

ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

| รายการตรวจวัด | เครื่องมือเก็บตัวอย่าง | เครื่องมือตรวจวิเคราะห์ |
|---|---|--|
| 1. คุณภาพอากาศในบรรยากาศ Total Suspended Particulate | High Volume Air Sampler No. B15, B21, B24, B37, B41 | Digital Balance |
| PM ₁₀ | High Volume PM ₁₀ Air Sampler No. B06, B20, B31, B32, R01 | Digital Balance |
| PM _{2.5} | High Volume PM _{2.5} Air Sampler No. B03, B11, B12, B13, B15 | Digital Balance |
| Hydrogen Chloride | Gas Sampler Box No. B01, B03, B04, B06, B08 | - |
| Sulfur Dioxide | SO ₂ Analyzer No. B01, B04, B10, B11, R05 | SO ₂ Analyzer No. B01, B04, B10, B11, R05 |
| Nitrogen Dioxide | NO _x Analyzer No. B03, B12, B13, B17, B18 | NO _x Analyzer No. B03, B12, B13, B17, B18 |
| 2. คุณภาพอากาศจากปล่อง Total Suspended Particulate | Console No. B01 Pitot Tube No. B35 | Digital Balance |
| Oxides of Nitrogen | Vacuum Gauge | Spectrophotometer |
| Sulfur Dioxide | Personal Pump SKC No. B05 Rotameter No. H-B08 | - |
| Sodium Hydroxide as Sodium | Console No. B01 Pitot Tube No. B35 | Inductively Couple Plasma (ICP) |
| Oil Mist | Console No. B01, B04 Pitot Tube No. B04, B35 | Infrared Spectrophotometer (IR) |
| Hydrogen Chloride | Personal Pump SKC No. B05, B74 Rotameter No. H-B02, B08 | Ion Chromatography (IC) |
| 3. ระดับเสียงในบรรยากาศ 3.1 ระดับเสียงริมรั้วโรงงาน L _{eq} 24 hr และ L ₉₀ | Acoustic Calibrator Sound Level Meter No. ACO-B07, B09, B12, B19, B21, B26 Cirrus-CR-B06, B07, B09, B10 | - - |
| 3.2 ระดับเสียงในชุมชน L _{eq} 24 hr และ L _{max} | Acoustic Calibrator Sound Level Meter No. ACO-B02, B38, B44, Cirrus-CR-B07 | - |

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

| รายการตรวจวัด | เครื่องมือเก็บตัวอย่าง | เครื่องมือตรวจวิเคราะห์ |
|--|---|---|
| 4. คุณภาพน้ำ | | |
| pH | - | pH Meter |
| Temperature | - | Thermometer |
| Total Suspended Solids | - | Digital Balance |
| Total Dissolved Solids | - | Digital Balance |
| BOD ₅ | - | BOD Analyzer |
| COD | - | COD Reactor |
| Grease & Oil | - | Digital Balance |
| Manganese | - | Inductively Couple Plasma (ICP) |
| Lead | - | Inductively Couple Plasma (ICP) |
| | | Atomic Absorption Spectrophotometer (AAS) |
| Zinc | - | Inductively Couple Plasma (ICP) |
| Total Chromium | - | Inductively Couple Plasma (ICP) |
| Conductivity | - | Conductivity Meter |
| Total Aluminum | - | Inductively Couple Plasma (ICP) |
| Total Iron | - | Inductively Couple Plasma (ICP) |
| Total Coliform Bacteria | - | Incubator |
| | | Water Bath |
| Sulfate | - | Spectrophotometer |
| Mercury | - | Atomic Absorption Spectrophotometer (AAS) |
| Hexavalent Chromium | - | Spectrophotometer |
| Cadmium | - | Atomic Absorption Spectrophotometer (AAS) |
| Arsenic | - | Atomic Absorption Spectrophotometer (AAS) |
| Nickel | - | Inductively Couple Plasma (ICP) |
| Copper | - | Inductively Couple Plasma (ICP) |
| 5. คุณภาพดิน | | |
| Total Iron | - | Inductively Couple Plasma (ICP) |
| Total Manganese | - | Inductively Couple Plasma (ICP) |
| Total Chromium | - | Inductively Couple Plasma (ICP) |
| Total Lead | - | Inductively Couple Plasma (ICP) |
| 6. ระดับความร้อนในสถานประกอบการ | | |
| WBGT | Digital Thermometer Heat Stress WBGT Meter No. B07, B11, B12, B25, B26, B28 | - |

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)**

| รายการตรวจวัด | เครื่องมือเก็บตัวอย่าง | เครื่องมือตรวจวิเคราะห์ |
|---|---|-------------------------|
| 7. คุณภาพอากาศในสถานประกอบการ Total Dust | Personal Pump No. B53, B90 Rotameter No. H-B07, B10 | Digital Balance |
| Respirable Dust | Personal Pump No. B26, B93 Rotameter No. H-B07, B10 | Digital Balance |
| Hydrogen Chloride | Personal Pump No. B21, B89 Rotameter No. H-B07, B10 | Ion Chromatography (IC) |
| 8. ระดับเสียงในสถานประกอบการ L_{eq} 8 hr | Acoustic Calibrator Sound Level Meter No. ACO-B18, B29, B33, R40, R50 | - |
| 9. ปริมาณเสียงสะสมแบบติดตัวบุคคล Noise Dose (TWA) | Acoustic Calibrator Sound Level Meter No.NMD-B01, B02, B03, B05, B07, B11 | - |

