|---------------|-----------------|------------|------------|
| Holmium liquid | RM-HL | 29706 | 126461 | 24/10/2026 |
| Didymium liquid | RM-DL | 28912 | 126462 | 24/10/2026 |
| Neutral density filter | RM-1N2N3N | 13877 | 126457 | 24/10/2026 |
| Potassium dichromate solutions | RM-0204060810 | 14204 | 126497 | 25/10/2026 |
| Potassium Iodide solution | - | KI-0701-001 | CI-0185-24 | 14/05/2026 |

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

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

3.1 The UK National Physical Laboratory (NPL)

Result of calibration : Wavelength Accuracy

(Without adjustment)

| Material | Certified Values of Reference Material (nm) | UUC* Reading (nm) | Error (nm) | Uncertainty ± (nm) | k Factor |
|----------|---|-------------------|------------|--------------------|----------|
| RM-HL | 278.13 | 278.21 | 0.08 | 0.16 | 2.00 |
| | 361.25 | 361.39 | 0.14 | 0.16 | 2.00 |
| | 467.82 | 467.71 | -0.11 | 0.16 | 2.00 |
| | 536.56 | 536.50 | -0.06 | 0.16 | 2.00 |
| | 640.50 | 640.36 | -0.14 | 0.16 | 2.00 |
| RM-DL | 740.09 | 739.85 | -0.24 | 0.16 | 2.00 |
| | 864.94 | 865.12 | 0.18 | 0.16 | 2.00 |

UUC* = Unit Under Calibration

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

Result of calibration : Photometric Accuracy

| Material | Wavelength (nm) | Filter S/N | Nominal Absorbance (A) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor |
|------------------------------|--------------------|------------|---------------------------|-----------------------------|--------------------------------|--------------|----------------------|-------------|
| Neutral Density glass filter | 440.0 | 29381 | 0.5 | 0.5443 | 0.5413 | -0.0030 | 0.0043 | 2.00 |
| | | 29914 | 0.7 | 0.7484 | 0.7455 | -0.0029 | 0.0054 | 2.00 |
| | | 29360 | 1.0 | 1.0527 | 1.0535 | 0.0008 | 0.0032 | 2.00 |
| | 465.0 | 29381 | 0.5 | 0.4948 | 0.4922 | -0.0026 | 0.0041 | 2.00 |
| | | 29914 | 0.7 | 0.6906 | 0.6877 | -0.0029 | 0.0050 | 2.00 |
| | | 29360 | 1.0 | 0.9695 | 0.9709 | 0.0014 | 0.0031 | 2.00 |
| | 546.1 | 29381 | 0.5 | 0.5090 | 0.5068 | -0.0022 | 0.0036 | 2.00 |
| | | 29914 | 0.7 | 0.6985 | 0.6960 | -0.0025 | 0.0041 | 2.00 |
| | | 29360 | 1.0 | 0.9814 | 0.9825 | 0.0011 | 0.0031 | 2.00 |
| | 590.0 | 29381 | 0.5 | 0.5375 | 0.5353 | -0.0022 | 0.0034 | 2.00 |
| | | 29914 | 0.7 | 0.7256 | 0.7231 | -0.0025 | 0.0037 | 2.00 |
| | | 29360 | 1.0 | 1.0213 | 1.0219 | 0.0006 | 0.0032 | 2.00 |
| | 635.0 | 29381 | 0.5 | 0.5223 | 0.5202 | -0.0021 | 0.0033 | 2.00 |
| | | 29914 | 0.7 | 0.6927 | 0.6901 | -0.0026 | 0.0036 | 2.00 |
| | | 29360 | 1.0 | 0.9744 | 0.9750 | 0.0006 | 0.0032 | 2.00 |

UUC* = Unit Under Calibration

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

Result of calibration : Photometric Accuracy

(Without adjustment)

| Material | Wavelength (nm) | Solution (mg/l) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor |
|-----------------------------------|--------------------|--------------------|-----------------------------|--------------------------------|--------------|----------------------|-------------|
| Potassium dichromate solutions | 235.0 | 20 | 0.2415 | 0.2443 | 0.0028 | 0.0101 | 2.00 |
| | | 40 | 0.4866 | 0.4871 | 0.0005 | 0.0115 | 2.00 |
| | | 60 | 0.7415 | 0.7295 | -0.0120 | 0.0067 | 2.00 |
| | | 80 | 0.9854 | 0.9844 | -0.0010 | 0.0071 | 2.00 |
| | | 100 | 1.2444 | 1.2425 | -0.0019 | 0.0073 | 2.00 |

UUC* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 190 nm - 1100 nm

Scanning Speed 7.5 nm/min

Band width(Wavelength) 1.0

Band width(Vis) 1.0

Band width(Uv) 1.0

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate



CERTIFICATE No : 25M2256
REFERENCE No : 76365-3

PAGE : 1 OF 2

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.



F-G010 REV 03



CERTIFICATE No : 25M2256

PAGE : 2 OF 2

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 \pm 1mbar CALIBRATION DATE : 07-Mar-25
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0.000071 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm 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



F-G010 REV 03



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



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)



Page 1 of 2

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

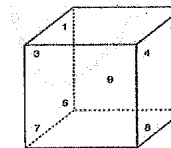
| Calibration Temperature (°C) | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | No. 6 | No. 7 | No. 8 | No. 9 | MPE (±°C) |
|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|
| 35 | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass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

Pass = $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$ MPE = Maximum Permissible Error

Fail = $|\text{error}| + |\text{uncertainty}| > |\text{MPE}|$

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

The measurement 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

Page 2 of 2



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Page 1 of 2

Certificate No. : S2025070410-0003

Date Issued : 24-Jul-25

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 : 22-Jul-25

Date Calibrated : 22-Jul-25

Calibrated by : Auttapol Kunaumpal

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:

K. Nathong
(Nathapong Krudaum)



Certificate No. : S2025070410-0003

Environment : Ambient Temperature : Start record 25.1 °C, Stop record 25.1 °C
Relative Humidity : Start record 48.9 %RH, Stop record 49.3 %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 | 0.13 | 0.37 | 0.57 |
| 41.5 | 41.5 | 41.5 | 0.10 | 0.35 | 0.49 |

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 | 34.97 | 34.91 | 34.96 | 34.82 | 34.81 | 34.86 | 34.83 | 35.11 | 34.95 | 0.23 |
| 41.5 | 41.51 | 41.37 | 41.40 | 41.26 | 41.27 | 41.42 | 41.43 | 41.53 | 41.50 | 0.23 |

STD = Standard

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. OFF



Condition As-Received : Used Item

The measurement 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. L202412300-0027 for Temperature Indicator with Sensor Serial No. US37020317, Due 09-Sep-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

CERT.No.: HS-W015C

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 : 25T0520
REFERENCE No : 75853-1

PAGE : 1 OF 2

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.



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 : 25T0520

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR
MANUFACTURER : HACH
ID NUMBER : DRB 05/59
RECEIVED DATE : 15-Jan-25
AMBIENT TEMPERATURE : 23°C ± 1°C

MODEL : DRB 200
SERIAL NUMBER : 15110C0497
CALIBRATION DATE : 27-Jan-25
RELATIVE HUMIDITY : 53 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|-------------------------------|-------------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH TC TYPE K | HYDRA 2635A | 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

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

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

| 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



F-G010 REV : 03



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwaek Rd. Bangpai Bangae 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 T.
(Sarayuth Tochua)



Page 1 of 2

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) |
|------------------------------|--|--------|--------|--------|--------|-----------------------------------|
| 380 | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | 2.2 |
| | 380.07 | 379.54 | 380.96 | 379.66 | 379.31 | |
| | No. 6 | No. 7 | No. 8 | No. 9 | No. 10 | |
| | 380.63 | 380.22 | 379.71 | 380.41 | 380.72 | |
| | No. 11 | No. 12 | No. 13 | No. 14 | No. 15 | |
| | 380.40 | 380.28 | 380.03 | 379.69 | 380.47 | |
| 380 | No. 16 | No. 17 | No. 18 | No. 19 | No. 20 | 2.2 |
| | 380.11 | 379.97 | 379.93 | 379.81 | 379.58 | |

Decision Rule with Guard Band

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

Pass = $|\text{error}| \leq |\text{MPE}|$ MPE = Maximum Permissible Error

Fail = $|\text{error}| > |\text{MPE}|$

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 measurement 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. 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



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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

CALIBRATION CERTIFICATE

Page 1 of 2

Certificate No. : S2025070410-0004

Date Issued : 24-Jul-25

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 : 22-Jul-25

Date Calibrated : 22-Jul-25

Calibrated by : Auttapol Kunaumpal

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:

K. Nathong
(Nathapong Krudaum)



Certificate No. : S2025070410-0004

Environment : Ambient Temperature : Start record 25.5 °C, Stop record 25.5 °C
Relative Humidity : Start record 50.4 %RH, Stop record 50.1 %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 | 1.03 | 1.73 | 2.57 |

| Calibration Temperature (°C) | Standard Reading (°C), Probe No. 10 is Reference Probe | | | | | Uncertainty ⁴ (±°C) |
|------------------------------|--|--------|--------|--------|--------|-----------------------------------|
| 380 | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | 1.9 |
| | 380.49 | 380.79 | 380.68 | 380.85 | 380.56 | |
| | No. 6 | No. 7 | No. 8 | No. 9 | No. 10 | |
| | 380.60 | 379.85 | 380.28 | 379.65 | 380.55 | |
| | No. 11 | No. 12 | No. 13 | No. 14 | No. 15 | |
| | 380.38 | 380.54 | 380.49 | 380.75 | 380.37 | |
| 380 | No. 16 | No. 17 | No. 18 | No. 19 | No. 20 | 1.9 |
| | 380.25 | 379.64 | 379.73 | 380.52 | 380.79 | |

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 measurement 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. L202502406-0002 for Digital Thermometer with Probe (Agilent) Module 2 (172) Type K Serial No. US37011 Due 10-Oct-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.

End of Certificate

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: | N68APSSFXP |
| 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 | |

Scope

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

General Instructions:

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

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Component List

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

Parts Lists

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

Procedure Checklist

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

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Check incoming AC line voltage for proper levels and grounding.
 L-N 220 Volt
 L-G 220 Volt
 N-G 0.33 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.

- ☒ 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

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

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: | N68APSSFXPMP |
| Customer Name (if applicable): | Ms.Naruecha | PM number: | 2 of 2 |
| Service Engineer Name: | Monchai Kitcharoenkeat | Service Order Number: | WO-06815714 |
| Date PM Performed: (DD-MMM-YYYY) | 13-Aug-2025 | Next PM Due Date: (DD-MMM-YYYY) | 13-Feb-2026 |

| Part Number | Release | Publication Date |  |
|-------------|---------|------------------|---|
| TH09370070 | C | August 2016 | |

Scope

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

General Instructions:

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

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Component List

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

Parts Lists

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

Procedure Checklist

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

1. General:

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

| | | |
|-----|------|------|
| L-N | 220 | Volt |
| L-G | 220 | Volt |
| N-G | 0.32 | 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 | <input checked="" type="checkbox"/> Helium | <input type="checkbox"/> Nitrogen | <input type="checkbox"/> Hydrogen |
| Moisture level | <input checked="" type="checkbox"/> Good | <input type="checkbox"/> Need to replace | <input type="checkbox"/> Other _____ |
| Detector gas | <input checked="" type="checkbox"/> Air Zero | <input checked="" type="checkbox"/> Hydrogen | <input type="checkbox"/> Nitrogen <input type="checkbox"/> Helium |
| Moisture level | <input checked="" type="checkbox"/> Good | <input type="checkbox"/> Need to replace | <input type="checkbox"/> Other _____ |
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Leak check all fittings from the gas source to instrument.

| | | | |
|-------------|--|-------------------------------|---------------|
| Gas leakage | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail | Comment _____ |
|-------------|--|-------------------------------|---------------|
- ☒ Perform general inspection of system for cleanliness.
- ☒ Inspect for functional and clean electronic cooling and oven vent fans

| | | |
|------------------------|---|-----------------------------|
| Electronic cooling fan | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| Oven cooling fan | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |

2. Electronic :

- ☒ Check oven temperature. Calibrate if necessary.

| | | | |
|----------------------------|--------|--|-------------------------------|
| Oven temperature set point | 150 °C | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
|----------------------------|--------|--|-------------------------------|
- ☐ Check sub-ambient option. (If installed).

| | | | |
|----------------------------|------|-------------------------------|-------------------------------|
| Oven temperature set point | 5 °C | <input type="checkbox"/> Pass | <input type="checkbox"/> Fail |
|----------------------------|------|-------------------------------|-------------------------------|
- ☒ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.

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

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

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

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

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

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

| | | |
|--------------------|------|-----|
| Detector Channel A | 0.98 | mV. |
| Detector Channel B | NA | mV. |

3. Diagnostics Tests:

- ☒ Run instrument diagnostics.

| | |
|-------|------|
| BRAM | Pass |
| EPROM | Pass |
- ☒ Run Autosampler diagnostics.

| | |
|-------|------|
| BRAM | Pass |
| EPROM | Pass |

4. Review:

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

Additional Comments

| Additional Comments Regarding the PM |
|--------------------------------------|
| |
| |
| |

Review

| | |
|--|---------------------------------------|
| <i>The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed.</i> | |
| <i>This Clarus600/680 GC Pass the preventive maintenance.</i> | |
| Review of Preventive Maintenance: | |
| Authorized PerkinElmer Representative: Monchai Kitcharoenkeat <i>Monchai</i> | Date: 13-Aug-2025 (DD-MMM-YYYY) |
| Authorized Customer Representative: Ms.Naruecha <i>Naruecha</i> | Date: 13-Aug-2025 (DD-MMM-YYYY) |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|-------------------|----------------------------------|---------------------------------------|---------------------|
| Customer : | S.P.S.Consulting Service Co.,Ltd | Date Tested: | July 1, 2025 |
| | | Recommendation Recertification | |
| Address : | 7 Soi Phaholyothin 24 | Period | 6 Months |
| | Paholyothin Road | Recertification Due: | January 1, 2026 |
| | Jompol Chatuchak, Bangkok 1090 | Date Last Certified: | January 6, 2025 |
| User Name: | K.Phenpha Viphashtawat | Visit Number: | 1of 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, 2024 |
| Wavecal Solution | N058-2152 | March 30, 2024 |
| VIS Wavecal solution | N930-2946 | February 28, 2024 |
| Instrument Cal. STD4 | N930-0221 | November 30, 2024 |
| CUSTOMER SUPPLIED | COMMENTS | CUSTOMER INITIALS |
| 2 % HNO3 | | |
| 10 % HNO3 | | |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| SERIAL NUMBER : <u>077C7042401</u> | | DATE TESTED : <u>July 1, 2025</u> | |
|------------------------------------|---------------|-----------------------------------|-------------|
| PARAMETER | SPECIFICATION | | FINAL VALUE |
| Spectral Resolution : UV | As 193.696 nm | ≤ 0.007 | 0.00570 |
| | Ni 231.604 nm | ≤ 0.008 | 0.00734 |
| | Ni 341.476 nm | ≤ 0.012 | 0.00763 |
| Spectral Resolution : VIS | La 408.672 nm | ≤ 0.020 | 0.01627 |
| | Ba 455.403 nm | ≤ 0.025 | 0.02428 |
| Precision | As 193.656 nm | % RSD < 1.0 | 0.82 % |
| | Zn 213.856 nm | % RSD < 1.0 | 0.83 % |
| | Mn 257.610 nm | % RSD < 1.0 | 0.20 % |
| | La 379.478 nm | % RSD < 1.0 | 0.89 % |
| | Ba 455.403 nm | % RSD < 1.0 | 0.92 % |
| | Ba 493.408 nm | % RSD < 1.0 | 0.75 % |
| 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) | 331.50 ppb |
| | Zn 213.856 nm | 3(sd) | 0.98 ppb |
| | Mn 257.610 nm | 3(sd) | 0.34 ppb |
| | La 379.478 nm | 3(sd) | 2.54 ppb |
| | Ba 455.403 nm | 3(sd) | 2.19 ppb |
| | Ba 493.408 nm | 3(sd) | 4.32 ppb |
| BEC : Axial (IB X 500)/(IS-IB) | Cd 226.502 nm | ≤ 150 ppb | 140.03 |
| BEC : Radial (IB X 1000)/(IS-IB) | Mn 257.610 nm | ≤ 45 ppb | 24.17 |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|---------------|--------------------|-------------|---------------------|
| SERIAL NUMBER | <u>077C7042401</u> | DATE TESTED | <u>July 1, 2025</u> |
|---------------|--------------------|-------------|---------------------|

Remarks :

Commissioning follow as commissioning performance sheets.

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

☒ meets
☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative: *Wiphan Promlumda*

(Wiphan Promlumda)
Service Engineer

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | |
|-------------------|---|---------------------------------------|--------------------------|
| Customer : | <u>S.P.S.Consulting Service Co.,Ltd</u> | Date Tested: | <u>July 1, 2025</u> |
| | | Recommendation Recertification | |
| Address : | <u>7 Soi Phaholyothin 24</u> <u>Paholyothin Road</u> <u>Jompol Chatuchak, Bangkok 10900</u> | Period | <u>6</u> Months |
| | | Recertification Due: | <u>January 1, 2026</u> |
| | | Date Last Certified: | <u>January 6, 2025</u> |
| User Name: | <u>K.Phenpha Viphasthawat</u> | Visit Number: | <u>1 of 2</u> |
| Phone: | <u>083-9269252</u> | PerkinElmer Phone: | <u>02-719-6420 ext 8</u> |
| Fax: | <u>02-513-4221</u> | PerkinElmer Fax: | <u>02-318-5597</u> |

| CONFIGURATION TESTED | | |
|----------------------|---------------|-----------------------|
| MODEL | SERIAL NUMBER | SOFTWARE |
| FIAS 100 | 100S14090404 | Syngistix version 7.3 |
| | | |
| | | |
| | | |
| | | |
| | | |
| TEST STANDARD USED | PART NUMBER | EXPIRATION DATE |
| Mercury (Hg) Std | N9300174 | JUN 30, 2026 |
| | | |
| | | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | |
|--|--------------------|---------------------|
| SERIAL NUMBER <u>100S14090404</u> | DATE TESTED | <u>July 1, 2025</u> |
|--|--------------------|---------------------|

1. INSTRUMENT CHECKS

| | |
|---|---|
| A. The light part, quartz windows and detector. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect the mercury lamp. Alignment if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect the mercury filter. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect and clean or replace the dust filter. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| E. Inspect peristaltic pump tubes. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

2. ELECTRONICS CHECKS

| | | |
|------------------------------|-------------------|-------|
| A. Electronic power supplies | | |
| + 5 Volts (\pm 0.3) | <u> </u> | Volts |
| + 15 Volts (\pm 1.0) | <u> </u> | Volts |
| - 15 Volts (\pm 1.0) | <u> </u> | Volts |
| + 40 Volts (\pm 1.0) | <u> </u> | Volts |

3. GAS SYSTEM CHECK

| | |
|---|---|
| A. Leak test all internal and external gas box joints. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect solenoid valve and pressure switch. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect non return valve. Replace sleeve if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect flow meter and needle valve. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

4. MECHANICAL CHECKS

| | |
|---|---|
| A. Inspect pump motor and pump roller. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect and clean switching valve. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect, clean and lubricant autosample. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

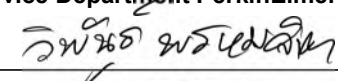
FIAS 100

| | | | | | |
|---|-----------------|--|--------------------|--------------|------------------|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| PARAMETER | | | SPECIFICATION | ACTUAL VALUE | |
| 5. PERFORMANCE TEST | | | | | |
| A. Baseline Noise Test | | | | | |
| (measure peak area at 10 replicates without any sample) | | | | | |
| | SD | | ≤ 0.0015 A*s | | 0.0025 A*s |
| B. Sensitivity Check | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | Mean Absorbance | | ≥ 0.0800 Abs. | | 0.1201 Abs. |
| C. Characteristic mass(m_0) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | m_0 | | ≤ 314 pg | | 183.2 pg/0.0044A |
| D. Precision Check (%RSD) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | %RSD | | ≤ 2.5 % | | 1.65 % |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | | | |
|--|--------------|--|-------------|--------------|--|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| Remarks : | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| This is to certify that the above tests have been performed and the configuration tested | | | | | |
| <input checked="" type="checkbox"/> meets | | | | | |
| <input type="checkbox"/> does not meet | | | | | |
| the PerkinElmer Specifications listed on this certificate. | | | | | |
| This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms. | | | | | |
| Service Department PerkinElmer Ltd. | | | | | |
| Customer Service Engineer:  | | | | | |
| (Wiphan Promlumda) | | | | | |
| Service Engineer | | | | | |

เอกสารแนบ 5-7

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำฝน



CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

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

Calibrated By : Sukgasem Seehanart
Wenick 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)

Certificate No. Q25070523

F3-011-05/12-23

page 1 of 4



@clccalibration



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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

PROCEDURE USED :

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

This instrument was calibrated under procedure No. CLC-CPH-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.