คุณภาพอากาศในบรรยากาศ



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

High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

| High Volume PM-10 Data | | Calibration Data | | |
|------------------------|------------|------------------|--|----------------|
| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
| B01 | B01 | 04/02/2025 | $y = 1.135x - 1.122$ | 0.996 |
| B02 | B02 | 04/02/2025 | $y = 1.140x - 0.728$ | 0.999 |
| B03 | B03 | 04/02/2025 | $y = 1.160x - 3.702$ | 0.998 |
| B04 | B04 | 05/02/2025 | $y = 1.154x - 4.671$ | 0.999 |
| B05 | B05 | 06/02/2025 | $y = 1.151x - 2.705$ | 0.998 |
| B06 | B06 | 03/02/2025 | $y = 1.114x - 1.672$ | 0.997 |
| B07 | B07 | 03/02/2025 | $y = 1.085x + 0.543$ | 0.996 |
| B08 | B08 | 04/02/2025 | $y = 1.149x - 2.014$ | 0.998 |
| B09 | B09 | 03/02/2025 | $y = 1.081x + 0.344$ | 0.997 |
| B10 | B10 | 03/02/2025 | $y = 1.094x - 1.679$ | 0.997 |
| B11 | B11 | 05/02/2025 | $y = 1.137x - 0.690$ | 0.997 |
| B12 | B12 | 03/02/2025 | $y = 1.094x - 1.679$ | 0.997 |
| B13 | B13 | 03/02/2025 | $y = 1.172x - 3.186$ | 0.998 |
| B14 | B14 | 05/02/2025 | $y = 1.160x - 5.111$ | 0.998 |
| B15 | B15 | 03/02/2025 | $y = 1.141x - 2.637$ | 0.998 |
| B16 | B16 | 04/02/2025 | $y = 1.106x + 1.699$ | 0.998 |
| B17 | B17 | 04/02/2025 | $y = 1.105x + 1.676$ | 0.998 |
| B18 | B18 | 04/02/2025 | $y = 1.176x - 3.948$ | 0.997 |
| B19 | B19 | 04/02/2025 | $y = 1.065x + 0.997$ | 0.998 |
| B20 | B20 | 04/02/2025 | $y = 1.163x - 5.103$ | 0.997 |
| B21 | B21 | 05/02/2025 | $y = 1.120x + 0.250$ | 0.999 |
| B22 | B22 | 06/02/2025 | $y = 1.152x - 3.458$ | 0.998 |
| B23 | B23 | 06/02/2025 | $y = 1.149x - 3.696$ | 0.999 |
| B24 | B24 | 03/02/2025 | $y = 1.109x - 1.930$ | 0.999 |
| B25 | B25 | 03/02/2025 | $y = 1.166x - 4.876$ | 0.998 |
| B26 | B26 | 05/02/2025 | $y = 1.118x - 2.223$ | 0.997 |
| B27 | B27 | 03/02/2025 | $y = 1.127x - 3.668$ | 0.999 |
| B28 | B28 | 04/02/2025 | $y = 1.112x - 2.294$ | 0.999 |
| B29 | B29 | 04/02/2025 | $y = 1.155x - 4.309$ | 0.997 |
| B30 | B30 | 04/02/2025 | $y = 1.136x - 2.651$ | 0.998 |
| B31 | B31 | 03/02/2025 | $y = 1.086x + 2.828$ | 0.999 |
| B32 | B32 | 04/02/2025 | $y = 1.099x - 0.279$ | 0.998 |
| B33 | B33 | 04/02/2025 | $y = 1.152x - 4.474$ | 0.997 |
| B34 | B34 | 04/02/2025 | $y = 1.149x - 0.892$ | 0.997 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

Calibration Data

| High Volume PM-10 Data | | Calibration Data | | |
|------------------------|------------|------------------|--|----------------|
| Recorder No. | Blower No. | Date | Actual Flowrate (ft ³ /min) | R ² |
| R01 | R01 | 04/02/2025 | y = 1.168x-5.536 | 0.996 |
| R02 | R02 | 04/02/2025 | y = 1.116x-2.200 | 0.998 |
| R03 | R03 | 03/02/2025 | y = 1.160x-5.911 | 0.997 |
| R04 | R04 | 03/02/2025 | y = 1.129x-4.829 | 0.999 |
| R05 | R05 | 03/02/2025 | y = 1.119x-3.825 | 0.998 |
| R06 | R06 | 05/02/2025 | y = 1.125x-1.580 | 0.997 |
| R07 | R07 | 06/02/2025 | y = 1.152x-2.503 | 0.997 |
| R08 | R08 | 03/02/2025 | y = 1.114x-1.275 | 0.996 |
| R09 | R09 | 03/02/2025 | y = 1.130x-4.187 | 0.999 |
| R10 | R10 | 05/02/2025 | y = 1.151x-2.832 | 0.998 |
| R11 | R11 | 05/02/2025 | y = 1.134x-2.692 | 0.997 |
| R12 | R12 | 05/02/2025 | y = 1.158x-4.761 | 0.996 |
| R13 | R13 | 03/02/2025 | y = 1.137x-3.435 | 0.999 |
| R14 | R14 | 03/02/2025 | y = 1.126x-2.499 | 0.996 |
| R15 | R15 | 04/02/2025 | y = 1.111x-3.285 | 0.999 |
| R16 | R16 | 04/02/2025 | y = 1.124x-0.808 | 0.996 |
| R17 | R17 | 04/02/2025 | y = 1.141x-3.412 | 0.999 |
| R18 | R18 | 03/02/2025 | y = 1.115x-3.615 | 0.998 |
| R19 | R19 | 03/02/2025 | y = 1.117x-0.234 | 0.996 |
| R20 | R20 | 06/02/2025 | y = 1.146x-4.675 | 0.997 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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| CALIBRATION REPORT | | | |
|---|---|------------------------|--|
| PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC) | | | |
| DATE : | 18 February 2025 | BRAND : | BGI |
| | | MODEL : | PQ200 |
| NO. | PM2.5-03 | SERIAL NO. | 160810-49 (VSCC) |
| CALIBRATING CONDITION | | | |
| Pressure | 1011 | mmbars | Temp. 24.5 °C |
| | | % RH | 50 |
| Calibration Method : Dry Cal Primary | | Model : Defender 510 H | S/N : 136164 |
| CALIBRATION SETTING | | | |
| detaCal | PM2.5 AIR SAMPLER | | |
| Flowrate Reading, L/min | Initial Flowrate Reading (Before Adj.), L/min | % Dif. | Final Flowrate Reading (After Adj.), L/min |
| 16.70 | 16.65 | 0.299 | 16.70 |

Calibrated by : Adul Dangklom
 (Mr. Adul Dangklom)

Approved by : Peera Detudom
 (Mr. Peera Detudom)



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| CALIBRATION REPORT | | | |
|---|--|------------------------|---|
| PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC) | | | |
| DATE : | 18 February 2025 | MODEL : | CCZ--30 |
| NO. | PM2.5-11 | SERIAL NO. | 2024EN0242005 |
| CALIBRATING CONDITION | | | |
| Pressure | 1011 | mmbar | Temp. 24.5 °C % RH 50 |
| Calibration Method : Dry Cal Primary | | Model : Defender 510 H | S/N : 136164 |
| CALIBRATION SETTING | | | |
| detaCal | PM2.5 AIR SAMPLER | | |
| Flowrate Reading,L/min | Initial Flowrate Reading (Before Adj.),L/min | %Dif. | Final Flowrate Reading (After Adj.),L/min |
| 16.70 | 16.66 | 0.240 | 16.70 |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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| CALIBRATION REPORT | | | |
|---|--|------------------------|---|
| PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC) | | | |
| DATE : | 18 February 2025 | MODEL : | CCZ--30 |
| NO. | PM2.5-12 | SERIAL NO. | 2024EN0242003 |
| CALIBRATING CONDITION | | | |
| Pressure | 1011 | mmbar | Temp. 24.5 °C % RH 50 |
| Calibration Method : Dry Cal Primary | | Model : Defender 510 H | S/N : 136164 |
| CALIBRATION SETTING | | | |
| detaCal | PM2.5 AIR SAMPLER | | |
| Flowrate Reading,L/min | Initial Flowrate Reading (Before Adj.),L/min | %Dif. | Final Flowrate Reading (After Adj.),L/min |
| 16.70 | 16.64 | 0.359 | 16.70 |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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| CALIBRATION REPORT | | | |
|---|--|------------------------|---|
| PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC) | | | |
| DATE : | 18 February 2025 | MODEL : | CCZ--30 |
| NO. | PM2.5-13 | SERIAL NO. | 2024EN0242004 |
| CALIBRATING CONDITION | | | |
| Pressure | 1011 | mmbar | Temp. 24.5 °C % RH 50 |
| Calibration Method : Dry Cal Primary | | Model : Defender 510 H | S/N : 136164 |
| CALIBRATION SETTING | | | |
| detaCal | PM2.5 AIR SAMPLER | | |
| Flowrate Reading,L/min | Initial Flowrate Reading (Before Adj.),L/min | %Dif. | Final Flowrate Reading (After Adj.),L/min |
| 16.70 | 16.66 | 0.240 | 16.70 |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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| CALIBRATION REPORT | | | |
|---|--|------------------------|---|
| PM2.5 AIR SAMPLER (VERY SHARP CUT CYCLONE-VSCC) | | | |
| DATE : | 18 February 2025 | MODEL : | CCZ--30 |
| NO. | PM2.5-15 | SERIAL NO. | 2024EN0242002 |
| CALIBRATING CONDITION | | | |
| Pressure | 1011 | mmbar | Temp. 24.5 °C % RH 50 |
| Calibration Method : Dry Cal Primary | | Model : Defender 510 H | S/N : 136164 |
| CALIBRATION SETTING | | | |
| detaCal | PM2.5 AIR SAMPLER | | |
| Flowrate Reading,L/min | Initial Flowrate Reading (Before Adj.),L/min | %Dif. | Final Flowrate Reading (After Adj.),L/min |
| 16.70 | 16.64 | 0.359 | 16.70 |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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Gas Sampler Box Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Dry Cal DCL-ML

S/N : 136164

Calibration Data

| Gas Sampler | | Calibration Data | | | | | |
|-------------|-----------|------------------|--|---------------------------|--------------------|------------------|--------------------|
| No. | Rotameter | Date | Setting (Constant Flow) (ml/min) | Actual Flow Rate (ml/min) | | | |
| | | | | Sampling Line A | | Sampling Line B | |
| | | | | Normal Condition | Standard Condition | Normal Condition | Standard Condition |
| B01 | 2 (A&B) | 02/12/2024 | 200 | 199.8 | 199.7 | 200.5 | 200.4 |
| B02 | 2 (A&B) | 04/12/2024 | 200 | 200.2 | 200.1 | 200.7 | 200.6 |
| B03 | 2 (A&B) | 06/12/2024 | 200 | 199.9 | 199.8 | 200.4 | 200.3 |
| B04 | 2 (A&B) | 02/12/2024 | 200 | 200.6 | 200.5 | 200.2 | 200.1 |
| B05 | 2 (A&B) | 05/12/2024 | 200 | 200.4 | 200.3 | 200.3 | 200.2 |
| B06 | 2 (A&B) | 02/12/2024 | 200 | 200.3 | 200.2 | 200.5 | 200.4 |
| B07 | 2 (A&B) | 02/12/2024 | 200 | 200.6 | 200.5 | 200.8 | 200.7 |
| B08 | 2 (A&B) | 03/12/2024 | 200 | 199.9 | 199.8 | 200.4 | 200.3 |
| B09 | 2 (A&B) | 03/12/2024 | 200 | 200.5 | 200.4 | 200.6 | 200.5 |
| B10 | 2 (A&B) | 06/12/2024 | 200 | 200.7 | 200.6 | 200.3 | 200.2 |
| B11 | 2 (A&B) | 02/12/2024 | 200 | 200.8 | 200.7 | 200.4 | 200.3 |
| B12 | 2 (A&B) | 02/12/2024 | 200 | 200.7 | 200.6 | 200.6 | 200.5 |
| B13 | 2 (A&B) | 04/12/2024 | 200 | 200.8 | 200.7 | 200.3 | 200.2 |
| B14 | 2 (A&B) | 03/12/2024 | 200 | 200.3 | 200.2 | 200.7 | 200.6 |
| B15 | 2 (A&B) | 02/12/2024 | 200 | 199.8 | 199.7 | 200.5 | 200.4 |
| B16 | 2 (A&B) | 04/12/2024 | 200 | 200.4 | 200.3 | 200.6 | 200.5 |
| B17 | 2 (A&B) | 06/12/2024 | 200 | 199.8 | 199.7 | 200.3 | 200.2 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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| CALIBRATION REPORT | | | | | |
|--|--------------------------------------|-------------------|--------------------------------|--------------------------------|------------|
| SO ₂ FLUORESCENT ANALYZER | | | | | |
| DATE : | 18 February 2025 | BRAND : | API | MODEL : | 100A |
| NO. | SO ₂ -B01 | | | SERIAL NO. | 1749 |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | | Model | : 700 |
| Last Cal. Date | : 05 August 2024 | | | Serial No. | : 911 |
| 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 | Analyzer Response | Slope |
| Zero | 0 | 0.10 | - | 0 | - |
| SO ₂ Span | 400.0 | 399.8 | -0.050 | 400.0 | 1.008 |
| API Model 100A 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 | 659 | cc/min | 650 ± 10% | | |
| PMT | 103.2 | mV | -20-150 with Zero Air | | |
| UV LAMP | 3026.8 | mV | 1000-4900 | | |
| STR. LGT | 61.9 | PPB | <100 | | |
| DRK PMT | 63.4 | mV | -50 - 200 | | |
| DRK LMP | 58.2 | mV | -50 - 200 | | |
| HVPS | 675 | V | 550-900 constant | | |
| DCPS | 2529 | mV | 2500 ± 200 | | |
| RCELL TEMP | 50.3 | °C | 50 ± 1 | | |
| BOX TEMP | 29.4 | °C | 5-40 | | |
| PMT TEMP | 7.1 | °C | 7 ± 2.0 | | |
| SO ₂ Span Conc | 400 | PPB | 20-20,000 | | |
| SO ₂ Slope | 1.008 | - | 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 : Peera Detudom
(Mr.Peera Detudom)



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| CALIBRATION REPORT | | | | | |
|--|--------------------------------------|-------------------|--------------------------------|--------------------------------|------------|
| SO ₂ FLUORESCENT ANALYZER | | | | | |
| DATE : | 18 February 2025 | BRAND : | API | MODEL : | 100E |
| NO. | SO ₂ -B04 | | | SERIAL NO. | 3159 |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | | Model | : 700 |
| Last Cal. Date | : 05 August 2024 | | | Serial No. | : 911 |
| 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 | Analyzer Response | Slope |
| Zero | 0 | -0.10 | - | 0 | - |
| SO ₂ Span | 400.0 | 399.7 | -0.075 | 400.0 | 1.006 |
| API Model 100E SO ₂ Analyzer Check list | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 0-500 | | |
| SAMPLE PRESS | 28.5 | in-Hg | 25-35 | | |
| SAMPLE FLOW | 657 | cc/min | 650 ± 10% | | |
| PMT | 103.0 | mV | -20-150 with Zero Air | | |
| UV LAMP | 3016.4 | mV | 1000-4900 | | |
| STR. LGT | 61.7 | PPB | <100 | | |
| DRK PMT | 63.2 | mV | -50 - 200 | | |
| DRK LMP | 58.0 | mV | -50 - 200 | | |
| HVPS | 672 | V | 550-900 constant | | |
| DCPS | 2517 | mV | 2500 ± 200 | | |
| RCELL TEMP | 50.4 | °C | 50 ± 1 | | |
| BOX TEMP | 29.1 | °C | 5-40 | | |
| PMT TEMP | 7.0 | °C | 7 ± 2.0 | | |
| SO ₂ Span Conc | 400 | PPB | 20-20,000 | | |
| SO ₂ Slope | 1.006 | - | 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 :