Certificate No. Q25070523

F3-011-05/12-23

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@clccalibration



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TRACEABILITY :

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

UNCERTAINTY :

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

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

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

page 3 of 4



CALIBRATION LABORATORY Co.,LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

| Standard pH Buffer Solution (pH) | pH Meter Reading (pH) | pH Meter Reading (mV) | Correction (pH) | Uncertainty of pH Measurement (\pm pH) | k Factor |
|--|-----------------------------|-----------------------------|--------------------|---|----------|
| 4.003 | 4.005 | 168.2 | -0.002 | 0.010 | 2,00 |
| 7.005 | 7.010 | -8.1 | -0.005 | 0.013 | 2,00 |
| 10.015 | 10.010 | -177.7 | +0.005 | 0.014 | 2,00 |

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

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

2. TEMPERATURE RESULT

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

Technical Note. Type of sensor : Thermistor

Probe \varnothing 3 mm

Materials : Metal Sheath.

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

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

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

End of Certificate

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

page 4 of 4



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 :

(Permon Chanpu)

Supervisor

The Uncertainties are for a confidence probability of approximately 95%

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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%

- o0o -





CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : 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 Sechanart
Wenick Inchaistri
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)

Certificate No. Q25013412

F3-011-05/12-23

page 1 of 4



CALIBRATION LABORATORY Co.,LTD.

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



REPORT OF CALIBRATION

FOR

NOMENCLATURE : 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 : $(25 \pm 2.5) ^\circ\text{C}$

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

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.

Certificate No. Q25013412

F3-011-05/12-23

page 2 of 4





CALIBRATION LABORATORY Co.,LTD.

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



TRACEABILITY :

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

Certificate No. Q25013412

F3-011-05/12-23

page 3 of 4



CALIBRATION LABORATORY Co.,LTD.

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

The table in the following gives the calibration results and associated measurement uncertainties of 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

Certificate No. Q25013412

F3-011-05/12-23

page 4 of 4



CERT.No.: HS-W015C

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



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)



Page 1 of 2

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

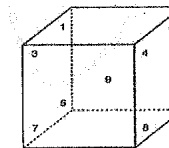
| Calibration Temperature (°C) | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | No. 6 | No. 7 | No. 8 | No. 9 | MPE (±°C) |
|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|
| 35 | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass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

Pass = $|\text{error}| + |\text{uncertainty}| \leq |\text{MPE}|$ MPE = Maximum Permissible Error

Fail = $|\text{error}| + |\text{uncertainty}| > |\text{MPE}|$

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. 0



Condition As-Received : Used Item

The measurement 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

Page 2 of 2



MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

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



CALIBRATION CERTIFICATE

Page 1 of 2

Certificate No. : S2025070410-0003

Date Issued : 24-Jul-25

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 : 22-Jul-25

Date Calibrated : 22-Jul-25

Calibrated by : Auttapol Kunaumpal

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:

K. Nathong
(Nathapong Krudaum)



Certificate No. : S2025070410-0003

Environment : Ambient Temperature : Start record 25.1 °C, Stop record 25.1 °C
Relative Humidity : Start record 48.9 %RH, Stop record 49.3 %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 | 0.13 | 0.37 | 0.57 |
| 41.5 | 41.5 | 41.5 | 0.10 | 0.35 | 0.49 |

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 | 34.97 | 34.91 | 34.96 | 34.82 | 34.81 | 34.86 | 34.83 | 35.11 | 34.95 | 0.23 |
| 41.5 | 41.51 | 41.37 | 41.40 | 41.26 | 41.27 | 41.42 | 41.43 | 41.53 | 41.50 | 0.23 |

STD = Standard

Note : Probe No. 9 is Reference Probe

Setting Air Fresh No. OFF



Condition As-Received : Used Item

The measurement 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. L202412300-0027 for Temperature Indicator with Sensor Serial No. US37020317, Due 09-Sep-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



CERTIFICATE No : 25T2261

REFERENCE No : 76365-8

PAGE : 1 OF 2

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 : PONGSUK J.

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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



CERTIFICATE No : 25T2261

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

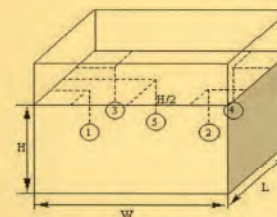
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE 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



Cert. No. : SP24020

Pages 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

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

Location : WET CHEMISTRY LABORATORY IV

Ambient Temperature : (28.1 ± 5) °C

Relative Humidity : (47.2 ± 25) %

Received Date : 27 AUGUST 2024

Calibration Date : 27 AUGUST 2024

Date of Issue : 27 AUGUST 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 2 of 3

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Certified reference materials

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

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

Result of calibration : Wavelength Accuracy

(Without adjustment)

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

UUC* = Unit Under Calibration

T. Petchurai

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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



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

Result of calibration : Photometric Accuracy

(Without adjustment)

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

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

UUC* = Unit Under Calibration

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

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

Parameter Setting
 Measurement Mode Wavelength, Absorbance

Wavelength Scan 1100 nm-190 nm
 Scanning Speed 7.5 nm/min
 Data Pitch 0.1 nm
 Band width(Wavelength) 1.0 nm
 Band width(Vis) 1.0 nm
 Band width(Uv) 1.0 nm

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

T. Petch

Cert. No. : SP25026

Pages : 1 of 4

Calibration Certificate

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

Condition As Found : GOOD

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

Location : ORGANIC LABORATORY IV

Ambient Temperature : (22.9 ± 5) °C

Relative Humidity : (53.7 ± 25) %

Received Date : 22 AUGUST 2025

Calibration Date : 22 AUGUST 2025

Date of Issue : 25 AUGUST 2025

Calibrated by : Nitinun Srihawan

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

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

Cert. No. : SP25026

Job No. : VC68SP0019

Pages : 2 of 4

Calibration Method :

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

Condition of this result of calibration :

1. Certified reference materials

| Material | Ref. type | Cell serial No. | Cert. No. | Due Date |
|--------------------------------|---------------|-----------------|------------|------------|
| Holmium liquid | RM-HL | 29706 | 126461 | 24/10/2026 |
| Didymium liquid | RM-DL | 28912 | 126462 | 24/10/2026 |
| Neutral density filter | RM-1N2N3N | 13877 | 126457 | 24/10/2026 |
| Potassium dichromate solutions | RM-0204060810 | 14204 | 126497 | 25/10/2026 |
| Potassium Iodide solution | - | KI-0701-001 | CI-0185-24 | 14/05/2026 |

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

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

3.1 The UK National Physical Laboratory (NPL)

Result of calibration : Wavelength Accuracy

(Without adjustment)

| Material | Certified Values of Reference Material (nm) | UUC* Reading (nm) | Error (nm) | Uncertainty ± (nm) | k Factor |
|----------|---|-------------------|------------|--------------------|----------|
| RM-HL | 278.13 | 278.21 | 0.08 | 0.16 | 2.00 |
| | 361.25 | 361.39 | 0.14 | 0.16 | 2.00 |
| | 467.82 | 467.71 | -0.11 | 0.16 | 2.00 |
| | 536.56 | 536.50 | -0.06 | 0.16 | 2.00 |
| | 640.50 | 640.36 | -0.14 | 0.16 | 2.00 |
| RM-DL | 740.09 | 739.85 | -0.24 | 0.16 | 2.00 |
| | 864.94 | 865.12 | 0.18 | 0.16 | 2.00 |

UUC* = Unit Under Calibration

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

Result of calibration : Photometric Accuracy

| Material | Wavelength (nm) | Filter S/N | Nominal Absorbance (A) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor |
|------------------------------|--------------------|------------|---------------------------|-----------------------------|--------------------------------|--------------|----------------------|-------------|
| Neutral Density glass filter | 440.0 | 29381 | 0.5 | 0.5443 | 0.5413 | -0.0030 | 0.0043 | 2.00 |
| | | 29914 | 0.7 | 0.7484 | 0.7455 | -0.0029 | 0.0054 | 2.00 |
| | | 29360 | 1.0 | 1.0527 | 1.0535 | 0.0008 | 0.0032 | 2.00 |
| | 465.0 | 29381 | 0.5 | 0.4948 | 0.4922 | -0.0026 | 0.0041 | 2.00 |
| | | 29914 | 0.7 | 0.6906 | 0.6877 | -0.0029 | 0.0050 | 2.00 |
| | | 29360 | 1.0 | 0.9695 | 0.9709 | 0.0014 | 0.0031 | 2.00 |
| | 546.1 | 29381 | 0.5 | 0.5090 | 0.5068 | -0.0022 | 0.0036 | 2.00 |
| | | 29914 | 0.7 | 0.6985 | 0.6960 | -0.0025 | 0.0041 | 2.00 |
| | | 29360 | 1.0 | 0.9814 | 0.9825 | 0.0011 | 0.0031 | 2.00 |
| | 590.0 | 29381 | 0.5 | 0.5375 | 0.5353 | -0.0022 | 0.0034 | 2.00 |
| | | 29914 | 0.7 | 0.7256 | 0.7231 | -0.0025 | 0.0037 | 2.00 |
| | | 29360 | 1.0 | 1.0213 | 1.0219 | 0.0006 | 0.0032 | 2.00 |
| | 635.0 | 29381 | 0.5 | 0.5223 | 0.5202 | -0.0021 | 0.0033 | 2.00 |
| | | 29914 | 0.7 | 0.6927 | 0.6901 | -0.0026 | 0.0036 | 2.00 |
| | | 29360 | 1.0 | 0.9744 | 0.9750 | 0.0006 | 0.0032 | 2.00 |

UUC* = Unit Under Calibration

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

Result of calibration : Photometric Accuracy

(Without adjustment)

| Material | Wavelength (nm) | Solution (mg/l) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor |
|-----------------------------------|--------------------|--------------------|-----------------------------|--------------------------------|--------------|----------------------|-------------|
| Potassium dichromate solutions | 235.0 | 20 | 0.2415 | 0.2443 | 0.0028 | 0.0101 | 2.00 |
| | | 40 | 0.4866 | 0.4871 | 0.0005 | 0.0115 | 2.00 |
| | | 60 | 0.7415 | 0.7295 | -0.0120 | 0.0067 | 2.00 |
| | | 80 | 0.9854 | 0.9844 | -0.0010 | 0.0071 | 2.00 |
| | | 100 | 1.2444 | 1.2425 | -0.0019 | 0.0073 | 2.00 |

UUC* = Unit Under Calibration

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

Resolution of Wavelength Mode 0.1 nm

Resolution of Photometric Mode 0.001 A

Parameter Setting

Measurement Mode Wavelength, Absorbance

Wavelength Scan 190 nm - 1100 nm

Scanning Speed 7.5 nm/min

Band width(Wavelength) 1.0

Band width(Vis) 1.0

Band width(Uv) 1.0

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|-------------------|----------------------------------|---------------------------------------|---------------------|
| Customer : | S.P.S.Consulting Service Co.,Ltd | Date Tested: | July 1, 2025 |
| | | Recommendation Recertification | |
| Address : | 7 Soi Phaholyothin 24 | Period | 6 Months |
| | Paholyothin Road | Recertification Due: | January 1, 2026 |
| | Jompoi Chatuchak, Bangkok 1090 | Date Last Certified: | January 6, 2025 |
| User Name: | K.Phenpha Viphashtawat | Visit Number: | 1of 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, 2024 |
| Wavecal Solution | N058-2152 | March 30, 2024 |
| VIS Wavecal solution | N930-2946 | February 28, 2024 |
| Instrument Cal. STD4 | N930-0221 | November 30, 2024 |
| CUSTOMER SUPPLIED | COMMENTS | CUSTOMER INITIALS |
| 2 % HNO3 | | |
| 10 % HNO3 | | |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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



MAINTENANCE AND TEST CERTIFICATE MODEL

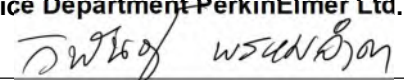
OPTIMA 5300DV

| SERIAL NUMBER : 077C7042401 | | DATE TESTED : July 1, 2025 | |
|----------------------------------|---------------|----------------------------|------------|
| PARAMETER | SPECIFICATION | FINAL VALUE | |
| Spectral Resolution : UV | As 193.696 nm | ≤ 0.007 | 0.00570 |
| | Ni 231.604 nm | ≤ 0.008 | 0.00734 |
| | Ni 341.476 nm | ≤ 0.012 | 0.00763 |
| Spectral Resolution : VIS | La 408.672 nm | ≤ 0.020 | 0.01627 |
| | Ba 455.403 nm | ≤ 0.025 | 0.02428 |
| Precision | As 193.656 nm | % RSD < 1.0 | 0.82 % |
| | Zn 213.856 nm | % RSD < 1.0 | 0.83 % |
| | Mn 257.610 nm | % RSD < 1.0 | 0.20 % |
| | La 379.478 nm | % RSD < 1.0 | 0.89 % |
| | Ba 455.403 nm | % RSD < 1.0 | 0.92 % |
| | Ba 493.408 nm | % RSD < 1.0 | 0.75 % |
| 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) | 331.50 ppb |
| | Zn 213.856 nm | 3(sd) | 0.98 ppb |
| | Mn 257.610 nm | 3(sd) | 0.34 ppb |
| | La 379.478 nm | 3(sd) | 2.54 ppb |
| | Ba 455.403 nm | 3(sd) | 2.19 ppb |
| | Ba 493.408 nm | 3(sd) | 4.32 ppb |
| BEC : Axial (IB X 500)/(IS-IB) | Cd 226.502 nm | ≤ 150 ppb | 140.03 |
| BEC : Radial (IB X 1000)/(IS-IB) | Mn 257.610 nm | ≤ 45 ppb | 24.17 |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| SERIAL NUMBER | 077C7042401 | DATE TESTED | July 1, 2025 |
|--|-------------|-------------|--------------|
| Remarks : | | | |
| Commissioning follow as commissioning performance sheets. | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| This is to certify that the above tests have been performed and the configuration tested | | | |
| <input checked="" type="checkbox"/> meets | | | |
| <input type="checkbox"/> does not meet | | | |
| the PerkinElmer Specifications listed on this certificate. | | | |
| This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms. | | | |
| Service Department PerkinElmer Ltd. | | | |
| Authorized Representative:  | | | |
| (Wiphan Promlumda) | | | |
| Service Engineer | | | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | |
|---------------------------------|----------------------------------|--------------------------------|-------------------|
| Customer : | S.P.S.Consulting Service Co.,Ltd | Date Tested: | July 1, 2025 |
| | | Recommendation Recertification | |
| Address : | 7 Soi Phaholyothin 24 | Period | 6 Months |
| Paholyothin Road | | Recertification Due: | January 1, 2026 |
| Jompol Chatuchak, Bangkok 10900 | | Date Last Certified: | January 6, 2025 |
| User Name: | K.Phenpa Vipasthawat | Visit Number: | 1 of 2 |
| Phone: | 083-9269252 | PerkinElmer Phone: | 02-719-6420 ext 8 |
| Fax: | 02-513-4221 | PerkinElmer Fax: | 02-318-5597 |

| CONFIGURATION TESTED | | |
|----------------------|---------------|-----------------------|
| MODEL | SERIAL NUMBER | SOFTWARE |
| FIAS 100 | 100S14090404 | Syngistix version 7.3 |
| | | |
| | | |
| | | |
| | | |
| | | |
| TEST STANDARD USED | PART NUMBER | EXPIRATION DATE |
| Mercury (Hg) Std | N9300174 | JUN 30, 2026 |
| | | |
| | | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | |
|----------------------|---------------------|--|
| SERIAL NUMBER | DATE TESTED | |
| <u>100S14090404</u> | <u>July 1, 2025</u> | |

1. INSTRUMENT CHECKS

| | |
|---|---|
| A. The light part, quartz windows and detector. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect the mercury lamp. Alignment if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect the mercury filter. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect and clean or replace the dust filter. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| E. Inspect peristaltic pump tubes. Replace if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

2. ELECTRONICS CHECKS

| | | |
|------------------------------|--------------|-------|
| A. Electronic power supplies | | |
| + 5 Volts (\pm 0.3) | <u>4.98</u> | Volts |
| + 15 Volts (\pm 1.0) | <u>15.03</u> | Volts |
| - 15 Volts (\pm 1.0) | <u>15.07</u> | Volts |
| + 40 Volts (\pm 1.0) | <u>40.02</u> | Volts |

3. GAS SYSTEM CHECK

| | |
|---|---|
| A. Leak test all internal and external gas box joints. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect solenoid valve and pressure switch. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect non return valve. Replace sleeve if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| D. Inspect flow meter and needle valve. Clean if necessary. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

4. MECHANICAL CHECKS

| | |
|---|---|
| A. Inspect pump motor and pump roller. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| B. Inspect and clean switching valve. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |
| C. Inspect, clean and lubricant autosample. | <div style="border: 1px solid black; padding: 2px; display: inline-block;">OK</div> |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

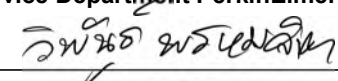
FIAS 100

| | | | | | |
|---|-----------------|--|---------------|--------------|------------------|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| PARAMETER | | | SPECIFICATION | ACTUAL VALUE | |
| 5. PERFORMANCE TEST | | | | | |
| A. Baseline Noise Test | | | | | |
| (measure peak area at 10 replicates without any sample) | | | | | |
| | SD | | ≤ 0.0015 A*s | | 0.0025 A*s |
| B. Sensitivity Check | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | Mean Absorbance | | ≥ 0.0800 Abs. | | 0.1201 Abs. |
| C. Characteristic mass(m_0) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | m_0 | | ≤ 314 pg | | 183.2 pg/0.0044A |
| D. Precision Check (%RSD) | | | | | |
| (10 ppb Hg Standard at 11 replicates) | | | | | |
| | %RSD | | ≤ 2.5 % | | 1.65 % |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

FLOW INJECTION MERCURY SYSTEMS MODEL

FIAS 100

| | | | | | |
|--|--------------|--|-------------|--------------|--|
| SERIAL NUMBER | 100S14090404 | | DATE TESTED | July 1, 2025 | |
| Remarks : | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| _____ | | | | | |
| This is to certify that the above tests have been performed and the configuration tested | | | | | |
| <input checked="" type="checkbox"/> meets | | | | | |
| <input type="checkbox"/> does not meet | | | | | |
| the PerkinElmer Specifications listed on this certificate. | | | | | |
| This certificate does not modify PerkinElmer's standard terms and condition of sale, including warranty terms. | | | | | |
| Service Department PerkinElmer Ltd. | | | | | |
| Customer Service Engineer:  | | | | | |
| (Wiphan Promlumda) | | | | | |
| Service Engineer | | | | | |

เอกสารแนบ 5-8

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพน้ำในบ่อสังเกตการณ์
การรั่วซึมของถังเก็บน้ำเสีย



CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

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

Calibrated By : Sukgasem Seehanart
Wenick 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)

Certificate No. Q25070523

F3-011-05/12-23

page 1 of 4



@clccalibration



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



REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

PROCEDURE USED :

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

This instrument was calibrated under procedure No. CLC-CPH-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.