Abul Dangklom
(Mr.Adul Dangklom)

Approved by :

Mr. Peera Detudom
(Mr.Peera Detudom)



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| CALIBRATION REPORT | | | | | | | | |
|--------------------------------------|--------------------------------------|-------------------|----------------|--------------------------------|------------|----|------|----|
| SO ₂ FLUORESCENT ANALYZER | | | | | | | | |
| DATE : | 18 February 2025 | BRAND : | Thermo | MODEL : | 43C | | | |
| NO. | SO2-B10 | SERIAL NO. | 43C-69604-364 | | | | | |
| Calibrator (Dilution System) | | | | | | | | |
| Brand | : API | | | Model | : 700 | | | |
| Last Cal. Date | : 05 August 2024 | | | Serial No. | : 911 | | | |
| Reference Standard Gas | | | | | | | | |
| Standard Gas | : Sulphur Dioxide (SO ₂) | | | Cylinder No. | : A00814SK | | | |
| Certified Date | : 21 June 2021 | Expired Date | : 21 June 2029 | Cylinder Conc. | : 49.8 ppm | | | |
| CALIBRATING CONDITION | | | | | | | | |
| Pressure | 1011 | mmbar | 24.6 | 24.6 | °C | 50 | % RH | 50 |
| CALIBRATION SETTING | | | | | | | | |
| Span | Initial Reading (Before Adj.),PPB | | | Final Reading (After Adj.),PPB | | | | |
| Set Point | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | | | | |
| Zero | 0 | 0.11 | - | 0 | | | | |
| SO ₂ Span | 400.0 | 400.3 | 0.075 | 400.0 | | | | |
| INSTRUMENT STATUS | | | | | | | | |
| CHAMBER TEMP | 44.2 °C | | FLOW | 1.0 LPM | | | | |
| PRESSURE | 728.7 mm Hg | | | | | | | |

Calibrated by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : Peera Detudom
(Mr.Peera Detudom)



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| CALIBRATION REPORT | | | | | |
|--|--------------------------------------|-------------------|--------------------------------|--------------------------------|--------|
| SO ₂ FLUORESCENT ANALYZER | | | | | |
| DATE : | 18 February 2025 | BRAND : | TELEDYNE | MODEL : | TML-50 |
| NO. | SO ₂ -811 | SERIAL NO. | SO2187 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | Model | : 700 | |
| Last Cal. Date | : 05 August 2024 | | Serial No. | : 911 | |
| 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 | Analyzer Response | Slope |
| Zero | 0 | -0.11 | - | 0 | - |
| SO ₂ Span | 400.0 | 400.1 | 0.025 | 400.0 | 1.010 |
| API Model TML-50 SO ₂ Analyzer Check list | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 0-500 | | |
| SAMPLE PRESS | 28.6 | in-Hg | 25-35 | | |
| SAMPLE FLOW | 655 | cc/min | 650 ± 10% | | |
| PMT | 103.4 | mV | -20-150 with Zero Air | | |
| UV LAMP | 3038.1 | mV | 1000-4900 | | |
| STR. LGT | 61.5 | PPB | <100 | | |
| DRK PMT | 62.9 | mV | -50 - 200 | | |
| DRK LMP | 57.6 | mV | -50 - 200 | | |
| HVPS | 670 | V | 550-900 constant | | |
| DCPS | 2524 | mV | 2500 ± 200 | | |
| RCELL TEMP | 50.1 | °C | 50 ± 1 | | |
| BOX TEMP | 29.0 | °C | 5-40 | | |
| PMT TEMP | 7.2 | °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 | 21.7 | mV | <250 | | |
| Stability at Zero | 0.1 | PPB | <0.2 | | |
| Stability at Span | 0.2 | PPB | 0.5% of reading (above 50 ppb) | | |

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr.Peera Detudom)



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CALIBRATION REPORT

SO₂ FLUORESCENT ANALYZER

DATE : 18 February 2025

BRAND : API

MODEL : 100E

NO. SO₂-R05

SERIAL NO. 3490

Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 05 August 2024

Serial No. : 911

Reference Standard Gas

Standard Gas : Sulphur Dioxide (SO₂)

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 | Analyzer Response | Slope |
| Zero | 0 | -0.10 | - | 0 | - |
| SO ₂ Span | 400.0 | 399.6 | -0.100 | 400.0 | 1.005 |

API Model 100E SO₂ Analyzer Check list

| Test Values | Observed Value | Units | Nominal Range |
|---------------------------|----------------|--------|--------------------------------|
| RANGE | 500 | PPB | 0-500 |
| SAMPLE PRESS | 28.4 | in-Hg | 25-35 |
| SAMPLE FLOW | 660 | cc/min | 650 ± 10% |
| PMT | 103.3 | mV | -20-150 with Zero Air |
| UV LAMP | 3031.2 | mV | 1000-4900 |
| STR. LGT | 61.6 | PPB | <100 |
| DRK PMT | 63.0 | mV | -50 - 200 |
| DRK LMP | 57.8 | mV | -50 - 200 |
| HVPS | 673 | V | 550-900 constant |
| DCPS | 2518 | mV | 2500 ± 200 |
| RCELL TEMP | 50.5 | °C | 50 ± 1 |
| BOX TEMP | 29.2 | °C | 5-40 |
| PMT TEMP | 7.3 | °C | 7 ± 2.0 |
| SO ₂ Span Conc | 400 | PPB | 20-20,000 |
| SO ₂ Slope | 1.005 | - | 1.0 ± 0.3 |
| SO ₂ Offset | 22.0 | mV | <250 |
| Stability at Zero | 0.1 | PPB | <0.2 |
| Stability at Span | 0.2 | PPB | 0.5% of reading (above 50 ppb) |

Calibrated by : Adul Dangklom

(Mr.Adul Dangklom)

Approved by : Peera Detudom

(Mr.Peera Detudom)