Certificate No. Q25070523

F3-011-05/12-23

page 2 of 4



@clccalibration



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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



TRACEABILITY :

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

UNCERTAINTY :

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

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

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

page 3 of 4



CALIBRATION LABORATORY Co.,LTD.

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

| Standard pH Buffer Solution (pH) | pH Meter Reading (pH) | pH Meter Reading (mV) | Correction (pH) | Uncertainty of pH Measurement (\pm pH) | k Factor |
|--|-----------------------------|-----------------------------|--------------------|---|----------|
| 4.003 | 4.005 | 168.2 | -0.002 | 0.010 | 2,00 |
| 7.005 | 7.010 | -8.1 | -0.005 | 0.013 | 2,00 |
| 10.015 | 10.010 | -177.7 | +0.005 | 0.014 | 2,00 |

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

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

2. TEMPERATURE RESULT

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

Technical Note. Type of sensor : Thermistor

Probe \varnothing 3 mm

Materials : Metal Sheath.

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

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

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

End of Certificate

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

page 4 of 4





CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : 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 Sechanart
Wenick Inchaistri
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)

Certificate No. Q25013412

F3-011-05/12-23

page 1 of 4



@clccalibration



CALIBRATION LABORATORY Co.,LTD.

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



REPORT OF CALIBRATION

FOR

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

PROCEDURE USED :

This instrument [Conductivity Meter] was calibrated under procedure No. W1-305-130.

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.

Certificate No. Q25013412

F3-011-05/12-23

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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. 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)"

Certificate No. Q25013412

F3-011-05/12-23

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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

Certificate No. Q25013412

F3-011-05/12-23

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@clccalibration



CERTIFICATE No : 25M2256
REFERENCE No : 76365-3

PAGE : 1 OF 2

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.



CERTIFICATE No : 25M2256

PAGE : 2 OF 2

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 \pm 1mbar CALIBRATION DATE : 07-Mar-25
AMBIENT TEMPERATURE : 24°C \pm 1°C RELATIVE HUMIDITY : 52 %RH \pm 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

- ZERO SETTING FUNCTION : NORMAL
- TARE FUNCTION : NORMAL
- REPEATABILITY OF READING AT 200 g WAS 0.000071 g
- DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm 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



CERT.No.: HS-W015C

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 : 25T0520
REFERENCE No : 75853-1

PAGE : 1 OF 2

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.



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 : 25T0520

PAGE : 2 OF 2

Calibration Report

EQUIPMENT : COD REACTOR

MANUFACTURER : HACH

ID NUMBER : DRB 05/59

RECEIVED DATE : 15-Jan-25

AMBIENT TEMPERATURE : 23°C ± 1°C

MODEL : DRB 200

SERIAL NUMBER : 15110C0497

CALIBRATION DATE : 27-Jan-25

RELATIVE HUMIDITY : 53 %RH ± 10 % RH

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

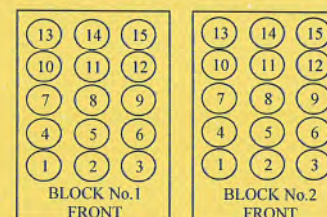
| INSTRUMENT | MODEL | SERIAL No | CERTIFICATE No | DUE DATE |
|-------------------------------|-------------|-----------|----------------|-----------|
| 1) DATA LOGGER WITH TC TYPE K | HYDRA 2635A | 6635300 | 24T6468 | 26-Jun-25 |

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



F-G010 REV : 03

เอกสารแนบ 5-9

เอกสารสอบเทียบเครื่องมือการตรวจวัดคุณภาพดินและน้ำใต้ดิน



CALIBRATION LABORATORY Co.,LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : pH METER
MANUFACTURER : HANNA
MODEL / TYPE : HI3512/HI1332/HI7662-T
SERIAL NO. : 08685754/11250B7M/092806BN[PH04/56]
CLID. NO. : 272501562
JOB CONTROL NO. : 250617070523
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 17 June 2025

DATE OF ISSUED : 20 June 2025

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

Calibrated By : Sukgasem Seehanart
Wenick Inchaistri
Calibration Engineer

Approved By : Mongkol Yotsoontorn
Authorized Signatory
20 June 2025



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

Certificate No. Q25070523

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REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

PROCEDURE USED :

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

This instrument was calibrated under procedure No. CLC-CPH-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.

Certificate No. Q25070523

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TRACEABILITY :

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

UNCERTAINTY :

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

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

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

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. pH METER RESULT @ 25 °C

| Standard pH Buffer Solution (pH) | pH Meter Reading (pH) | pH Meter Reading (mV) | Correction (pH) | Uncertainty of pH Measurement (\pm pH) | k Factor |
|--|-----------------------------|-----------------------------|--------------------|---|----------|
| 4.003 | 4.005 | 168.2 | -0.002 | 0.010 | 2,00 |
| 7.005 | 7.010 | -8.1 | -0.005 | 0.013 | 2,00 |
| 10.015 | 10.010 | -177.7 | +0.005 | 0.014 | 2,00 |

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

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

2. TEMPERATURE RESULT

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

Technical Note. Type of sensor : Thermistor

Probe \varnothing 3 mm

Materials : Metal Sheath.

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

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

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

End of Certificate

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

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MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|-------------------|----------------------------------|---------------------------------------|---------------------|
| Customer : | S.P.S.Consulting Service Co.,Ltd | Date Tested: | July 1, 2025 |
| | | Recommendation Recertification | |
| Address : | 7 Soi Phaholyothin 24 | Period | 6 Months |
| | Paholyothin Road | Recertification Due: | January 1, 2026 |
| | Jompoi Chatuchak, Bangkok 1090 | Date Last Certified: | January 6, 2025 |
| User Name: | K.Phenpha Viphashtawat | Visit Number: | 1of 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, 2024 |
| Wavecal Solution | N058-2152 | March 30, 2024 |
| VIS Wavecal solution | N930-2946 | February 28, 2024 |
| Instrument Cal. STD4 | N930-0221 | November 30, 2024 |
| CUSTOMER SUPPLIED | COMMENTS | CUSTOMER INITIALS |
| 2 % HNO3 | | |
| 10 % HNO3 | | |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| SERIAL NUMBER : <u>077C7042401</u> | | DATE TESTED : <u>July 1, 2025</u> | |
|------------------------------------|---------------|-----------------------------------|-------------|
| PARAMETER | SPECIFICATION | | FINAL VALUE |
| Spectral Resolution : UV | As 193.696 nm | ≤ 0.007 | 0.00570 |
| | Ni 231.604 nm | ≤ 0.008 | 0.00734 |
| | Ni 341.476 nm | ≤ 0.012 | 0.00763 |
| Spectral Resolution : VIS | La 408.672 nm | ≤ 0.020 | 0.01627 |
| | Ba 455.403 nm | ≤ 0.025 | 0.02428 |
| Precision | | | |
| | As 193.656 nm | % RSD < 1.0 | 0.82 % |
| | Zn 213.856 nm | % RSD < 1.0 | 0.83 % |
| | Mn 257.610 nm | % RSD < 1.0 | 0.20 % |
| | La 379.478 nm | % RSD < 1.0 | 0.89 % |
| | Ba 455.403 nm | % RSD < 1.0 | 0.92 % |
| | Ba 493.408 nm | % RSD < 1.0 | 0.75 % |
| 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) | 331.50 ppb |
| | Zn 213.856 nm | 3(sd) | 0.98 ppb |
| | Mn 257.610 nm | 3(sd) | 0.34 ppb |
| | La 379.478 nm | 3(sd) | 2.54 ppb |
| | Ba 455.403 nm | 3(sd) | 2.19 ppb |
| | Ba 493.408 nm | 3(sd) | 4.32 ppb |
| BEC : Axial (IB X 500)/(IS-IB) | Cd 226.502 nm | ≤ 150 ppb | 140.03 |
| BEC : Radial (IB X 1000)/(IS-IB) | Mn 257.610 nm | ≤ 45 ppb | 24.17 |



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

| | | | |
|---------------|--------------------|-------------|---------------------|
| SERIAL NUMBER | <u>077C7042401</u> | DATE TESTED | <u>July 1, 2025</u> |
|---------------|--------------------|-------------|---------------------|

Remarks :

Commissioning follow as commissioning performance sheets.

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

☒ meets

☐ does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative: *[Signature]*

(Wiphan Promlumda)

Service Engineer

GC Clarus 600/680 Preventive Maintenance (PM)

| | | | |
|---|--|--|-------------|
| Company Name: | | | |
| Address (Instrument Location): | 7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900. | | |
| Serial Number: | 680S14042502 | Service Tag: | N68APSSFXP |
| 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 | |

Scope

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

General Instructions:

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

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Component List

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

Parts Lists

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

Procedure Checklist

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

1. General:

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

| | | |
|-----|------|------|
| L-N | 220 | Volt |
| L-G | 220 | Volt |
| N-G | 0.33 | 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 | <input type="checkbox"/> Helium <input type="checkbox"/> Nitrogen <input type="checkbox"/> Hydrogen |
| Moisture level | <input type="checkbox"/> Good <input type="checkbox"/> Need to replace <input type="checkbox"/> Other _____ |
| Detector gas | <input type="checkbox"/> Air Zero <input type="checkbox"/> Hydrogen <input type="checkbox"/> Nitrogen <input type="checkbox"/> Helium |
| Moisture level | <input type="checkbox"/> Good <input type="checkbox"/> Need to replace <input type="checkbox"/> Other _____ |
- ☐ Inspect the customer log book and make any appropriate PM entries.
- ☐ Leak check all fittings from the gas source to instrument.

| | | |
|-------------|---|---------------|
| Gas leakage | <input type="checkbox"/> Pass <input type="checkbox"/> Fail | Comment _____ |
|-------------|---|---------------|
- ☐ Perform general inspection of system for cleanliness.
- ☐ Inspect for functional and clean electronic cooling and oven vent fans

| | |
|------------------------|--|
| Electronic cooling fan | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| Oven cooling fan | <input type="checkbox"/> Yes <input type="checkbox"/> No |

2. Electronic :

- ☐ Check oven temperature. Calibrate if necessary.

| | | |
|----------------------------|--------|---|
| Oven temperature set point | 150 °C | <input type="checkbox"/> Pass <input type="checkbox"/> Fail |
|----------------------------|--------|---|
- ☐ Check sub-ambient option. (If installed).

| | | |
|----------------------------|------|---|
| Oven temperature set point | 5 °C | <input type="checkbox"/> Pass <input type="checkbox"/> Fail |
|----------------------------|------|---|
- ☐ Perform routine maintenance on detector/injector. Replace parts as necessary with customer supplied spares.

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

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

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

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

| | |
|------------------|-----|
| Firmware version | 6.5 |
|------------------|-----|
- ☐ Measure all accessible power supply voltages.

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

| | | |
|--------------------|------|-----|
| Detector Channel A | 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

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

GC Clarus 600/680 Preventive Maintenance (PM)

| | | | |
|---|--|--|--------------|
| Company Name: | | | |
| Address (Instrument Location): | 7 Soi Phaholyothin24 Phaholyothin Road, Jompol, Chatuchak, Bangkok, 10900. | | |
| Serial Number: | 680S14042502 | Service Tag: | N68APSSFXPMP |
| Customer Name (if applicable): | Ms.Naruecha | PM number: | 2 of 2 |
| Service Engineer Name: | Monchai Kitcharoenkeat | Service Order Number: | WO-06815714 |
| Date PM Performed: (DD-MMM-YYYY) | 13-Aug-2025 | Next PM Due Date: (DD-MMM-YYYY) | 13-Feb-2026 |

| Part Number | Release | Publication Date |  |
|-------------|---------|------------------|---|
| TH09370070 | C | August 2016 | |

Scope

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

General Instructions:

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

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Component List

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

Parts Lists

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

Procedure Checklist

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

1. General:

- ☐ Review the instrument performance with the customer and document any recent problems.
- ☐ Check incoming AC line voltage for proper levels and grounding.
 L-N 220 Volt
 L-G 220 Volt
 N-G 0.32 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.

- ☐ Check flows, including split flows if applicable. Calibrate if necessary.
 Carrier flow Pass
 Split flow Pass
- ☐ Check detector gas flows and adjust if necessary.
 Detector flow Pass
- ☐ Autosampler installed ☐ Yes ☐ No
 Check autosampler sensor for wear and replace if necessary.
 Vial sensor Pass
 Door sensor Pass
 Tower sensor Pass
 Plunger sensor Pass
 Elevator sensor Pass
- ☐ Remove syringe, manually flush. Replace with customer supplied spare if necessary.
- ☐ Check firmware version. Upgrade to current levels if necessary.
 Firmware version 6.5
- ☐ Measure all accessible power supply voltages.
 5 Volt Pass
 +15 Volt Pass
 -15 Volt Pass
 24 Volt Pass
- ☐ Record all detector voltage signal.
 Detector Channel A 0.98 mV.
 Detector Channel B NA mV.

3. Diagnostics Tests:

- ☐ Run instrument diagnostics.
 BRAM Pass
 EPROM Pass
- ☐ Run Autosampler diagnostics.
 BRAM Pass
 EPROM Pass

4. Review:

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



Additional Comments

| Additional Comments Regarding the PM |
|--------------------------------------|
| |
| |
| |

Review

| | |
|--|---------------------------------------|
| <i>The preventive maintenance checks and if applicable performance tests for Clarus600/680 GC have been completed.</i> | |
| <i>This Clarus600/680 GC Pass the preventive maintenance.</i> | |
| Review of Preventive Maintenance: | |
| Authorized PerkinElmer Representative: Monchai Kitcharoenkeat <i>Monchai</i> | Date: 13-Aug-2025 (DD-MMM-YYYY) |
| Authorized Customer Representative: Ms.Naruecha <i>Naruecha</i> | Date: 13-Aug-2025 (DD-MMM-YYYY) |



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THAI UNIQUE CO., LTD.

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

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

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

Model : CP-3800

Serial Number : 00734

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

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

Date : 05/08/2024

ELECTRONIC TEST

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

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

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

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

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

SENSITIVITY TEST: C15. (Area count) = 156,955 Counts.



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

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

Detector Sensitivity (FID)

| Detector Response | Result | Specification |
|----------------------------|--------|---------------|
| Baseline Noise (µV) | 2.85 | ≤ 50 |
| Baseline Drift (%) | 0.09 | ≤ 1 |
| Sensitivity (S/N for C15) | 16,400 | ≥ 1,024 |

Temperature Specification

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

Relative Standard Deviation % (% RSD)

| Checkout Procedure | Result | Specification |
|-------------------------|--------|---------------|
| Area C15 (%) | 1.71 | ≤ 5 |
| Retention Time C15(%) | 0 | ≤ 0.5 |

APPROVAL :

Signature: Suwarot.

Engineer : Suwarot Trikanut

Date : 05/08/2024



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev.04



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev.04



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

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

Results Integrated System Testing

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

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

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

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

| | | |
|----------------|--|-------------------------------|
| Compliance | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| Performance by | Samarot. | |
| Date | 05/08/2567 | |



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



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

Results Integrated System Testing

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

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

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

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

| | | |
|----------------|--|-------------------------------|
| Compliance | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| Performance by | Samarot. | |
| Date | 05/08/2024 | |



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



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

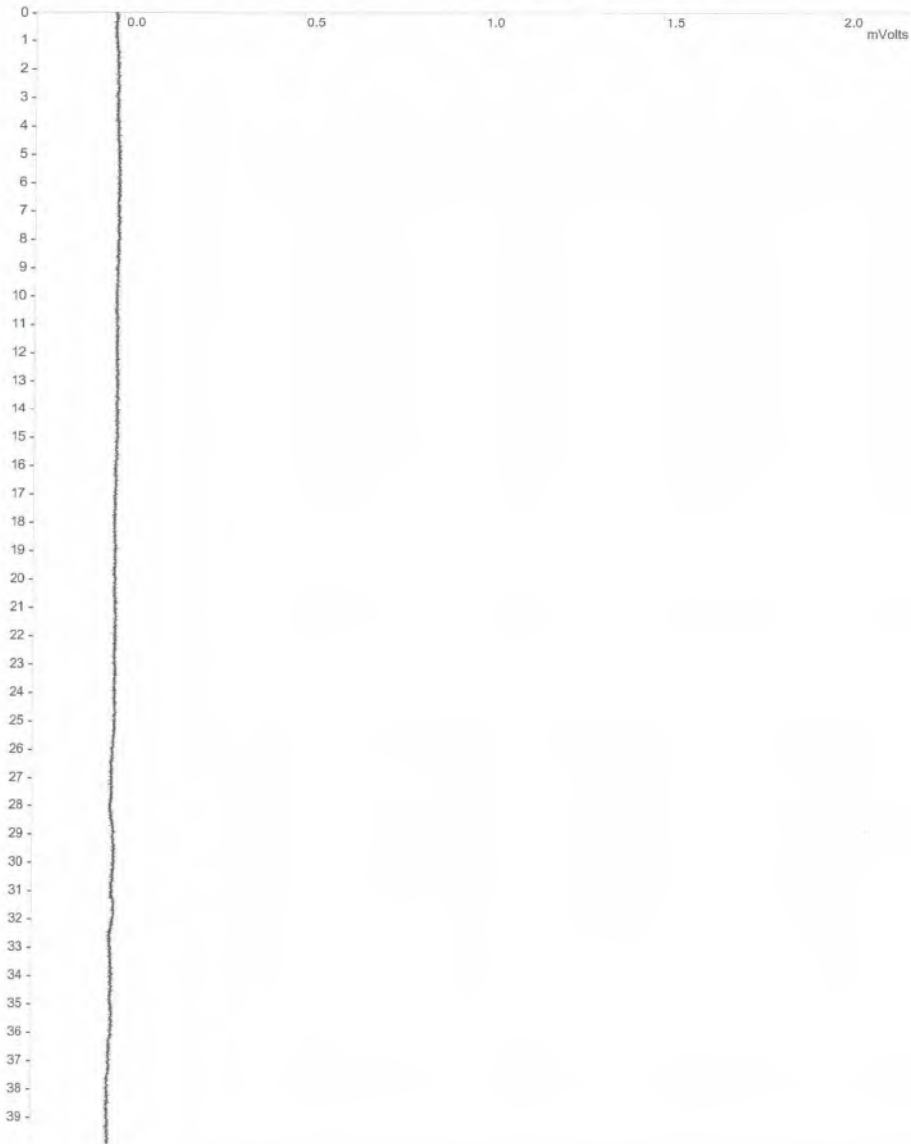
Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

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

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

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

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



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

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

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

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

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

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

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

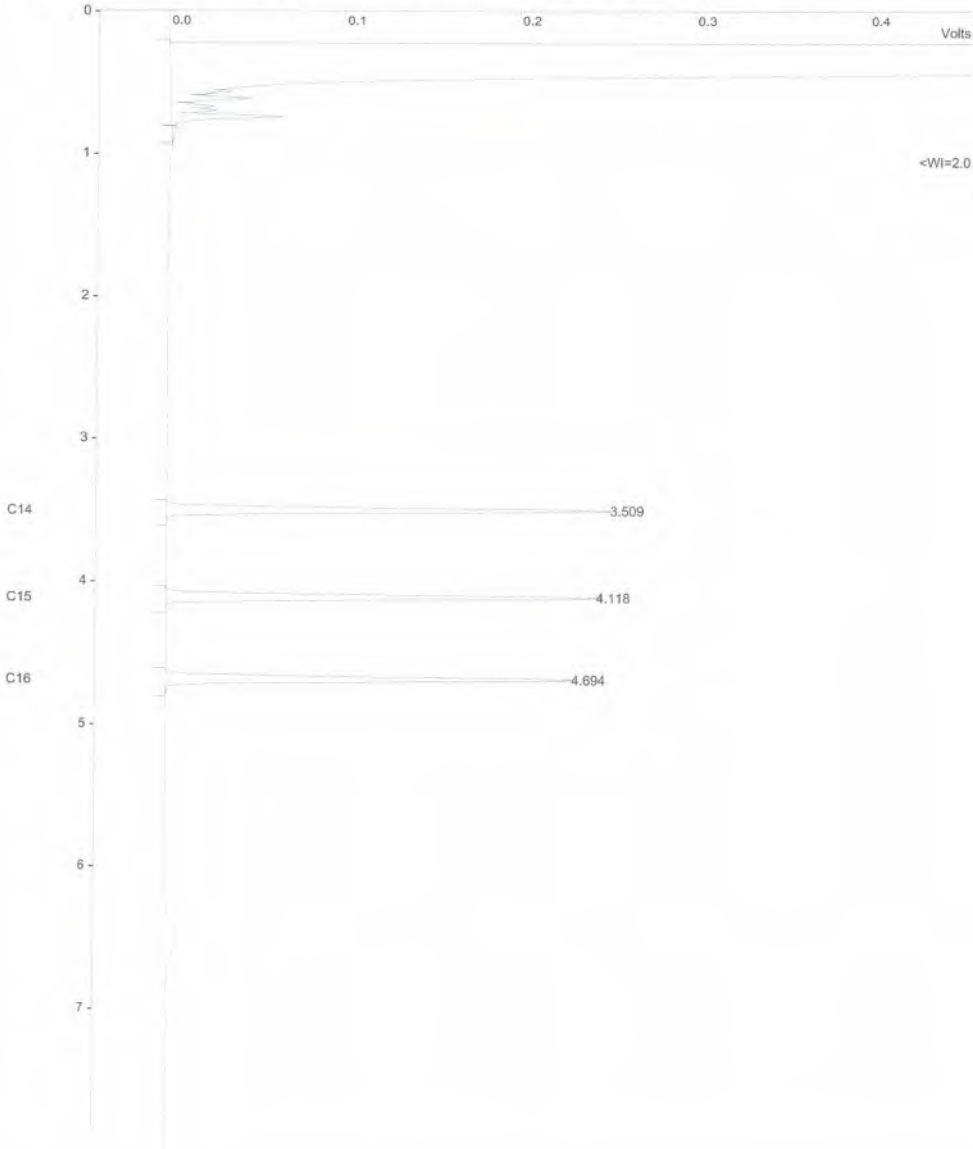
Title :
Run File : f:\ \sps2024\cal2024\fid2024003.run
Method File : d:\cafid2024003-front.mth
Sample ID : FID2024

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

Sample ID: fid std

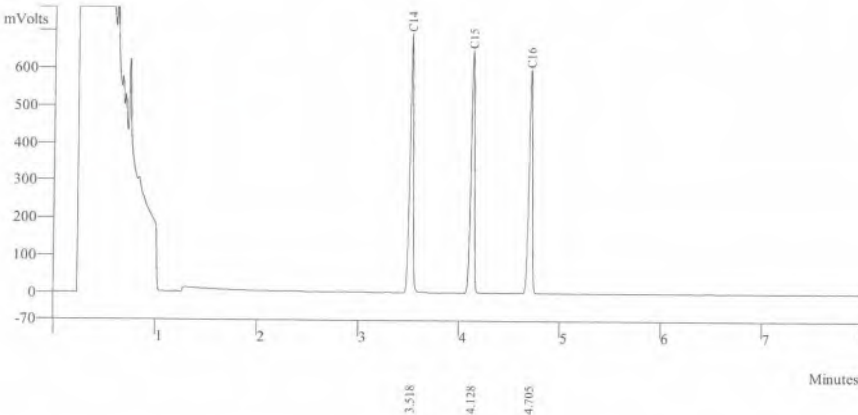
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024001.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 152.6865 | 3.518 | 163565 | BB | 2.2 |
| 2 | C15 | 147.1889 | 4.128 | 157309 | BB | 2.3 |
| 3 | C16 | 138.7997 | 4.705 | 146804 | BB | 2.3 |
| Totals | | 438.6751 | | 467678 | | |

Sample ID: fid std

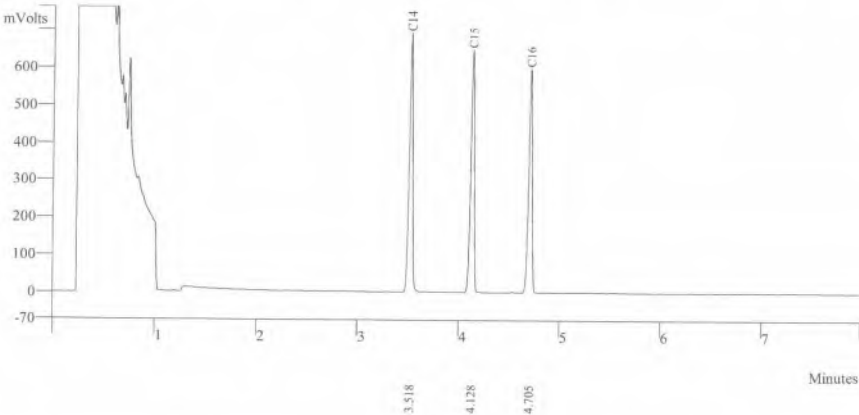
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024002.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 152.6865 | 3.518 | 168565 | BB | 2.2 |
| 2 | C15 | 137.1189 | 4.128 | 159359 | BB | 2.3 |
| 3 | C16 | 128.7997 | 4.705 | 147834 | BB | 2.3 |
| Totals | | 418.6042 | | 475758 | | |

Sample ID: fid std

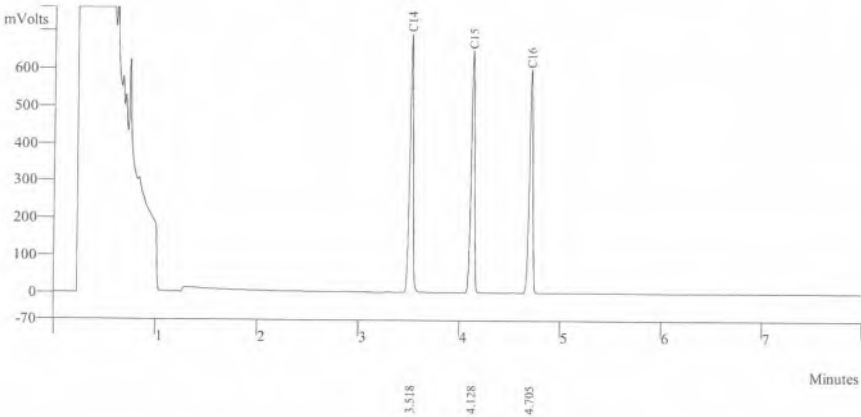
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024003.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 152.7865 | 3.518 | 169535 | BB | 2.2 |
| 2 | C15 | 197.1159 | 4.128 | 157349 | BB | 2.3 |
| 3 | C16 | 128.5997 | 4.705 | 149834 | BB | 2.3 |
| Totals | | 478.5021 | | 476718 | | |

Sample ID: fid std

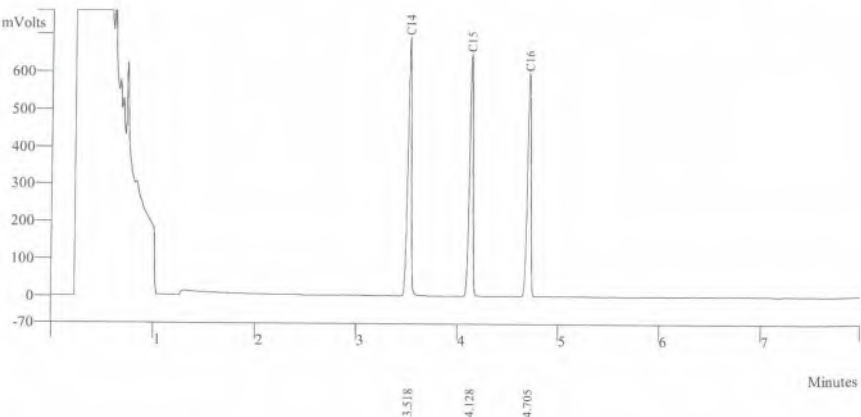
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024004.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 162.7865 | 3.518 | 165521 | BB | 2.2 |
| 2 | C15 | 157.1159 | 4.128 | 152379 | BB | 2.3 |
| 3 | C16 | 138.5997 | 4.705 | 146834 | BB | 2.3 |
| Totals | | 458.5021 | | 464734 | | |

Sample ID: **fid std**

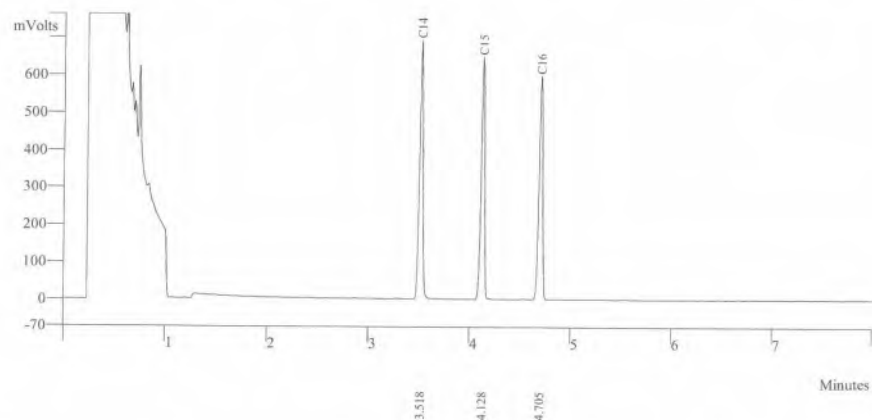
Operator (Inj): suwarot
 Injection Date: 05/08/2024
 Calc Date: 05/08/2024
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024005.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 162.7965 | 3.518 | 164521 | BB | 2.2 |
| 2 | C15 | 137.1159 | 4.128 | 158379 | BB | 2.3 |
| 3 | C16 | 128.1947 | 4.705 | 149834 | BB | 2.3 |
| Totals | | 428.1071 | | 472734 | | |



THAI UNIQUE CO.,LTD.

1 Of 1



Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

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

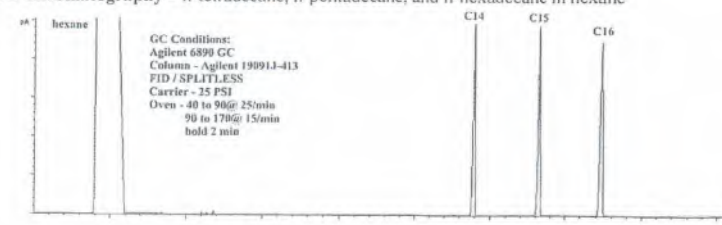
| | | |
|------------------------|---------------------------|-------------|
| Concentrations: | | |
| n-tetradecane | 0.218 g/L ($\pm 0.5\%$) | 0.033 w/w % |
| n-pentadecane | 0.218 g/L ($\pm 0.5\%$) | 0.033 w/w % |
| n-hexadecane | 0.218 g/L ($\pm 0.5\%$) | 0.033 w/w % |

Solvent: hexane

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

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

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



Date of release: 30 June 2023

Date of expiration: 31 July 2025

Monica Bourgeois
 Monica Bourgeois
 QMS Representative

Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

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

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

Reference standard instruments :

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

MIT : Miracle International Technology Co.,Ltd.

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

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

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

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

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

Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

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

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

(X) Without Adjustment () After Adjustment

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**** End of Certificate****



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



Certificate of Calibration

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

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

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

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

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

Calibrated by

Nanthiya Ngampring
Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 1 of 3



Measuretronix Limited

Calibration Report

UUC : Fluke 51 Thermometer

Serial No. : 5910857

Asset No. : 5910857

Procedure : CP-LP-04:Rev.02

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

Certificate No. : LF24-0278

Report data type : As-Found

Date of Calibrate : 26-Jun-2024

Date of Receive : 17-Jun-2024

Environment condition

Temperature : 23 °C ± 3 °C

Humidity : 50 %RH ± 20 %RH

Customer : Thai Unique Co., Ltd.

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

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

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

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

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

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

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

Standard Used

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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

Page 2 of 3

Test Data

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

End of Calibration Report

Certificate

It is hereby certified that

Suwarot Trikainut

Has successfully completed the Application Training for

Basic Gas Chromatography and Sampler

Training Contents were:

Hardware Operation, Software Operation, Data analysis and

Troubleshooting : Model

CP-3800, 3900, 450-GC, 430-GC, 456-GC, 436-GC

At Thai Unique Co., Ltd, Bangkok, Thailand

On 15th March, 2019

S. Pohtongkam

S. Pohtongkam

Service Manager



บริษัท ไทยยูนิค จำกัด THAI UNIQUE CO., LTD.

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

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

GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0825/23032

Instrument Type : Gas Chromatography

Model : 3800

Serial Number : 00734

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

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

Date : 02/08/2025

ELECTRONIC TEST

| | | |
|----------------------|--|-------------------------------|
| CPU | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |
| DISPLAY & LED TEST | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |
| VENT TEST | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |
| KEY ECHO TEST | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |
| DESTRUCTION RAM TEST | <input checked="" type="checkbox"/> PASS | <input type="checkbox"/> FAIL |

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detectors (FID Channel-Front)

INJECTOR : 1079 Injector

GC CONDITION:

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

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

Sample: 1 µL Injection FID Test Sample 0.218g/L C14,C15,C16 in hexane (diluted to 30ppm)

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



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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) | 2.40 | ≤ 50 |
| Baseline Drift (%) | 0.18 | ≤ 1 |
| Sensitivity (S/N for C15) | 19,716 | ≥ 1,024 |


Temperature Specification

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

Relative Standard Deviation % (%RSD)

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

APPROVAL:

Signature: 

Engineer : Somchai Pohtongkam

Date : 02/08/2025



VARIAN

1/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT

FR-SV-029 Rev. 04



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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 | 506,043 |
| C15 Area 2 | 520,497 |
| C15 Area 3 | 522,154 |
| C15 Area 4 | 521,664 |
| C15 Area 5 | 509,340 |
| C15 Area Average | 515,940 |
| * % RSD (< 5 %) | 1.48 |

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

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

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

| | | |
|----------------|--|-------------------------------|
| Compliance | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| Performance by | Sachul P. | |
| Date | 02/08/2025 | |



| | | | |
|-------------|-------|------|------------|
| Comments | | | |
| Reviewed by | Wanai | Date | 02/08/2025 |



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THAI UNIQUE CO., LTD.