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

| CALIBRATION REPORT | | | | | |
|--|------------------------------------|--------------------------------|----------------------------|---------------------------------|-------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 18 February 2025 | BRAND : | API | MODEL : | 200A |
| NO. | NOX-B03 | SERIAL NO. | 2617 | | |
| Calibrator (Dilution System) | | | | | |
| Brand : API | | | Model : 700 | | |
| Last Cal. Date : 05 August 2024 | | | Serial No. : 911 | | |
| 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 | 1.008 |
| NO _x Span | 400 | 400.2 | 0.050 | 400.0 | 1.012 |
| API Model 200A NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 512 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 79 | cc/min | 80 ± 15 | | |
| PMT | 103.0 | mV | -20 - 150 | | |
| AZERO | 93.7 | mV | -20 - 150 | | |
| HVPS | 674 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.3 | °C | 50 ± 1 | | |
| BOX TEMP | 29.5 | °C | 8 - 48 | | |
| PMT TEMP | 7.1 | °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 | 1.008 | - | 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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/ Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72. Fax : (662) 513-4221. E-mail : sale@spscon.com. www.spscon.com

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|------------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 18 February 2025 | BRAND : | API | MODEL : | 200A |
| NO. | NOX-B12 | SERIAL NO. | 2675 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | | Model | : 700 |
| Last Cal. Date | : 05 August 2024 | | | Serial No. | : 911 |
| 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 | 1.008 |
| API Model 200A NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 509 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 78 | cc/min | 80 ± 15 | | |
| PMT | 103.2 | mV | -20 - 150 | | |
| AZERO | 93.9 | mV | -20 - 150 | | |
| HVPS | 669 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.0 | °C | 50 ± 1 | | |
| BOX TEMP | 28.8 | °C | 8 - 48 | | |
| PMT TEMP | 7.2 | °C | 7 ± 2 | | |
| MOLY TEMP | 314.9 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.5 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.7 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.004 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.008 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.1 | mV | -20 to +150 | | |
| NO _x Offset | 0.7 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

Peera Detudom
(Mr.Peera Detudom)



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Tel : (662) 939-4370-72 Fax : (662) 513-4722, E-mail : sale@spscn.com, www.spscn.com

CALIBRATION REPORT

CHEMILUMINESCENT NO / NO₂ / NO_x ANALYZER

DATE : 18 February 2025

BRAND : API

MODEL : 200A

NO. NOX-B13

SERIAL NO. 1983

Calibrator (Dilution System)

| | |
|---------------------------------|------------------|
| Brand : API | Model : 700 |
| Last Cal. Date : 05 August 2024 | Serial No. : 911 |

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 | |
|----------------------|------------------------------------|-------------------|-------|---------------------------------|-------|
| | Expected Concentration | Analyzer Response | %Dif | Analyzer Response | Slope |
| Zero | 0 | 0.11 | - | 0 | - |
| NO Span | 400 | 400.1 | 0.025 | 400.0 | 1.010 |
| NO _x Span | 400 | 400.4 | 0.100 | 400.0 | 1.014 |

API Model 200E NO_x Analyzer Check List

| Test Values | Observed Value | Units | Nominal Range |
|---------------------------|----------------|---------|----------------------------|
| RANGE | 500 | PPB | 500 standard |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air |
| SAMPLE FLOW | 510 | cc/min | 500 ± 50 |
| OZONE FLOW | 79 | cc/min | 80 ± 15 |
| PMT | 103.1 | mV | -20 - 150 |
| AZERO | 93.8 | mV | -20 - 150 |
| HVPS | 671 | V | 420 - 900 constant |
| RCELL TEMP | 50.4 | °C | 50 ± 1 |
| BOX TEMP | 29.3 | °C | 8 - 48 |
| PMT TEMP | 7.1 | °C | 7 ± 2 |
| MOLY TEMP | 315.4 | °C | 315 ± 5 |
| RCELL PRESS | 8.2 | IN-Hg-A | 2 - 10 constant |
| SAMPLE PRESS | 28.5 | IN-Hg-A | 25 - 30 constant |
| NO Span Conc | 400 | PPB | 20 - 20,000 |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 |
| NO Slope | 1.010 | - | 1.0 ± 0.3 |
| NO _x Slope | 1.014 | - | 1.0 ± 0.3 |
| NO Offset | 1.8 | mV | -20 to +150 |
| NO _x Offset | 1.1 | mV | -20 to 150 |
| Stability at Zero | 0.1 | PPB | < 0.2 |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas |

Calibrated by : Adul Dangklom
(Mr. Adul Dangklom)

Approved by : Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|------------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 18 February 2025 | BRAND : | API | MODEL : | 200A |
| NO. | NOX-B17 | SERIAL NO. | 1977 | | |
| Calibrator (Dilution System) | | | | | |
| Brand | : API | | | Model | : 700 |
| Last Cal. Date | : 05 August 2024 | | | Serial No. | : 911 |
| 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 | 399.9 | -0.025 | 400.0 | 1.009 |
| API Model 200A NO _x Analyzer Check List | | | | | |
| Test Values | Observed Value | Units | Nominal Range | | |
| RANGE | 500 | PPB | 500 standard | | |
| STABILITY (Zero Gas) | 0.1 | PPB | < 2 with zero air | | |
| SAMPLE FLOW | 506 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 78 | cc/min | 80 ± 15 | | |
| PMT | 103.4 | mV | -20 - 150 | | |
| AZERO | 94.2 | mV | -20 - 150 | | |
| HVPS | 672 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.1 | °C | 50 ± 1 | | |
| BOX TEMP | 28.9 | °C | 8 - 48 | | |
| PMT TEMP | 7.0 | °C | 7 ± 2 | | |
| MOLY TEMP | 315.1 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.4 | IN-Hg-A | 2 - 10 constant | | |
| SAMPLE PRESS | 28.7 | IN-Hg-A | 25 - 30 constant | | |
| NO Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO _x Span Conc | 400 | PPB | 20 - 20,000 | | |
| NO Slope | 1.005 | - | 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)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

| CALIBRATION REPORT | | | | | |
|--|-----------------------------------|--------------------------------|----------------------------|--------------------------------|---------|
| CHEMILUMINESCENT NO / NO ₂ / NO _x ANALYZER | | | | | |
| DATE : | 18 February 2025 | BRAND : | API | MODEL : | TML-41M |
| NO. | NOX-B18 | SERIAL NO. | N07543 | | |
| Calibrator (Dilution System) | | | | | |
| Brand : API | | | Model : 700 | | |
| Last Cal. Date : 05 August 2024 | | | Serial No. : 911 | | |
| 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 | 0.11 | - | 0 | - |
| NO Span | 400 | 399.9 | -0.025 | 400.0 | 1.007 |
| NO _x Span | 400 | 400.2 | 0.050 | 400.0 | 1.011 |
| 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 | 504 | cc/min | 500 ± 50 | | |
| OZONE FLOW | 78 | cc/min | 80 ± 15 | | |
| PMT | 103.2 | mV | -20 - 150 | | |
| AZERO | 94.0 | mV | -20 - 150 | | |
| HVPS | 675 | V | 420 - 900 constant | | |
| RCELL TEMP | 50.3 | °C | 50 ± 1 | | |
| BOX TEMP | 29.4 | °C | 8 - 48 | | |
| PMT TEMP | 7.5 | °C | 7 ± 2 | | |
| MOLY TEMP | 314.7 | °C | 315 ± 5 | | |
| RCELL PRESS | 8.3 | 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 | 1.007 | - | 1.0 ± 0.3 | | |
| NO _x Slope | 1.011 | - | 1.0 ± 0.3 | | |
| NO Offset | 1.5 | mV | -20 to +150 | | |
| NO _x Offset | 0.9 | mV | -20 to 150 | | |
| Stability at Zero | 0.1 | PPB | < 0.2 | | |
| Stability at Span | 0.2 | PPB | < 2 ppb @ 400 ppb span gas | | |

Calibrated by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :

(Mr.Peera Detudom)



CERTIFICATE No : 24M2227

REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905


ID No : BA05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

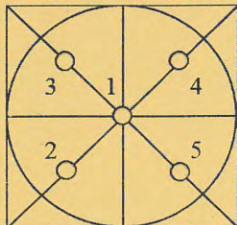
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY :  PONGSAK J.