80-82 ถนนประชาธิปไตย แขวงบางขุนพรหม เขตพระนคร กรุงเทพฯ 10200

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

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

Results Integrated System Testing

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

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

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

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

| | | |
|----------------|--|-------------------------------|
| Compliance | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| Performance by | Sachul P. | |
| Date | 02/08/2025 | |



| | | | |
|-------------|-------|------|------------|
| Comments | | | |
| Reviewed by | Wanai | Date | 02/08/2025 |



VARIAN

1/1

SERVICE DEPARTMENT



VARIAN

1/1

SERVICE DEPARTMENT

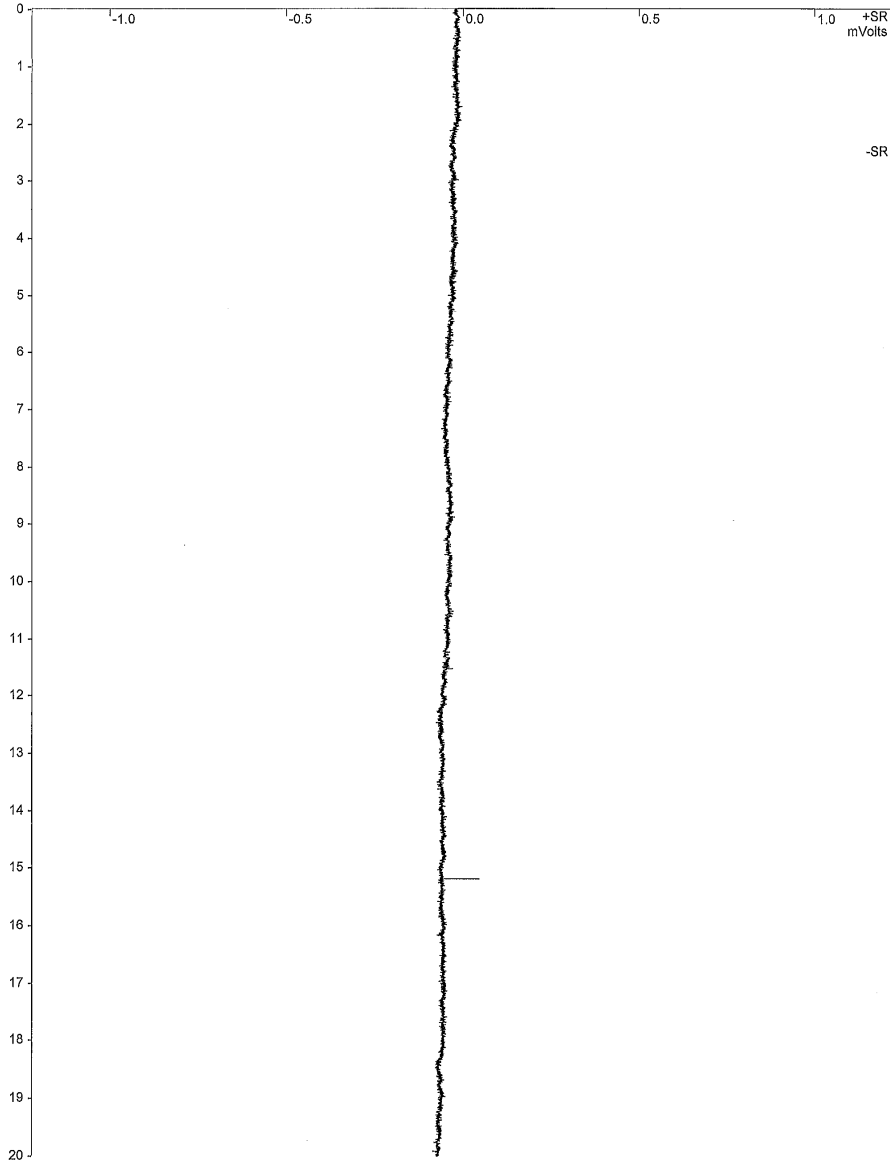
Title :
Run File : e:\sps2025\blk001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : blk

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

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

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

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



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

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

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

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

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

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

Total Unidentified Counts : 0 counts

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

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -14 microVolts LSB: 1 microVolts

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

Manual injection

Data Handling: No peaks

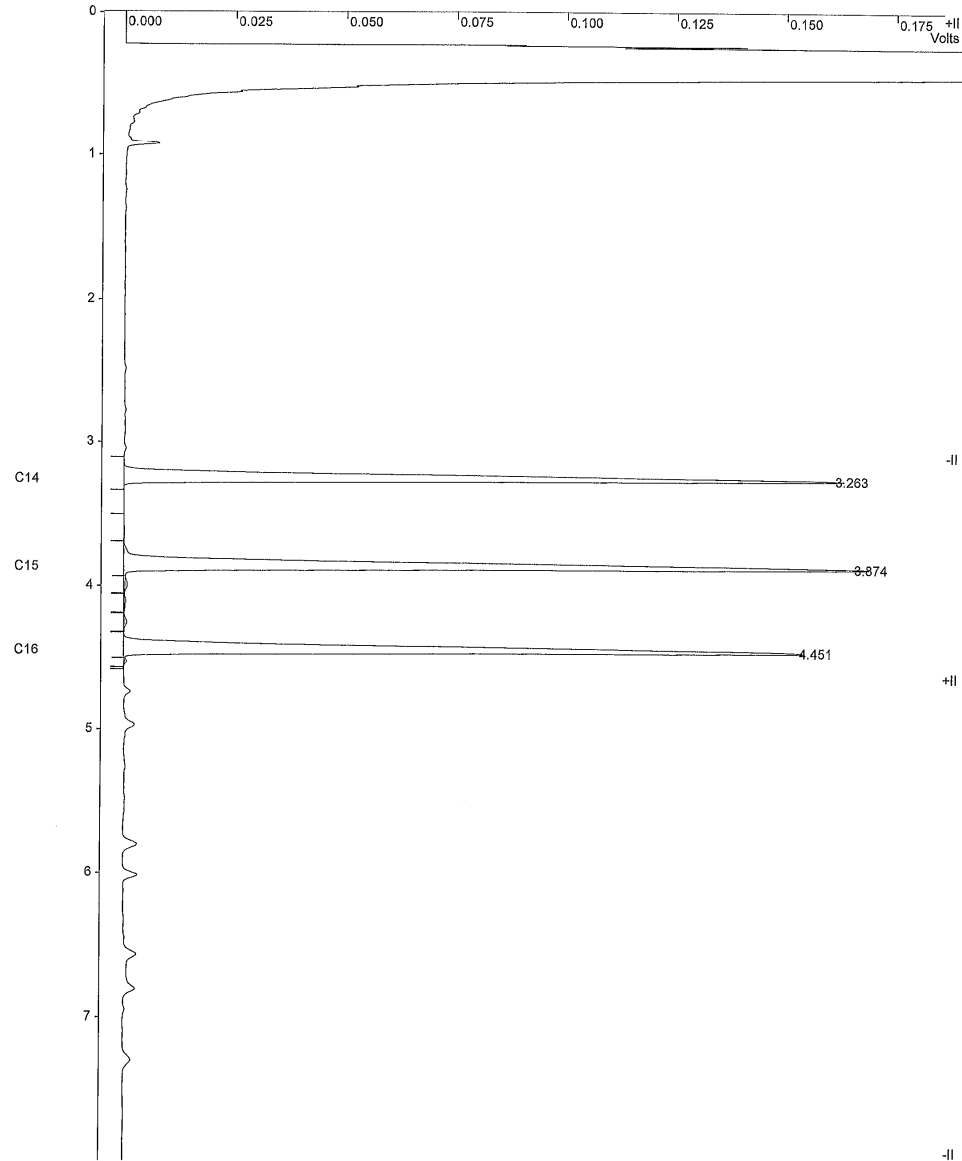
Title :
Run File : e:\sps2025\fidstd001.run
Method File : c:\star\data\tu\2025\cal fid.mth
Sample ID : fidstd

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

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

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

Chart Speed = 2.83 cm/min Attenuation = 79 Zero Offset = 2%
Start Time = 0.000 min End Time = 7.993 min Min / Tick = 1.00



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

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

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

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


Run Mode : Calibration
Peak Measurement: Peak Area
Calculation Type: External Standard
Level : 1

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

Total Unidentified Counts : 0 counts
Detected Peaks: 8 Rejected Peaks: 5 Identified Peaks: 3
Multiplier: N/A Divisor: N/A Unidentified Peak Factor: 0
Baseline Offset: 6 microVolts LSB: 1 microVolts
Noise (used): 2 microVolts - monitored before this run
Manual injection

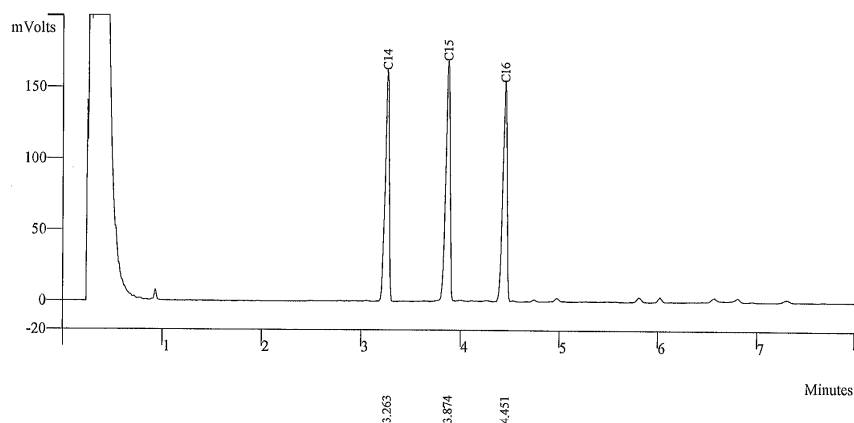
Sample ID: fid std

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


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

e:\sps2025\fidstd001.run

A = FID 10 V RESULTS




| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.263 | 458627 | BB | 2.7 |
| 2 | C15 | 0.0000 | 3.874 | 506043 | VV | 2.8 |
| 3 | C16 | 0.0000 | 4.451 | 460610 | VB | 2.8 |
| Totals | | 0.0000 | | 1425280 | | |



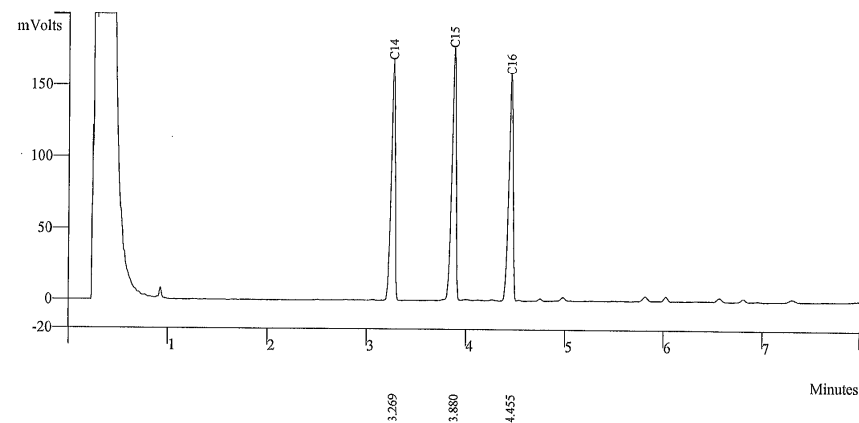
Sample ID: fid std

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


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

e:\sps2025\fidstd002.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.269 | 472338 | BB | 2.6 |
| 2 | C15 | 0.0000 | 3.880 | 520497 | VV | 2.7 |
| 3 | C16 | 0.0000 | 4.455 | 471916 | VB | 2.8 |
| Totals | | 0.0000 | | 1464751 | | |



Sample ID: **fid std**

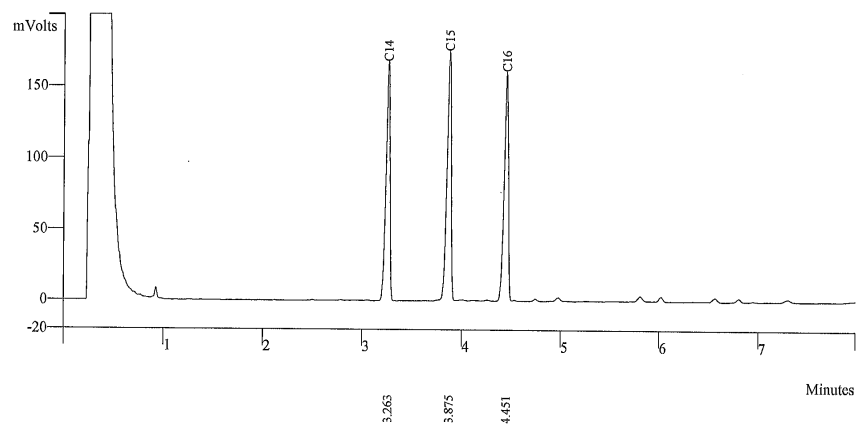
Operator (Inj): watsamon
Injection Date: 02/08/2025
Calc Date: 02/08/2025
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd003.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.263 | 469265 | BB | 2.6 |
| 2 | C15 | 0.0000 | 3.875 | 522154 | VV | 2.8 |
| 3 | C16 | 0.0000 | 4.451 | 478526 | VB | 2.8 |
| Totals | | 0.0000 | | 1469945 | | |

Sample ID: **fid std**

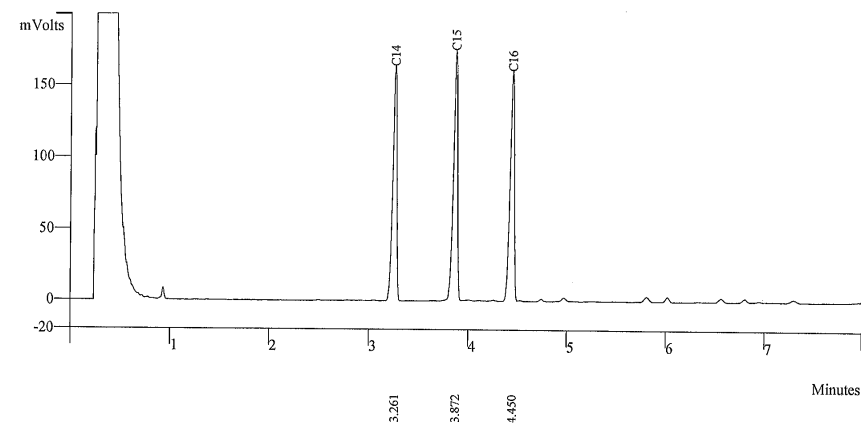
Operator (Inj): watsamon
Injection Date: 02/08/2025
Calc Date: 02/08/2025
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

**VARIAN**

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

e:\sps2025\fidstd004.run

A = FID 10 V RESULTS




| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.261 | 468907 | BB | 2.7 |
| 2 | C15 | 0.0000 | 3.872 | 521664 | VV | 2.8 |
| 3 | C16 | 0.0000 | 4.450 | 478772 | VB | 2.8 |
| Totals | | 0.0000 | | 1469343 | | |



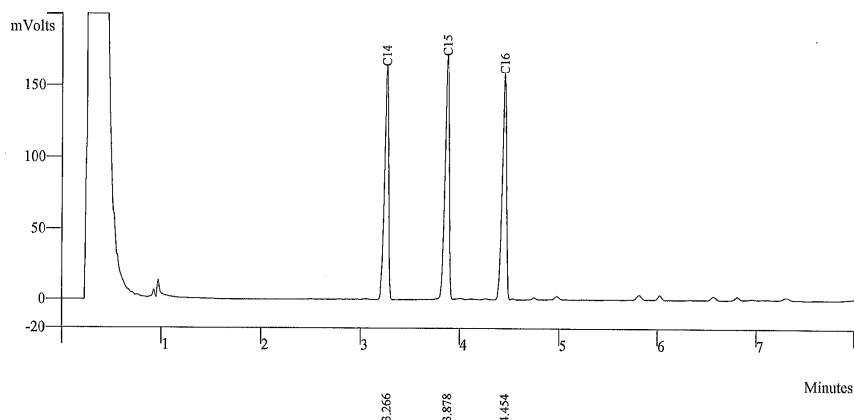
Sample ID: **fid std**

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


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

e:\sps2025\fidstd005.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 0.0000 | 3.266 | 459351 | BB | 2.6 |
| 2 | C15 | 0.0000 | 3.878 | 509340 | VV | 2.8 |
| 3 | C16 | 0.0000 | 4.454 | 468353 | VB | 2.8 |
| Totals | | 0.0000 | | 1437044 | | |



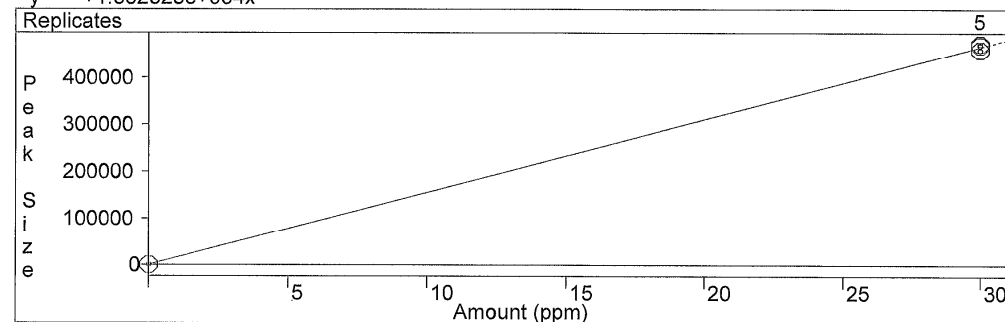
THAI UNIQUE CO.,LTD.

1 Of 1

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

C14

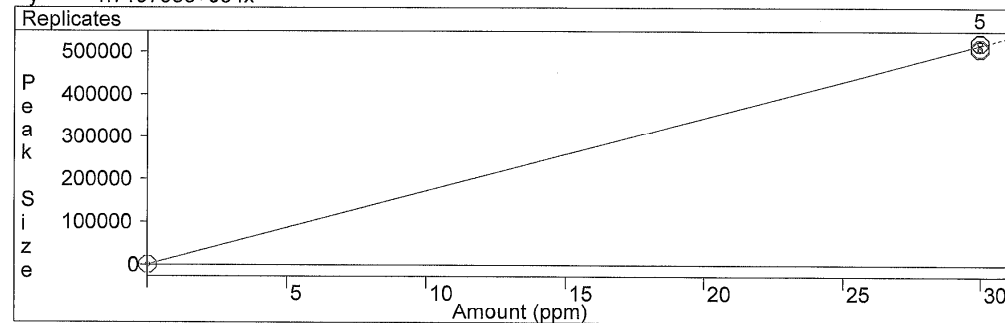
Resp. Fact. RSD: 1.347%
Coeff. Det.(r²): 0.999130



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

C15

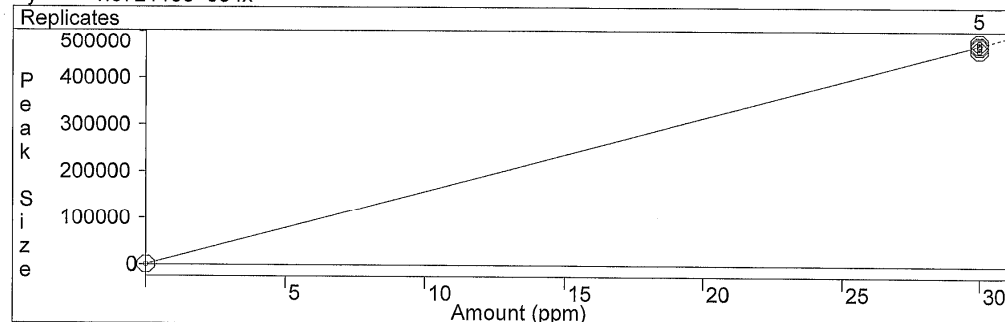
Resp. Fact. RSD: 1.481%
Coeff. Det.(r²): 0.998948



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

C16

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



CERTIFICATE

This is to certify, that

Somchai Pohthongkham

has participated the course

Basic GC and Sampler training

Date: **24 – 27 May 2004**

Location: **Middelburg**

Instructor: **W.J. Buys**

Signature instructor: _____



Varian Analytical Instruments
Varian Chrompack International BV
Herculesweg 8
P.O. Box 8033
4330 EA Middelburg
The Netherlands

Tel.: +31 118 671000
Fax: +31 118 633118
www.varianinc.com



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.: WK2412-053-1

Page 1 of 2

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

| | | | |
|--------------------|--------------------------|---------------------|-----------------|
| Instrument | : AMD Flow Meter | Ambient Temperature | : (23 ± 2) °C |
| Manufacturer | : Agilent Technologies | Humidity | : (50 ± 15) %RH |
| Model | : G6691A | Received Date | : 4-Dec-24 |
| Serial No. | : MY16470347 | Calibrated Date | : 11-Dec-24 |
| Identity No. | : SV-DF-001 | Issued Date | : 13-Dec-24 |
| Range | : 0 ml/min to 750 ml/min | Calibrated Location | : In Lab |
| Resolution | : See to Data | | |
| Calibration Method | : CP-WK-M10 | | |

Reference standard instruments :

| Instrument | Serial No. | Certificate No. | Due Date | Traceability to |
|-------------------------|------------|-----------------|-----------|-----------------------|
| Flow Calibrator | 140215-134 | L202304114-001 | 18-Apr-25 | MIT |
| Primary Flow Calibrator | 1107-S | WK2405-049-5 | 22-May-25 | WK Electric Co., Ltd. |

MIT : Miracle International Technology Co., Ltd.