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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





CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

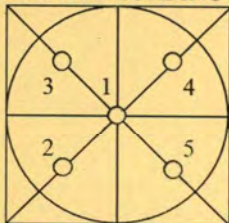
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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



คุณภาพอากาศจากปล่อง



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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_{\oplus} (mmH ₂ O) |
| B01 | 1563 | 03/12/2024 | 0.999 | 49.77 |
| B02 | 8002514 | 02/12/2024 | 0.997 | 49.92 |
| B03 | 1503016 | 04/12/2024 | 0.996 | 49.68 |
| B04 | 00006659 | 02/12/2024 | 0.998 | 49.59 |
| B05 | 00007428 | 04/12/2024 | 0.996 | 49.73 |
| R01 | 1561 | 05/12/2024 | 0.999 | 49.88 |
| R02 | 8002513 | 03/12/2024 | 0.996 | 49.65 |
| R03 | 1570 | 02/12/2024 | 1.002 | 50.04 |
| R04 | 8002519 | 03/12/2024 | 0.997 | 49.45 |
| R05 | 1503015 | 04/12/2024 | 1.003 | 49.98 |

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

Accept Value of ΔH_{\oplus} (test) is 46.7 ± 6.4 (mmH₂O)

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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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 | 03/02/2025 | 0.84 | 0.84 |
| B04 | S | 0.99 | 04/02/2025 | 0.85 | 0.84 |
| B05 | S | 0.99 | 04/02/2025 | 0.84 | 0.83 |
| B07 | S | 0.99 | 04/02/2025 | 0.84 | 0.85 |
| B08 | S | 0.99 | 05/02/2025 | 0.84 | 0.84 |
| B09 | S | 0.99 | 03/02/2025 | 0.85 | 0.84 |
| B11 | S | 0.99 | 03/02/2025 | 0.84 | 0.84 |
| B16 | S | 0.99 | 05/02/2025 | 0.84 | 0.83 |
| B18 | S | 0.99 | 05/02/2025 | 0.85 | 0.84 |
| B19 | S | 0.99 | 04/02/2025 | 0.84 | 0.84 |
| B21 | S | 0.99 | 04/02/2025 | 0.85 | 0.84 |
| B24 | S | 0.99 | 04/02/2025 | 0.84 | 0.84 |
| B27 | S | 0.99 | 05/02/2025 | 0.84 | 0.85 |
| B30 | S | 0.99 | 05/02/2025 | 0.84 | 0.84 |
| B31 | S | 0.99 | 05/02/2025 | 0.85 | 0.84 |
| B33 | S | 0.99 | 05/02/2025 | 0.84 | 0.84 |
| B35 | S | 0.99 | 03/02/2025 | 0.85 | 0.84 |

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

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :

Peera Detudom

(Mr. Peera Detudom)

CERTIFICATE OF CALIBRATION FOR

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

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

DATE OF RECEIVED : 20 July 2024

DATE OF ISSUED : 23 July 2024

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

Calibrated By : Sittipong Pimdee
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
23 July 2024



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

Certificate No. Q24076545

F3-011-05/12-23

page 1 of 3



@clccalibration

REPORT OF CALIBRATION

FOR

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

ENVIRONMENT CONDITIONS :

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

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

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

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

UNCERTAINTY :

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

Certificate No. Q24076545

F3-011-05/12-23

page 2 of 3



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

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

Uncertainty of measurement ± 0.2 inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

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

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

End of Certificate

Certificate No. Q24076545

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page 3 of 3





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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