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

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

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

Calibrated by : Mr.Thippatai Mungpungklang

Approved by : _____

Ms. 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.



Certificate of Analysis

| | |
|--------------------|---|
| Certificate Number | : LF25-0305 |
| 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 | : 6-Jun-2025 |
| Date of Issue | : 6-Jun-2025 |

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

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

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

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

Calibrated by

Samak

Mr. Samak Uaonkaonoi
Metrology Technician

Approved by

[Handwritten signature]

Miss Juthamas Sukhathainirun
Cal-Lab Manager

Certificate No. : LF25-0305

Model : 51

Serial No. : 5910857

Page 1 of 3

FID-TCD Performance Evaluation Sample Kit

Agilent Part
Number: 5080-8842, 18710-60170

Sample Lot
Number: 0006750304

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

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

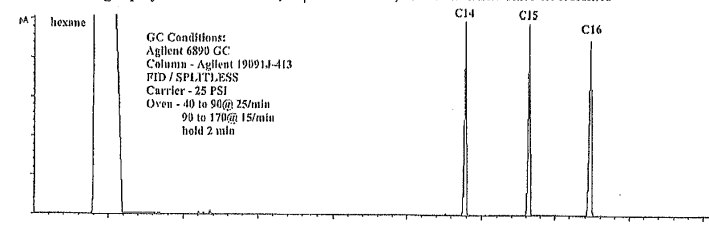
Solvent: hexane

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

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

Typical Analytical Spectrum or Chromatography

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



Date of release: 30 June 2023

Date of expiration: 31 July 2025

Monica Bourgeois
Monica Bourgeois
QMS Representative

เอกสารแนบ 5-10

เอกสารสอบเทียบเครื่องมือการตรวจวัดฝุ่นละอองในสถานที่ทำงาน



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature 25 ± 3 °C
Pressure 1010 ± 15 mmbar

| Personal Pump Data | | | | | Calibration Data | | | | | | | |
|--------------------|-------|-----------|------------|------------|--------------------|-------|-------|-----------------|-------|-------|------------------------------|----------------|
| No. | Brand | Model | Serial No. | Date | Flow Rate (ml/min) | | | | | | Value From Calibration Curve | |
| | | | | | Setting | | | Actual (Q std.) | | | | |
| | | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² |
| 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-PCXR8 | 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-PCXR8 | 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 - 2.359 | 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 :

Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

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

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 | 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 | 529541 | 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 - 13.764 | 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 | 2,006 | 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 | |



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

Personal Pump Data

Calibration Data

| No. | Brand | Model | Serial No. | Date | Flow Rate (ml/min) | | | | | | Value From Calibration Curve | |
|-----|-------|-----------|------------|------------|--------------------|-------|-------|-----------------|-------|-------|------------------------------|----------------|
| | | | | | Setting | | | Actual (Q std.) | | | | |
| | | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² |
| 880 | SKC | 224-PCXR3 | 504569 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,497 | 2,011 | 1.009x - 11.282 | 1.000 |
| 881 | 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 |
| 882 | SKC | 224-PCXR3 | 505673 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,509 | 2,005 | 1.014x - 24.323 | 0.999 |
| 883 | SKC | 224-PCXR3 | 510785 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,506 | 1,998 | 0.998x + 5.669 | 1.000 |
| 884 | SKC | 224-PCXR3 | 508333 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 993 | 1,492 | 2,004 | 1.009x - 21.129 | 1.000 |
| 885 | 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 |
| 886 | SKC | 224-PCXR3 | 512625 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,495 | 2,001 | 1.005x - 11.406 | 1.000 |
| 887 | SKC | 224-PCXR3 | 504324 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,498 | 1,999 | 1.004x - 12.097 | 1.000 |
| 888 | SKC | 224-PCXR3 | 508307 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 994 | 1,502 | 1,994 | 0.999x - 1.619 | 1.000 |
| 889 | SKC | 224-PCXR3 | 509860 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,507 | 2,003 | 1.008x - 14.844 | 1.000 |
| 890 | SKC | 224-PCXR3 | 508366 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,496 | 1,995 | 0.999x - 1.143 | 1.000 |
| 891 | 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 |
| 892 | SKC | 224-PCXR3 | 510987 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,494 | 2,010 | 1.013x - 24.882 | 0.999 |
| 893 | 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 :

Adul Dangklom
 (Mr.Adul Dangklom)

Approved by :

Peera Detudom
 (Mr. Peera Detudom)

CERTIFICATE No : 24M2227
REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24

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

CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT

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

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

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

FM.BLMTC.002 Rev.5



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

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
(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 : 2011268021900739001

End of Certificate

2 / 2

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

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

FM.BLMTC.002 Rev.5

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 Bangpoornai, 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

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 Bangpoornai, 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_395/25

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-B36 | ACO | 6236 | 00192027 | 20 August 2025 | 93.9 | 93.9 |
| ACO-B41 | ACO | 6236 | 00192032 | 20 August 2025 | 93.8 | 93.9 |
| ACO-B43 | ACO | 6236 | 00192034 | 20 August 2025 | 93.7 | 93.9 |
| ACO-R40 | ACO | 6236 | 00192052 | 20 August 2025 | 93.9 | 93.9 |
| ACO-R41 | ACO | 6236 | 00192053 | 20 August 2025 | 93.8 | 93.9 |
| ACO-R50 | ACO | 6236 | 00192062 | 20 August 2025 | 93.7 | 93.9 |
| ACO-R52 | ACO | 6236 | 00192064 | 20 August 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 :

Peera Detudom

(Mr. Peera Detudom)

เอกสารแนบ 5-12

เอกสารสอบเทียบเครื่องมือการตรวจวัดระดับเสียงที่ลูกจ้างได้รับเฉลี่ย
ตลอดเวลาการทำงานในแต่ละวัน (TWA)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0514 MTC No. EEL. BP. 34/0868

CALIBRATION CERTIFICATE

Submitted by : S.P.S.Consulting Service Co.,Ltd.
Address : 7 Soi Phaholyothin 24, Phaholyothin Road, Jompol, Chatuchak, Bangkok 10900.
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.
 : Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

Instrument Calibrated :
 Description : Sound Calibrator
 Manufacturer : SVANTEK
 Model : SV34
 Serial No. : 83820

Ambient Environment
 Temperature : $(23 \pm 3) ^\circ\text{C}$
 Relative Humidity : $(50 \pm 15) \%$
 Ambient Pressure : $(101.325 \pm 1.500) \text{ kPa}$

Standards used :

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

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

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

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

Date of Receipt : 14 Aug. 2025

Date of Calibration : 22 Aug. 2025

1/2

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

FM.BLMTC.002 Rev.5

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0514 MTC No. EEL. BP. 34/0868

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

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

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

1. Sound Pressure Level

| Standard Microphone Type | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 2 |
|---------------------------|------------------------------------|---------------------|------------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 114.02 | 0.02 | ± 0.10 | $\pm 0.75 \text{ dB}$ |

2. Frequency

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

3. Total Distortion

| Standard Microphone Type | Measured Total Distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 2 |
|---------------------------|-------------------------------|-----------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 0.21 | ± 0.50 | $\pm 4.0\%$ |

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :

(Signature)
 (Mr.Weerachai Deechaiyae)

Approved by :

(Signature)
 (Mr.Prawate Kluaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Aug. 2025

Date of Issue : 25 Aug. 2025

Ref : 2011268081403169011

End of Certificate

2 / 2

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

FM.BLMTC.002 Rev.5



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_395_1/25

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

| | | | |
|-------------------|-----------------|------------------|-------------------|
| Brand | SVANTEK | Number | SV 60/62 |
| Model | SV34 | Serial No. | 33146 |
| Calibration Range | 114 dB, 1000 Hz | Last Calibration | 25 September 2024 |
| | | Due Date | 25 September 2025 |

Calibration Data

| Sound Level Meter Data | | | | Calibration Data | | |
|--|---------|----------|------------|------------------|---------------------|------------------|
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| NMD-B09 | SVANTEK | SV-104IS | 80829 | 20 August 2025 | 113.7 | 113.6 |
| NMD-B10 | SVANTEK | SV-104IS | 80830 | 20 August 2025 | 113.6 | 113.6 |
| NMD-B11 | SVANTEK | SV-104IS | 80831 | 20 August 2025 | 113.5 | 113.6 |
| NMD-B12 | SVANTEK | SV-104IS | 80832 | 20 August 2025 | 113.6 | 113.6 |
| NMD-B13 | SVANTEK | SV-104IS | 80834 | 20 August 2025 | 113.7 | 113.6 |
| NMD-B14 | SVANTEK | SV-104IS | 80875 | 20 August 2025 | 113.6 | 113.6 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 113.60± 0.10 dB | |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)

เอกสารแนบ 5-13

เอกสารสอบเทียบเครื่องมือการตรวจวัดความร้อนบริเวณพื้นที่ปฏิบัติงาน (WBGT)



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 : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 21 Oct 2024
Relative Humidity : $60\% \pm 15\%$ Calibration Date : 21 Oct 2024
Location of Calibration : In-Lab Recommend Due Date : 21 Oct 2026
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 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. This 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 Tnpart)
Authorized Signatory

SP-FM-04-15 rev.0
rev.01



Calibration Report

Certificate Number : SPR24100363-5 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
rev.01



Result of Calibration

Certificate Number : SPR24100363-5 Page : 3 of 3

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 30.0 | 30.014 | 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 : $^{\circ}\text{C}$

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

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

| Humidity Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|------------------|------------------|-------------|-------|-----------------------|
| 30.0 | 30.014 | 30.2 | 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
rev.01

Certificate of Calibration

Certificate Number : SPR25030358-1 Page : 1 of 3
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaholyothin 24 Phaholyothin Road., Jompol, Chatuchak,
Bangkok 10900

Equipment Name : Area Heat Stress Monitor
Manufacturer : Quest Technologies
Model : QUESTemp 34
Serial Number : TEG040059
ID. Number : B07
Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 19 Mar 2025
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 22 Mar 2025
Location of Calibration : In-Lab Recommend Due Date : 22 Mar 2026
Calibration Procedure : SP-CPT-04-13 Date of Issue : 23 Mar 2025

Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by 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.Pootthipong A.)
Authorized Signatory

SP-FM-04-15 rev.0

Calibration Report

Certificate Number : SPR25030358-1 Page : 2 of 3

Reference Standards

| Equipment Name | Model | Serial No. | Certificate No. | Due. Date |
|-------------------|--------|------------|-----------------|-------------|
| Humidity Chamber | TH-80S | N/A | SPR25010173-14 | 30 Jan 2026 |
| THERMO-HYGROMETER | 5020A | A47046 | TMU2500342 | 29 Jan 2026 |

Traceability

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

NA - NA Caltechnologies Co., Ltd.

Result of Calibration

Certificate Number : SPR25030358-1 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|--------|-----------------------|
| 30.0 | 30.015 | 29.9 | -0.115 | 0.20 |
| 35.0 | 35.012 | 34.9 | -0.112 | 0.20 |
| 40.0 | 40.016 | 39.9 | -0.116 | 0.20 |

Temperature Accuracy in the Measurement. (DRY)

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|--------|-----------------------|
| 30.0 | 30.015 | 29.8 | -0.215 | 0.20 |
| 35.0 | 35.012 | 34.8 | -0.212 | 0.20 |
| 40.0 | 40.016 | 39.8 | -0.216 | 0.20 |

Temperature Accuracy in the Measurement. (GLOBE)

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|--------|-----------------------|
| 30.0 | 30.015 | 29.9 | -0.115 | 0.20 |
| 35.0 | 35.012 | 34.9 | -0.112 | 0.20 |
| 40.0 | 40.016 | 39.9 | -0.116 | 0.20 |

Note:

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

Measurement Uncertainty

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

- End of Certificate -



Certificate of Calibration


Certificate Number : SPR24100363-3 Page : 1 of 3
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phrahitayothin 24 Phrahitayothin 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 : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 21 Oct 2024
Relative Humidity : $50\% \pm 15\%$ 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

SP-FM-04-15 rev.0



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

SP-FM-04-15 rev.0



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 -

SP-FM-04-15 REV.0



Certificate of Calibration

Certificate Number : SPR24100363-4 Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phaniyotnin 24 Phaniyotnin Road., Jompoi, 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 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



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



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



ID LINE : IEC17025



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 : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 20 Sep 2024
Relative Humidity : $50\% \pm 15\%$ 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.Pootthipong A.)

Authorized Signatory

SP-FM-04-15 rev.0



ID LINE : IEC17025



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



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24090395-9 Page : 3 of 3

Temperature Accuracy in the Measurement, (WET)

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 30.0 | 30.014 | 30.2 | 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 : $^{\circ}\text{C}$

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 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 : $^{\circ}\text{C}$

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 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

Heat B_396_1

| Heat Stress WBGT Meter Verification Report | | | |
|--|--------------------------|-----------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. : | B05 | Verification Date : | 20 August 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 | 12.6 | -0.1 | ± 0.5 |
| Dry Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 47.1 | 47.3 | -0.2 | ± 0.5 |
| Globe Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 69.3 | 69.2 | 0.1 | ± 0.5 |
| UUC* = UNIT UNDER CALIBRATION | | | |

Verified by : Adul Dangklom
 (Mr. Adul Dangklom)

Approved by : Peera Detudom
 (Mr. Peera Detudom)

Heat B_396_2

| Heat Stress WBGT Meter Verification Report | | | |
|--|--------------------------|-----------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. : | B07 | Verification Date : | 20 August 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 | 12.7 | -0.2 | ± 0.5 |
| Dry Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 47.1 | 47.2 | -0.1 | ± 0.5 |
| Globe Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 69.3 | 69.2 | 0.1 | ± 0.5 |
| UUC* = UNIT UNDER CALIBRATION | | | |

Verified by : Adul Dangklom
 (Mr. Adul Dangklom)

Approved by : Peera Detudom
 (Mr. Peera Detudom)

Heat B_396_3

| Heat Stress WBGT Meter Verification Report | | | |
|--|--------------------------|-----------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. : | B11 | Verification Date : | 20 August 2025 |
| Brand : | Quest Technologies | Ambient Temp. : | 24.5 °C |
| Model : | QUESTemp ^o 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 | 12.6 | -0.1 | ± 0.5 |
| Dry Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 47.1 | 47.0 | 0.1 | ± 0.5 |
| Globe Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 69.3 | 69.1 | 0.2 | ± 0.5 |
| UUC* = UNIT UNDER CALIBRATION | | | |

Verified by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)

Heat B_396_4

| Heat Stress WBGT Meter Verification Report | | | |
|--|--------------------------|-----------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. : | B12 | Verification Date : | 20 August 2025 |
| Brand : | Quest Technologies | Ambient Temp. : | 24.5 °C |
| Model : | QUESTemp ^o 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 | 12.4 | 0.1 | ± 0.5 |
| Dry Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 47.1 | 47.3 | -0.2 | ± 0.5 |
| Globe Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 69.3 | 69.3 | 0.0 | ± 0.5 |
| UUC* = UNIT UNDER CALIBRATION | | | |

Verified by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจันทบุรี 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_396_5

| Heat Stress WBGT Meter Verification Report | | | |
|--|----------------------------|---------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. | : B17 | Verification Date | : 20 August 2025 |
| Brand | : Quest Technologies | Ambient Temp. | : 24.5 °C |
| Model | : QUESTemp ^o 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 | 12.7 | -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 : Peera Detudom
(Mr. Peera Detudom)

เอกสารแนบ 5-14

เอกสารสอบเทียบเครื่องมือการตรวจวัดความร้อนที่พนักงาน
ได้รับจากการปฏิบัติงาน



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 : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 21 Oct 2024
Relative Humidity : $60\% \pm 15\%$ Calibration Date : 21 Oct 2024
Location of Calibration : In-Lab Recommend Due Date : 21 Oct 2026
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 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. This 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 Tnpart)
Authorized Signatory

SP-FM-04-15 rev.0
rev.01



Calibration Report

Certificate Number : SPR24100363-5 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
rev.01



Result of Calibration

Certificate Number : SPR24100363-5 Page : 3 of 3

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 30.0 | 30.014 | 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 : $^{\circ}\text{C}$

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

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

| Humidity Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|------------------|------------------|-------------|-------|-----------------------|
| 30.0 | 30.014 | 30.2 | 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
rev.01



Certificate of Calibration

Certificate Number : SPR24030285-5 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 : TEG040059
ID. Number : B07

Environmental Conditions
Ambient Temperature : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 19 Mar 2024
Relative Humidity : $50\% \pm 15\%$ Calibration Date : 20 Mar 2024
Location of Calibration : In-Lab Recommend Due Date : 20 Mar 2025
Calibration Procedure : SP-CPT-04-13 Date of Issue : 21 Mar 2024

Method of Calibration

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

Calibrated by : Mr Navaporn Uengseng
Calibration Officer

Approved by :
(Ms. Bussakorn Chaikaew)
Authorized Signatory

SP-FM-04-15 rev.0
rev.01

Calibration Report

Certificate Number : SPR24030285-5

Page : 2 of 3

Reference Standards

| Equipment Name | Model | Serial No. | Certificate No. | Due Date |
|-------------------|--------|------------|-----------------|-------------|
| Humidity Chamber | TH-60S | N/A | SPR24020149-7 | 23 Feb 2025 |
| THERMO-HYGROMETER | 6020A | A17046 | GR24 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
rev.01

Result of Calibration

Certificate No. : SPR24030285-5 Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 30.0 | 30.014 | 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 : $^{\circ}\text{C}$

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 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 : $^{\circ}\text{C}$

| Humidity Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|------------------|------------------|-------------|-------|-----------------------|
| 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
rev.01



Certificate of Calibration


Certificate Number : SPR24100363-3 Page : 1 of 3
Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phatthayuthin 24 Phatthayuthin 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 : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 21 Oct 2024
Relative Humidity : $50\% \pm 15\%$ 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

SP-FM-04-15 rev.0



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

SP-FM-04-15 rev.0



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 -

SP-FM-04-15 REV.0



Certificate of Calibration

Certificate Number : SPR24100363-4 Page : 1 of 3

Customer : S.P.S. CONSULTING SERVICE CO., LTD.
7 Soi Phanoyotnin 24 Phanoyotnin Road., Jompoi, 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 : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 21 Oct 2024
Relative Humidity : $50\% \pm 15\%$ 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 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



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



Result of Calibration

Certificate Number : SPR24100363-4 Page : 3 of 3

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 30.0 | 30.019 | 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 : $^{\circ}\text{C}$

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 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 : $^{\circ}\text{C}$

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 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



ID LINE : IEC17025



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 : $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ Received Date : 20 Sep 2024
Relative Humidity : $50\% \pm 15\%$ 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.Pootthipong A.)

Authorized Signatory

SP-FM-04-15 rev.0



ID LINE : IEC17025



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



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24090395-9 Page : 3 of 3

Temperature Accuracy in the Measurement, (WET)

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 30.0 | 30.014 | 30.2 | 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 : $^{\circ}\text{C}$

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 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 : $^{\circ}\text{C}$

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (\pm) |
|---------------------|------------------|-------------|-------|-----------------------|
| 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

SP-FM-04-15 rev.0

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 : Peera Detudom
(Mr. Peera Detudom)

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 : Peera Detudom
(Mr. Peera Detudom)



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

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 ^o 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 : (Signature)
(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 ^o 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 : (Signature)
(Mr. Peera Detudom)

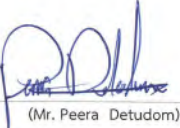


บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompet, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sole@spscon.com, www.spscon.com

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

| Personal Pump Data | | | | Calibration Data | | | | | | | | | |
|--------------------|-------|-----------|------------|------------------|--------------------|-------|-------|-----------------|-------|-------|------------------------------|----------------|--|
| No. | Brand | Model | Serial No. | Date | Flow Rate (ml/min) | | | | | | Value From Calibration Curve | | |
| | | | | | Setting | | | Actual (Q std.) | | | y | | |
| | | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² | |
| B01 | SKC | 224-PCXR4 | 262101 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,501 | 2,003 | 1.003x - 4.236 | 1.000 | |
| B02 | SKC | 224-PCXR4 | 626166 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,506 | 2,007 | 1.001x + 1.555 | 1.000 | |
| B03 | SKC | 224-PCXR4 | 612968 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,499 | 2,002 | 1.004x - 11.638 | 0.999 | |
| B04 | SKC | 224-PCXR4 | 602804 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,502 | 1,998 | 1.002x - 3.373 | 1.000 | |
| B05 | SKC | 224-PCXR4 | 612693 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,504 | 2,008 | 1.008x - 9.160 | 1.000 | |
| B06 | SKC | 224-PCXR4 | 262188 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,505 | 2,003 | 1.001x - 3.965 | 1.000 | |
| B07 | SKC | 224-PCXR4 | 626262 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,494 | 2,000 | 0.997x + 3.261 | 1.000 | |
| B08 | SKC | 224-PCXR4 | 626100 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,502 | 2,004 | 1.009x - 15.922 | 0.999 | |
| B09 | SKC | 224-PCXR4 | 626479 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,499 | 2,005 | 1.005x - 9.935 | 1.000 | |
| B10 | SKC | 224-PCXR4 | 091950 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,507 | 2,001 | 1.008x - 15.634 | 1.000 | |
| B11 | SKC | 224-PCXR8 | 564315 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,495 | 2,002 | 1.004x - 7.274 | 1.000 | |
| B12 | SKC | 224-PCXR4 | 034656 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,507 | 2,005 | 1.007x - 13.608 | 0.999 | |
| B13 | SKC | 224-PCXR4 | 602073 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,504 | 2,007 | 1.006x - 6.161 | 1.000 | |
| B14 | SKC | 224-PCXR4 | 626313 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,503 | 2,004 | 1.001x - 3.361 | 1.000 | |
| B15 | SKC | 224-PCXR4 | 626474 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,506 | 2,002 | 1.008x - 12.821 | 0.999 | |
| B16 | SKC | 224-PCXR4 | 626477 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,509 | 1,995 | 0.999x - 0.595 | 1.000 | |
| B17 | SKC | 224-PCXR4 | 626860 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,497 | 1,996 | 1.000x - 1.613 | 1.000 | |
| B18 | SKC | 224-PCXR4 | 691484 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,499 | 1,995 | 1.003x - 9.955 | 0.999 | |
| B19 | SKC | 224-PCXR4 | 691599 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,508 | 1,994 | 1.001x - 1.127 | 1.000 | |
| B20 | SKC | 224-PCXR4 | 691587 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,505 | 1,997 | 1.004x - 9.596 | 1.000 | |
| B21 | SKC | 224-PCXR4 | 691531 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,504 | 1,999 | 1.002x - 3.125 | 1.000 | |
| B22 | SKC | 224-PCXR4 | 691654 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,505 | 1,992 | 1.003x - 9.240 | 0.999 | |
| B23 | SKC | 224-PCXR4 | 798393 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 992 | 1,498 | 1,993 | 0.999x - 3.941 | 1.000 | |
| B24 | SKC | 224-PCXR4 | 626363 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 1,994 | 1.003x - 9.084 | 0.999 | |
| B25 | SKC | 224-PCXR4 | 798489 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,497 | 2,004 | 0.998x + 5.100 | 1.000 | |
| B26 | SKC | 224-PCXR4 | 798479 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,504 | 1,998 | 0.997x + 5.575 | 1.000 | |
| B27 | SKC | 224-PCXR4 | 691673 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,508 | 1,991 | 1.002x - 8.556 | 0.999 | |
| B28 | SKC | 224-PCXR4 | 691570 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,504 | 2,001 | 1.000x + 2.897 | 1.000 | |
| B29 | SKC | 224-PCXR4 | 626472 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,502 | 2,004 | 1.001x - 1.675 | 1.000 | |
| B30 | SKC | 224-PCXR4 | 691489 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,510 | 2,007 | 1.010x - 13.764 | 0.999 | |
| B31 | SKC | 224-PCXR4 | 691509 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,499 | 1,991 | 0.997x + 0.891 | 1.000 | |
| B32 | SKC | 224-PCXR4 | 091567 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,497 | 1,996 | 0.996x + 3.273 | 1.000 | |
| B33 | SKC | 224-PCXR4 | 091756 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,505 | 1,992 | 1.000x - 4.228 | 0.999 | |
| B34 | SKC | 224-PCXR4 | 612962 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,508 | 2,011 | 1.007x - 5.647 | 1.000 | |
| B35 | SKC | 224-PCXR4 | 602682 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 1,991 | 0.997x + 1.603 | 0.999 | |
| B36 | SKC | 224-PCXR4 | 626164 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,498 | 2,002 | 1.004x - 8.113 | 1.000 | |
| B37 | SKC | 224-PCXR4 | 626256 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,508 | 2,001 | 1.005x - 10.431 | 1.000 | |
| B38 | SKC | 224-PCXR4 | 626167 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,000 | 1,497 | 1,993 | 0.999x - 0.639 | 1.000 | |
| B39 | SKC | 224-PCXR4 | 034637 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,503 | 1,991 | 1.002x - 7.186 | 0.999 | |
| B40 | SKC | 224-PCXR4 | 798349 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,494 | 1,990 | 1.000x - 7.405 | 1.000 | |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peers Detudom
(Mr. Peers Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ซอยพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900
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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 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,498 | 2,001 | 1.001x - 3.597 | 1.000 | |
| B42 | SKC | 224-PCXR4 | 626041 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,499 | 2,007 | 1.005x - 8.012 | 1.000 | |
| B43 | SKC | 224-PCXR4 | 034636 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 1,997 | 0.993x + 10.787 | 1.000 | |
| B44 | SKC | 224-PCXR8 | 529341 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,502 | 2,009 | 1.010x - 14.387 | 1.000 | |
| B45 | SKC | 224-PCXR8 | 529594 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,509 | 1,991 | 0.992x + 12.045 | 1.000 | |
| B46 | SKC | 224-PCXR8 | 566743 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,505 | 2,000 | 1.006x - 13.608 | 0.999 | |
| B47 | SKC | 224-PCXR8 | 566747 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,504 | 1,998 | 1.004x - 7.545 | 1.000 | |
| B48 | SKC | 224-PCXR8 | 566753 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,494 | 1,996 | 0.998x - 0.387 | 1.000 | |
| B49 | SKC | 224-PCXR8 | 566780 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,499 | 1,995 | 1.005x - 13.932 | 0.999 | |
| B50 | SKC | 224-PCXR8 | 500400 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,006 | 1,498 | 2,008 | 1.002x - 1.667 | 1.000 | |
| B51 | SKC | 224-PCXR8 | 500363 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,505 | 2,002 | 1.008x - 17.209 | 0.999 | |
| B52 | SKC | 224-PCXR8 | 093186 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 994 | 1,496 | 1,998 | 1.003x - 7.976 | 1.000 | |
| B53 | SKC | 224-PCXR8 | 707670 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,512 | 2,002 | 1.004x - 6.981 | 1.000 | |
| B54 | SKC | 224-PCXR3 | 509821 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,503 | 2,006 | 1.009x - 17.041 | 0.999 | |
| B55 | SKC | 224-PCXR3 | 510710 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,000 | 1,501 | 1,993 | 0.996x + 2.606 | 1.000 | |
| B56 | SKC | 224-PCXR3 | 511450 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,012 | 1,502 | 2,008 | 0.997x + 9.801 | 1.000 | |
| B57 | SKC | 224-PCXR3 | 510798 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,493 | 2,004 | 1.003x - 2.925 | 1.000 | |
| B58 | SKC | 224-PCXR3 | 509852 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,499 | 1,997 | 1.001x - 8.640 | 0.999 | |
| B59 | SKC | 224-PCXR3 | 509862 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,000 | 1,504 | 2,001 | 0.999x + 4.160 | 1.000 | |
| B60 | SKC | 224-PCXR3 | 512655 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,502 | 2,008 | 1.007x - 9.991 | 1.000 | |
| B61 | SKC | 224-PCXR3 | 503915 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,491 | 1,995 | 1.003x - 8.373 | 1.000 | |
| B62 | SKC | 224-PCXR3 | 505975 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,498 | 2,001 | 1.002x - 4.813 | 1.000 | |
| B63 | SKC | 224-PCXR3 | 511432 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,503 | 1,996 | 1.008x - 19.707 | 0.999 | |
| B64 | SKC | 224-PCXR3 | 508302 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,494 | 1,992 | 0.993x + 6.854 | 1.000 | |
| B65 | SKC | 224-PCXR3 | 508310 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,000 | 1,505 | 2,001 | 1.003x - 8.089 | 0.999 | |
| B66 | SKC | 224-PCXR3 | 509861 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,495 | 1,996 | 0.992x + 10.934 | 1.000 | |
| B67 | SKC | 224-PCXR3 | 506295 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,509 | 1,997 | 1.001x - 4.236 | 1.000 | |
| B68 | SKC | 224-PCXR3 | 505872 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,491 | 2,001 | 1.000x - 1.187 | 1.000 | |
| B69 | SKC | 224-PCXR3 | 508375 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,006 | 1,505 | 1,998 | 1.005x - 11.342 | 0.999 | |
| B70 | SKC | 224-PCXR3 | 510623 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,508 | 1,997 | 1.001x - 1.890 | 1.000 | |
| B71 | SKC | 224-PCXR3 | 508367 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,504 | 2,004 | 1.006x - 12.521 | 0.999 | |
| B72 | SKC | 224-PCXR3 | 505977 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,007 | 1,496 | 1,998 | 0.991x + 11.538 | 1.000 | |
| B73 | SKC | 224-PCXR3 | 512666 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,498 | 1,995 | 0.996x + 0.711 | 1.000 | |
| B74 | SKC | 224-PCXR3 | 505993 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,497 | 1,998 | 1.002x - 6.570 | 1.000 | |
| B75 | SKC | 224-PCXR3 | 509820 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,499 | 1,996 | 0.999x - 0.923 | 1.000 | |
| B76 | SKC | 224-PCXR3 | 509811 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,502 | 2,003 | 1.007x - 11.834 | 1.000 | |
| B77 | SKC | 224-PCXR3 | 508301 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,505 | 1,993 | 1.000x - 3.349 | 0.999 | |
| B78 | SKC | 224-PCXR3 | 510677 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,509 | 1,998 | 1.004x - 9.191 | 0.999 | |
| B79 | SKC | 224-PCXR3 | 510920 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,498 | 1,994 | 0.997x + 2.162 | 1.000 | |



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

7 ซอยพหลโยธิน 24 แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10000

7 Soi 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

| Personal Pump Data | | | | Calibration Data | | | | | | | | |
|--------------------|-------|-----------|------------|------------------|--------------------|-------|-------|-----------------|-------|-------|------------------------------|----------------|
| No. | Brand | Model | Serial No. | Date | Flow Rate (mL/min) | | | | | | Value From Calibration Curve | |
| | | | | | Setting | | | Actual (Q std.) | | | | |
| | | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² |
| 880 | SKC | 224-PCXR3 | 504569 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,501 | 2,007 | 1.014x - 22.484 | 0.999 |
| 881 | SKC | 224-PCXR3 | 503480 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,494 | 1,995 | 1.005x - 14.583 | 1.000 |
| 882 | SKC | 224-PCXR3 | 505673 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,497 | 2,001 | 1.004 - 6.075 | 1.000 |
| 883 | SKC | 224-PCXR3 | 510785 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 1,009 | 1,501 | 1,998 | 1.003x - 7.370 | 0.999 |
| 884 | SKC | 224-PCXR3 | 508333 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,502 | 1,997 | 1.000x - 1.894 | 1.000 |
| 885 | SKC | 224-PCXR3 | 505757 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,503 | 2,004 | 1.004x - 7.222 | 1.000 |
| 886 | SKC | 224-PCXR3 | 512625 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,493 | 1,997 | 0.996x + 1.139 | 1.000 |
| 887 | SKC | 224-PCXR3 | 504324 | 01/07/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,498 | 2,002 | 1.001x + 0.607 | 1.000 |
| 888 | SKC | 224-PCXR3 | 508307 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,497 | 1,995 | 0.995x + 5.331 | 1.000 |
| 889 | SKC | 224-PCXR3 | 509860 | 02/07/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,494 | 1,998 | 1.007x - 15.027 | 0.999 |
| 890 | SKC | 224-PCXR3 | 508366 | 04/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,510 | 1,992 | 0.998x + 0.332 | 1.000 |
| 891 | SKC | 224-PCXR3 | 510919 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,503 | 1,999 | 0.990x + 13.532 | 1.000 |
| 892 | SKC | 224-PCXR3 | 510987 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 2,002 | 0.999x + 3.737 | 1.000 |
| 893 | SKC | 224-PCXR3 | 509845 | 03/07/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,501 | 2,004 | 1.008x - 12.857 | 1.000 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Mr. Peera Detudom
(Mr. Peera Detudom)



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

| Rotameter Data | | | Calibration Data | | | | | | | | | |
|----------------|-------|--------|------------------|---------------------|-------|-------|-----------------|--------|--------|------------------------------|----------------|--|
| No. | Brand | Model | Date | Flow Rate (ml/min) | | | | | | Value From Calibration Curve | | |
| | | | | Flow Rate (Reading) | | | Actual (Q std.) | | | | | |
| | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² | |
| H-B01 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 498.8 | 1001.4 | 2005.7 | 0.996x + 4.876 | 1.000 | |
| H-B02 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 501.6 | 1001.3 | 1997.6 | 0.997x + 5.643 | 1.000 | |
| H-B03 | Dwyer | VFB-65 | 03/07/2025 | 500 | 1,000 | 2,000 | 499.3 | 1001.9 | 1990.3 | 0.998x + 3.307 | 0.999 | |
| H-B04 | Dwyer | VFB-65 | 04/07/2025 | 500 | 1,000 | 2,000 | 501.3 | 997.3 | 2005.9 | 1.000x + 1.052 | 1.000 | |
| H-B05 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 501.6 | 998.8 | 2005.5 | 1.003x - 1.210 | 1.000 | |
| H-B06 | Dwyer | VFB-65 | 03/07/2025 | 500 | 1,000 | 2,000 | 500.9 | 1001.3 | 1990.6 | 0.997x + 5.814 | 0.999 | |
| H-B07 | Dwyer | VFB-65 | 04/07/2025 | 500 | 1,000 | 2,000 | 501.9 | 1001.7 | 2009.2 | 0.999x - 1.217 | 1.000 | |
| H-B08 | Dwyer | VFB-65 | 04/07/2025 | 500 | 1,000 | 2,000 | 499.0 | 998.4 | 2006.7 | 1.002x - 9.086 | 0.999 | |
| H-B09 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 498.8 | 1000.5 | 1998.8 | 1.001x - 1.402 | 1.000 | |
| H-B10 | Dwyer | VFB-65 | 02/07/2025 | 500 | 1,000 | 2,000 | 500.2 | 1000.6 | 2001.7 | 0.999x + 3.178 | 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@spscn.com, www.spscn.com

Rotameter Calibration Report (For Personal Pump Low Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Rotameter Data

| Rotameter Data | | | Calibration Data | | | | | | | | | |
|----------------|-------|--------|------------------|---------------------|-----|-----|-----------------|-------|-------|------------------------------|----------------|--|
| No. | Brand | Model | Date | Flow Rate (ml/min) | | | | | | Value From Calibration Curve | | |
| | | | | Flow Rate (Reading) | | | Actual (Q std.) | | | | | |
| | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² | |
| L-B01 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 50.3 | 100.2 | 201.1 | 1.001x + 0.271 | 1.000 | |
| L-B02 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 50.5 | 100.3 | 202.2 | 0.996x + 1.427 | 1.000 | |
| L-B03 | Dwyer | VFA-21 | 03/07/2025 | 50 | 100 | 200 | 50.2 | 101.5 | 199.1 | 1.000x + 0.166 | 1.000 | |
| L-B04 | Dwyer | VFA-21 | 04/07/2025 | 50 | 100 | 200 | 50.9 | 99.3 | 201.4 | 0.997x + 1.377 | 0.999 | |
| L-B05 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 50.1 | 101.7 | 199.9 | 0.994x + 1.540 | 1.000 | |
| L-B06 | Dwyer | VFA-21 | 03/07/2025 | 50 | 100 | 200 | 50.8 | 99.0 | 201.4 | 0.999x + 0.969 | 0.999 | |
| L-B07 | Dwyer | VFA-21 | 04/07/2025 | 50 | 100 | 200 | 49.9 | 101.2 | 200.6 | 1.002x + 0.347 | 1.000 | |
| L-B08 | Dwyer | VFA-21 | 04/07/2025 | 50 | 100 | 200 | 50.5 | 99.7 | 199.8 | 1.001x - 0.048 | 1.000 | |
| L-B09 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 50.7 | 99.9 | 199.3 | 0.997x + 1.056 | 0.999 | |
| L-B10 | Dwyer | VFA-21 | 02/07/2025 | 50 | 100 | 200 | 49.8 | 99.2 | 199.6 | 0.999x - 0.559 | 1.000 | |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



Certificate of Calibration

Aquion : Anion (ID#894)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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



บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO.,LTD.

Operator Signature : Teerapat B

Date : Jun 6, 2025

(Mr. Teerapat Boonla)

Application Chemist



GAS CHROMATOGRAPH TEST CERTIFICATION

Certificate No. : SV0824/22063

Instrument Type : Gas Chromatography

Model : CP-3800

Serial Number : 00734

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

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

Date : 05/08/2024

ELECTRONIC TEST

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

RUN CHROMATOGRAM TEST

DETECTOR : Flame Ionization Detector (FID Channel Front)

INJECTOR : Capillary Injector Model 1079

GC CONDITION:

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

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

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

SENSITIVITY TEST: C15. (Area count) = 156,955 Counts.