| Personal Pump Data | | | | Calibration Data | | | | | | | | |
|--------------------|-------|-----------|------------|------------------|--------------------|-------|-------|-----------------|-------|-------|------------------------------|----------------|
| No. | Brand | Model | Serial No. | Date | Flow Rate (ml/min) | | | | | | Value From Calibration Curve | |
| | | | | | Setting | | | Actual (Q std.) | | | | |
| | | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² |
| B41 | SKC | 224-PCXR4 | 612669 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,512 | 2,005 | 1.008x - 10.246 | 1.000 |
| B42 | SKC | 224-PCXR4 | 626041 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,499 | 2,002 | 1.002x - 2.343 | 1.000 |
| B43 | SKC | 224-PCXR4 | 034636 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,495 | 1,997 | 0.996x + 2.703 | 1.000 |
| B44 | SKC | 224-PCXR8 | 529341 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,510 | 2,003 | 1.009x - 16.871 | 0.999 |
| B45 | SKC | 224-PCXR8 | 529594 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,508 | 2,004 | 1.012x - 21.113 | 0.999 |
| B46 | SKC | 224-PCXR8 | 566743 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,497 | 2,003 | 1.010x - 16.955 | 1.000 |
| B47 | SKC | 224-PCXR8 | 566747 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,504 | 2,001 | 1.003x - 2.758 | 1.000 |
| B48 | SKC | 224-PCXR8 | 566753 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,512 | 2,002 | 1.008x -13.876 | 0.999 |
| B49 | SKC | 224-PCXR8 | 566780 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,497 | 1,997 | 1.002x - 5.465 | 1.000 |
| B50 | SKC | 224-PCXR8 | 500400 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,503 | 1,999 | 1.003x - 7.316 | 1.000 |
| B51 | SKC | 224-PCXR8 | 500363 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,505 | 1,998 | 0.995x + 8.579 | 1.000 |
| B52 | SKC | 224-PCXR8 | 093186 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,496 | 1,999 | 0.999x - 0.396 | 1.000 |
| B53 | SKC | 224-PCXR8 | 707670 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,505 | 2,005 | 1.010x - 19.569 | 0.999 |
| B54 | SKC | 224-PCXR3 | 509821 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,506 | 2,002 | 1.002x - 0.736 | 1.000 |
| B55 | SKC | 224-PCXR3 | 510710 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 998 | 1,501 | 2,001 | 1.003x - 5.629 | 1.000 |
| B56 | SKC | 224-PCXR3 | 511450 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,509 | 2,007 | 1.013x - 22.400 | 0.999 |
| B57 | SKC | 224-PCXR3 | 510798 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,498 | 1,996 | 0.996x + 4.985 | 1.000 |
| B58 | SKC | 224-PCXR3 | 509852 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,503 | 2,005 | 1.009x - 13.249 | 1.000 |
| B59 | SKC | 224-PCXR3 | 509862 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,506 | 2,007 | 1.015x - 25.718 | 0.999 |
| B60 | SKC | 224-PCXR3 | 512655 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,012 | 1,504 | 2,001 | 0.995x + 10.338 | 1.000 |
| B61 | SKC | 224-PCXR3 | 503915 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,507 | 2,010 | 1.010x - 13.769 | 1.000 |
| B62 | SKC | 224-PCXR3 | 505975 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,505 | 2,008 | 1.012x - 17.586 | 0.999 |
| B63 | SKC | 224-PCXR3 | 511432 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,503 | 2,003 | 1.013x - 21.568 | 0.999 |
| B64 | SKC | 224-PCXR3 | 508302 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,506 | 2,006 | 1.010x - 15.623 | 1.000 |
| B65 | SKC | 224-PCXR3 | 508310 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,502 | 2,002 | 1.001x + 1.279 | 1.000 |
| B66 | SKC | 224-PCXR3 | 509861 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,505 | 2,008 | 1.004x - 7.200 | 1.000 |
| B67 | SKC | 224-PCXR3 | 506295 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,497 | 2,007 | 1.011x - 22.995 | 0.999 |
| B68 | SKC | 224-PCXR3 | 505872 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 1,001 | 1,493 | 1,999 | 0.998x - 1.515 | 1.000 |
| B69 | SKC | 224-PCXR3 | 508375 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,508 | 2,003 | 1.013x - 23.639 | 0.999 |
| B70 | SKC | 224-PCXR3 | 510623 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,502 | 2,007 | 1.011x - 17.470 | 0.999 |
| B71 | SKC | 224-PCXR3 | 508367 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,504 | 2,008 | 1.016x - 24.787 | 0.999 |
| B72 | SKC | 224-PCXR3 | 505977 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,008 | 1,496 | 2,007 | 1.001x + 0.904 | 1.000 |
| B73 | SKC | 224-PCXR3 | 512606 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,502 | 2,003 | 1.007x - 15.456 | 0.999 |
| B74 | SKC | 224-PCXR3 | 505993 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,501 | 1,999 | 1.000x - 0.624 | 1.000 |
| B75 | SKC | 224-PCXR3 | 509820 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,510 | 2,003 | 1.010x - 17.886 | 0.999 |
| B76 | SKC | 224-PCXR3 | 509811 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 994 | 1,509 | 2,008 | 1.013x - 21.308 | 1.000 |
| B77 | SKC | 224-PCXR3 | 508301 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 1,002 | 1,491 | 2,006 | 1.006x - 10.302 | 1.000 |
| B78 | SKC | 224-PCXR3 | 510677 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,504 | 2,007 | 1.012x - 19.937 | 0.999 |
| B79 | SKC | 224-PCXR3 | 510920 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 1,003 | 1,503 | 2,006 | 1.015x - 24.223 | 0.999 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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

Rotameter Calibration Report (For Personal Pump 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



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

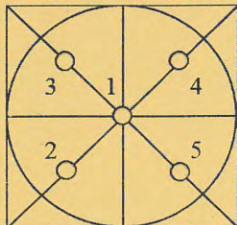
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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





CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

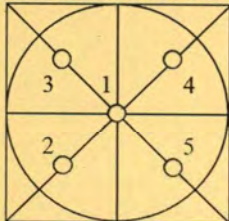
5. THIS CERTIFICATE IS TRACEABLE TO THE INTERNATIONAL SYSTEM OF UNIT MAINTAINED AT:-
- NATIONAL INSTITUTE OF METROLOGY (THAILAND)

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL
2. TARE FUNCTION : NORMAL
3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g
4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\pm g) |
|-------------------|---------------------|----------------|------------------------|
| 0.00 | 0.00000 | 0.00000 | 0.000065 |
| 0.02 | 0.01999 | 0.00001 | 0.000065 |
| 0.10 | 0.10001 | -0.00001 | 0.000066 |
| 0.20 | 0.20001 | -0.00001 | 0.000066 |
| 0.50 | 0.50002 | -0.00002 | 0.000065 |
| 1.00 | 1.00003 | -0.00003 | 0.000066 |
| 2.00 | 2.00001 | -0.00001 | 0.000067 |
| 5.00 | 5.00002 | -0.00002 | 0.000068 |
| 10.00 | 10.00000 | 0.00000 | 0.000070 |
| 20.00 | 20.00004 | -0.00004 | 0.000078 |
| 50.00 | 50.00000 | 0.00000 | 0.00013 |
| 100.00 | 100.00001 | -0.00001 | 0.00019 |
| 120.00 | 120.00002 | -0.00002 | 0.00022 |

5. OFF CENTER LOADING ERROR



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

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

END OF CALIBRATION REPORT



Cert. No. : SP24020

Pages 1 of 3

Calibration Certificate

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

Condition As Found : GOOD

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

Location : WET CHEMISTRY LABORATORY IV

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

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

Calibrated by :

Nathakorn Pisutpaisan

Approved by :


(Thanakul Petchurai)

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 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

F. Peter

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

| Material | Wavelength (nm) | Filter S/N | Nominal Absorbance (A) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor |
|------------------------------|--------------------|--------------------|-----------------------------|--------------------------------|--------------------------------|----------------------|----------------------|-------------|
| Neutral Density glass filter | 440.0 | 29360 | 1.0 | 1.0517 | 1.0550 | 0.0033 | 0.0029 | 2.00 |
| | | 29914 | 0.7 | 0.7445 | 0.7460 | 0.0015 | 0.0029 | 2.00 |
| | | 29381 | 0.5 | 0.5416 | 0.5431 | 0.0015 | 0.0030 | 2.00 |
| | 546.1 | 29360 | 1.0 | 0.9821 | 0.9820 | -0.0001 | 0.0028 | 2.00 |
| | | 29914 | 0.7 | 0.6961 | 0.6958 | -0.0003 | 0.0028 | 2.00 |
| | | 29381 | 0.5 | 0.5073 | 0.5080 | 0.0007 | 0.0029 | 2.00 |
| | 590.0 | 29360 | 1.0 | 1.0222 | 1.0210 | -0.0012 | 0.0028 | 2.00 |
| | | 29914 | 0.7 | 0.7237 | 0.7221 | -0.0016 | 0.0029 | 2.00 |
| | | 29381 | 0.5 | 0.5361 | 0.5361 | 0.0000 | 0.0031 | 2.00 |
| | 635.0 | 29360 | 1.0 | 0.9753 | 0.9745 | -0.0008 | 0.0028 | 2.00 |
| | | 29914 | 0.7 | 0.6910 | 0.6900 | -0.0010 | 0.0029 | 2.00 |
| | | 29381 | 0.5 | 0.5211 | 0.5210 | -0.0001 | 0.0032 | 2.00 |
| Material | Wavelength (nm) | Solution (mg/l) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor | |
| RM-0204060810 | 235.0 | 20 | 0.2422 | 0.2418 | -0.0004 | 0.0101 | 2.00 | |
| | | 40 | 0.4866 | 0.4852 | -0.0014 | 0.0115 | 2.00 | |
| | | 60 | 0.7414 | 0.7389 | -0.0025 | 0.0067 | 2.00 | |
| | | 80 | 0.9858 | 0.9842 | -0.0016 | 0.0093 | 2.00 | |
| | | 100 | 1.2442 | 1.2414 | -0.0028 | 0.0086 | 2.00 | |