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 Trikinut

Date : 05/08/2024



VARIAN

1/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



VARIAN

2/2

SERVICE DEPARTMENT
FR-SV-029 Rev. 04



Results Integrated System Testing

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

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

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

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

| | | |
|----------------|--|-------------------------------|
| Compliance | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| Performance by | Sumanot. | |
| Date | 05/08/2567 | |



| | | | |
|-------------|-------|------|------------|
| Comments | - | | |
| Reviewed by | S. P. | Date | 05/08/2024 |



Results Integrated System Testing

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

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

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

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

| | | |
|----------------|--|-------------------------------|
| Compliance | <input checked="" type="checkbox"/> Pass | <input type="checkbox"/> Fail |
| Performance by | Sumanot. | |
| Date | 05/08/2024 | |



| | | | |
|-------------|-------|------|------------|
| Comments | - | | |
| Reviewed by | S. P. | Date | 05/08/2024 |

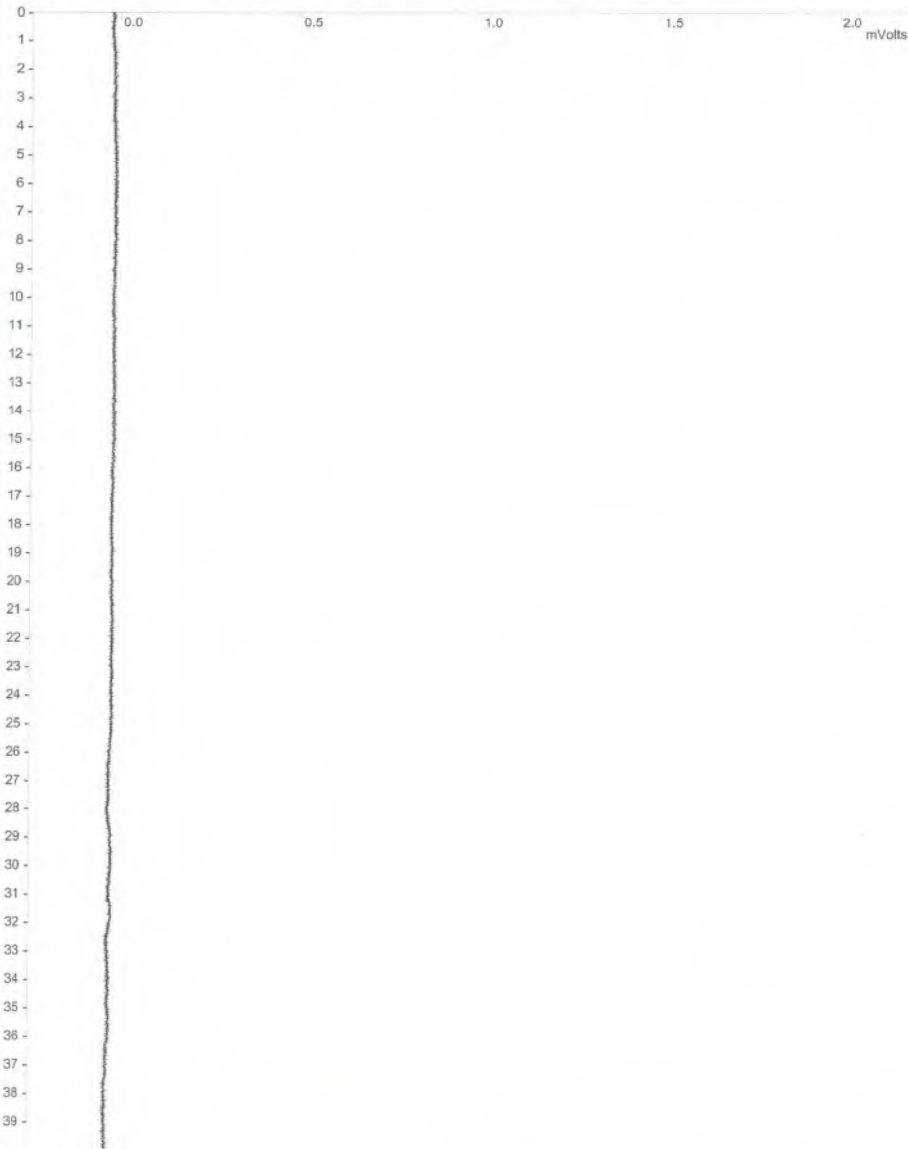
Title :
Run File : f:\ \sps2024\cal2024\baseline2024002.run
Method File : D:\Method-GC\star C\Star\TU\cal0203\baseline FID.mth
Sample ID : Baseline2024

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

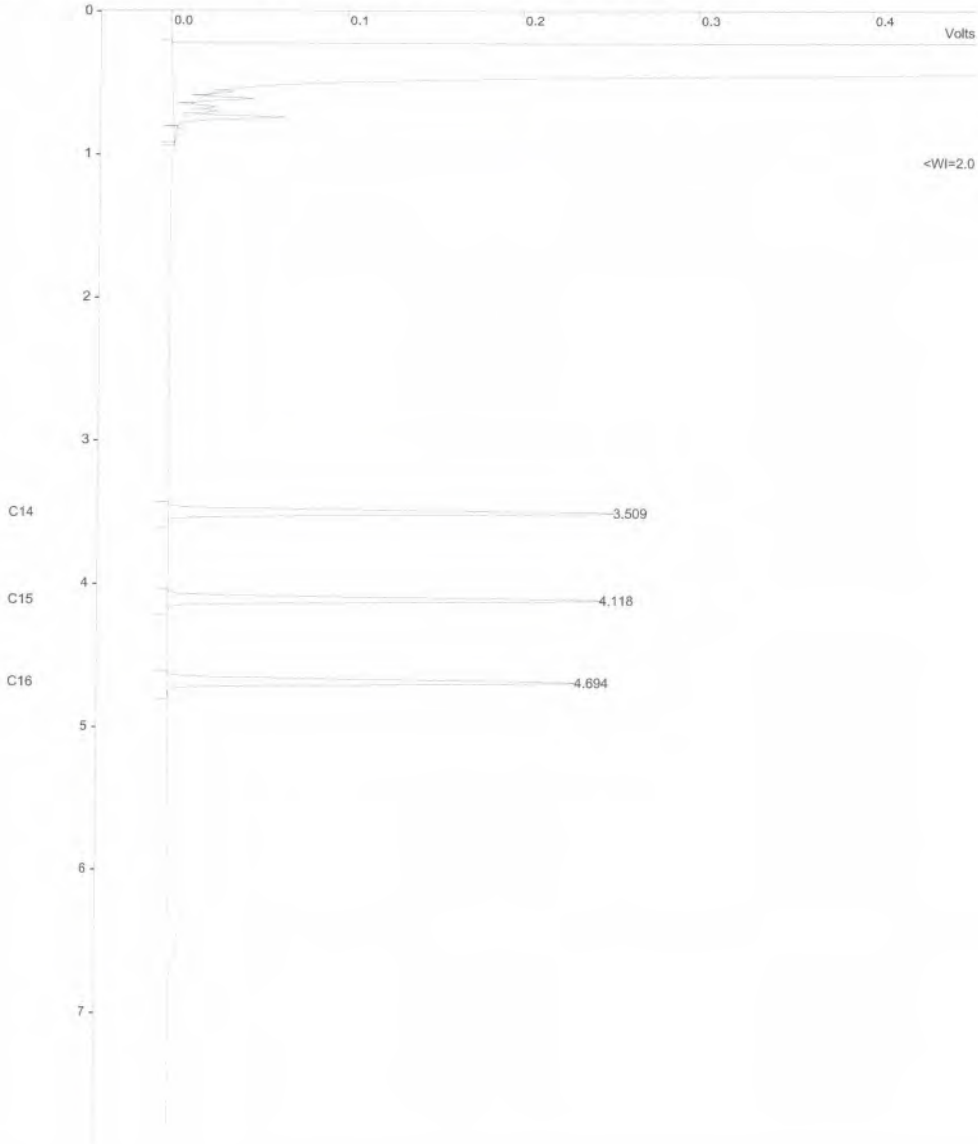
Title :
Run File : f:\sps2024\cal2024\fid2024003.run
Method File : d:\caf2024003-front.mth
Sample ID : FID2024

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

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

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

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



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

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

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

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

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

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

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

Status Codes:
C - Out of calibration range

Total Unidentified Counts : 69332200 counts

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

Multiplier: 1 Divisor: 1 Unidentified Peak Factor: 0

Baseline Offset: -29 microVolts LSB: 1 microVolts

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

Manual injection

Calib. out of range; No Recovery Action Specified

Sample ID: **fid std**

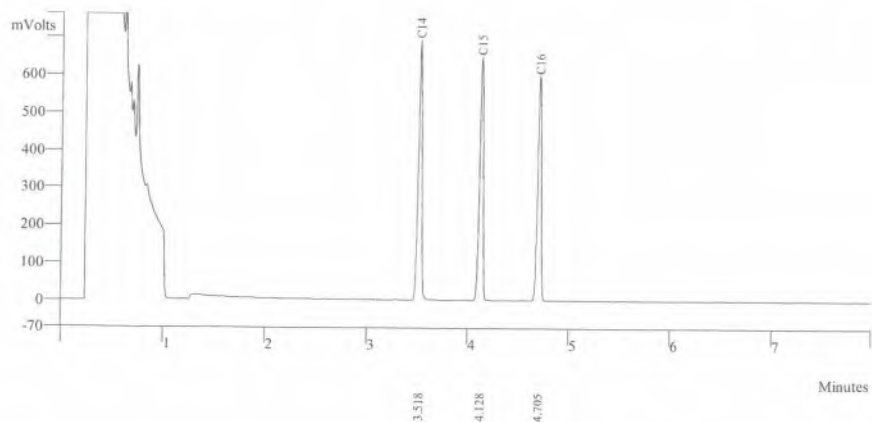
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024001.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 152.6865 | 3.518 | 163565 | BB | 2.2 |
| 2 | C15 | 147.1889 | 4.128 | 157309 | BB | 2.3 |
| 3 | C16 | 138.7997 | 4.705 | 146804 | BB | 2.3 |
| Totals | | 438.6751 | | 467678 | | |

Sample ID: **fid std**

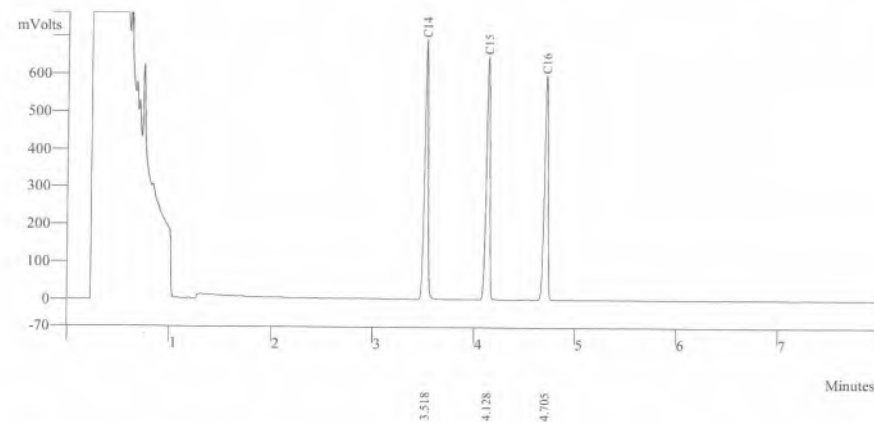
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):



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

c:\star\data\tu\cal2024\fid2024002.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 152.6865 | 3.518 | 168565 | BB | 2.2 |
| 2 | C15 | 137.1189 | 4.128 | 159359 | BB | 2.3 |
| 3 | C16 | 128.7997 | 4.705 | 147834 | BB | 2.3 |
| Totals | | 418.6042 | | 475758 | | |

Sample ID: **fid std**

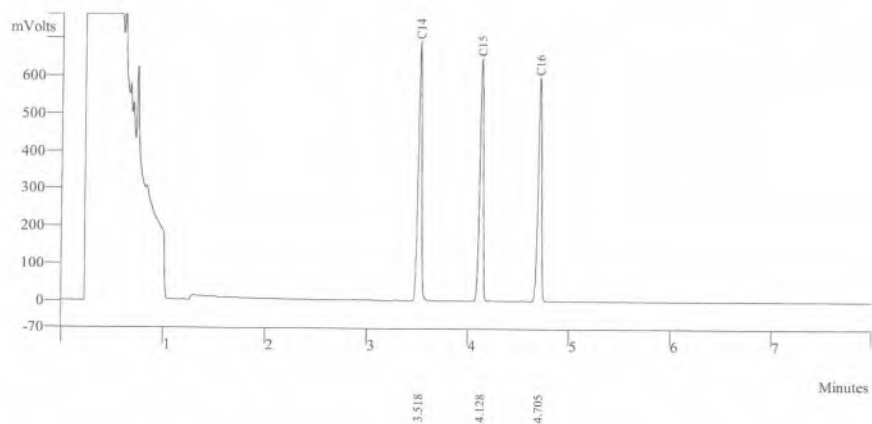
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

**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 | | |

Sample ID: **fid std**

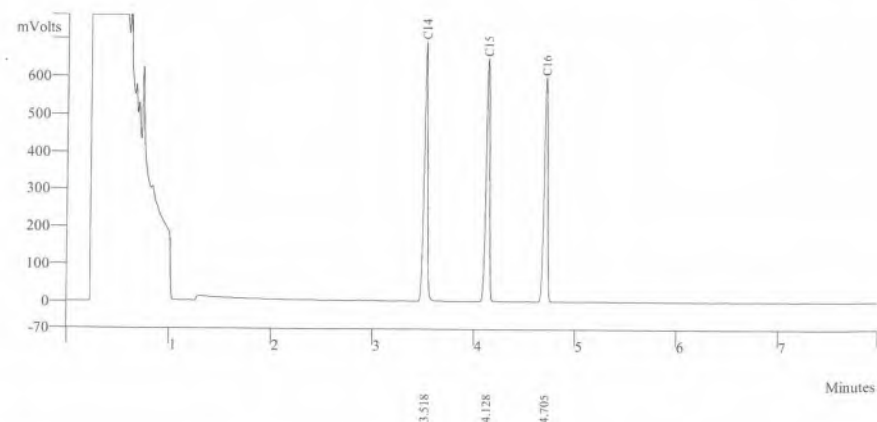
Operator (Inj): suwarot
Injection Date: 05/08/2024
Calc Date: 05/08/2024
Run Time (min): 7.993
Workstation: GC-LAB
Instrument (Inj):

**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 | | |

Sample ID: fid std

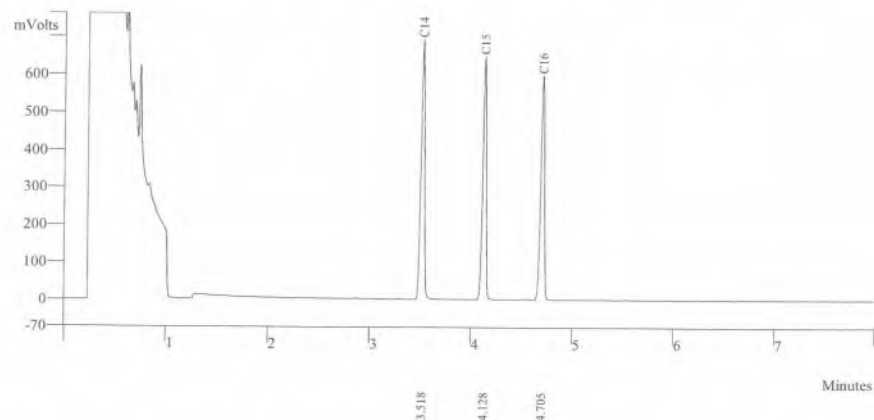
Operator (Inj): suwarot
 Injection Date: 05/08/2024
 Calc Date: 05/08/2024
 Run Time (min): 7.993
 Workstation: GC-LAB
 Instrument (Inj):

**VARIAN**

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

c:\star\data\tu\cal2024\fid2024005.run

A = FID 10 V RESULTS



| Peak No | Peak Name | Result () | Ret Time (min) | Peak Area (counts) | Sep. Code | Width 1/2 (sec) |
|---------|-----------|-----------|----------------|--------------------|-----------|-----------------|
| 1 | C14 | 162.7965 | 3.518 | 164521 | BB | 2.2 |
| 2 | C15 | 137.1159 | 4.128 | 158379 | BB | 2.3 |
| 3 | C16 | 128.1947 | 4.705 | 149834 | BB | 2.3 |
| Totals | | 428.1071 | | 472734 | | |



THAI UNIQUE CO.,LTD.

1 Of 1



Agilent Technologies

Certificate of Analysis

FID-TCD Performance Evaluation Sample Kit

Agilent Part Number: 5080-8842, 18710-60170

Sample Lot Number: 0006750304

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

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

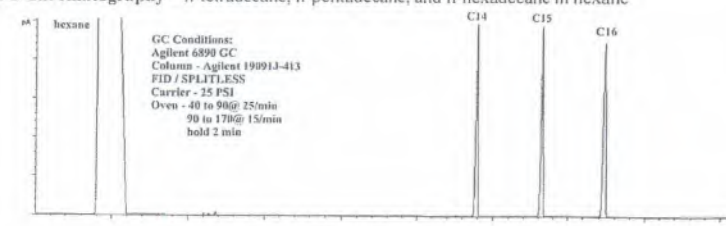
Solvent: hexane

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

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

Typical Analytical Spectrum or Chromatography

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



Date of release: 30 June 2023

Date of expiration: 31 July 2025

Monica Bourgeois
 Monica Bourgeois
 QMS Representative

Certificate of Calibration

Certificate No.: WK2312-031-1

Page 1 of 2

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

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

Reference standard instruments :

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

MIT : Miracle International Technology Co.,Ltd.

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

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

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

Calibrated by : Mr.Taywanat Hansuwankul

Approved by :

Ms. Budsagorn Patcha

Authorized Signatory

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

Calibration Results

Certificate No. : WK2312-031-1

Page 2 of 2

Calibration Result of the Accuracy

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

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

(X) Without Adjustment () After Adjustment

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



Certificate of Calibration

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

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

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

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

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

Calibrated by

Nanthiya Ngampring
Mrs. Nanthiya Ngampring
Metrology Technician

Approved by

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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

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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

Certificate No. : LF24-0278

Report data type : As-Found
Date of Calibrate : 26-Jun-2024
Date of Receive : 17-Jun-2024

Environment condition

Temperature : 23 °C ± 3 °C
Humidity : 50 %RH ± 20 %RH

Customer : Thai Unique Co., Ltd.
Address : 80-82 Prachathipatai Road,
Bangkhunphrom, Pranakorn,
Bangkok 10200

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

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

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

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

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

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

Standard Used

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

Certificate No. : LF24-0278

Model : 51

Serial No. : 5910857

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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