UUC* = Unit Under Calibration

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

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

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

T. Ketch



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** January 6, 2025**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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

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



MAINTENANCE AND TEST CERTIFICATE MODEL
OPTIMA 5300DV

SERIAL NUMBER 077C7042401

DATE TESTED January 6, 2025

Remarks :

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:



(Wiphan Promlumda)

Service Engineer

Spectrum BX Preventive Maintenance (PM)

| | | | |
|--|--|---|-------------|
| Company Name: | S.P.S. Consulting Service Co.,Ltd. | | |
| Address: | 7 Soi Phaholyothin 24 ,Phaholyothin Rd.,Jompol, Chatuchak,Bangkok 10900 | | |
| User Name: | K.Waraphon Phoowat | WO Number : | WO-02860803 |
| Telephone No.: | 083-033-6758 | Certificate Number: | IR1164-2024 |
| Customer Support Engineer: | Tanongsak | PM Number : | 1 of 1 |
| Date PM Performed: (DD-MMM-YYYY) | 14-Aug-2024 | Next PM Due Date: (DD-MMM-YYYY) | 14-Aug-2025 |

Scope

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

The document can be used for spectrum One, Spectrum One, NTS, Spectrum 100, Spectrum 100N, Spectrum Optica, Spectrum 4000F and the Frontier Series of FTIR Spectrophotometers.

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 should be signed by an authorized PerkinElmer and customer representative and left with the customer. Update the PM sticker and instrument logbook as required.

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 |
|----------------------------|----------|------------------|-----|---------------------|
| Spectrum BX | 70366 | 5.3.1 | Std | KBr B/S |
| | | | | |

Parts Lists

| Parts Included with the PM | | | | |
|-----------------------------|-------------|----------|----------------|-------------------------|
| Part Number (if applicable) | Description | Quantity | Batch/Lot/SN # | Expiration Date (MM/YY) |
| N0171159 | Desiccant | 2 | NA | NA |

Procedure Checklist

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

1. General:

- ☒ Source and Source Mirror
- ☒ Beam splitter
- ☒ Optical Unit Windows
- ☒ Mirror

2. Mechanical:

- ☒ Motors including Electronics unit fan
- ☒ Purge seals
- ☒ Change Desiccant

3. Electronics Check:

- ☒ Laser Output

| 1000, Paragon, RX or BX Laser Output | Specification | Value | Laser Gain |
|---|---------------|-------|------------|
| | 16 +/- 1 | 15.85 | 2.61 |

- ☒ EndStop

| End Stop | Specification | Value |
|----------|---------------|-------|
| | +/- 50 | 3.00 |

- ☒ Zero Path

| Zero Path | Specification | Value |
|-----------|---------------|-------|
| | +/- 20 | 4.00 |

- ☒ Energy

| Energy | Specification | Value |
|--------|---------------|----------|
| | NA | 14454.00 |

☒ Gain

| Gain | Specification | Value |
|------|-------------------|--------------|
| | Less than +/- 9.5 | 6.85 / -8.26 |

☒ Match

| Match | Specification | Value |
|-------|---------------|-------|
| | NA | 3.22 |

3. Performance Test:

☒ Signal to Noise Ratio (SNR) – (Record typical SNR Value).

| | Detector Type | Typical SNR |
|-----------------------|---------------|-------------|
| Signal to Noise Ratio | DTGS (MIR) | 2858.78 |

4. Wavenumber Calibrate:

☒ Wavenumber Calibrate

| Certified Value (cm-1) | Value | Specification | Difference (cm-1) |
|------------------------|---------|---------------|-------------------|
| 3082.22 | 3082.06 | +/- 0.5 | 0.16 |
| 3060.14 | 3060.00 | +/- 0.5 | 0.14 |
| 1601.38 | 1601.40 | +/- 0.5 | -0.02 |
| 1583.04 | 1583.27 | +/- 0.5 | -0.23 |
| 1028.42 | 1028.51 | +/- 0.5 | -0.09 |

6. Review:

- ☒ Review with the customer PM work performed.
- ☒ Reset desiccant and service intervals on maintenance dialog.
- ☒ 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

| | |
|--|---|
| <p><i>The preventive maintenance checks and if applicable performance tests for FTIR have been completed.</i></p> <p style="text-align: right;"><i>Passes <input checked="" type="checkbox"/> Fails <input type="checkbox"/> the preventive maintenance.</i></p> | |
| Review of Preventive Maintenance: | |
| <p>Authorized PerkinElmer Representative:</p> <p style="text-align: center;"><i>Tanongsak R.</i></p> | <p>Date:</p> <p style="text-align: center;">14-Aug-2024 (DD-MMM-YYYY)</p> |
| <p>Authorized Customer Representative:</p> | <p>Date:</p> <p style="text-align: center;">14-Aug-2024 (DD-MMM-YYYY)</p> |



Certificate of Calibration

Aquion: Anion (ID#894)

This certificate is to verify that instrument below are calibrated
by Archemica Lab Co.,Ltd.

AQUION S/N : 190840059

AS-DV S/N : 190915235

for

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



บริษัท อาร์เคมีกา แล็บ จำกัด
ARCHEMICA LAB CO., LTD.

Operator Signature: _____

Date: June 24, 2024

(Mr. Ponwut Kornthongnimit)

Test Engineer

ระดับเสียงในบรรยากาศ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

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

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

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

Standards used :

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Keithley 2015-P S/N4106495.
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 : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 / 2 ✓

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

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FM.BL.MTC.002 Rev.4

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Thailand

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Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion


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

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

Noise B_065/25

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 | 05 March 2025 |

Calibration Data

| Sound Level Meter Data | | | | Calibration Data | | |
|--|-------|-------|------------|------------------|---------------------|------------------|
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| ACO-B02 | ACO | 6236 | 00222306 | 18 February 2025 | 93.9 | 93.9 |
| ACO-B07 | ACO | 6236 | 00142004 | 18 February 2025 | 94.0 | 93.9 |
| ACO-B09 | ACO | 6236 | 00152004 | 18 February 2025 | 94.1 | 93.9 |
| ACO-B12 | ACO | 6236 | 00152081 | 18 February 2025 | 93.9 | 93.9 |
| ACO-B19 | ACO | 6236 | 00172057 | 18 February 2025 | 94.0 | 93.9 |
| ACO-B21 | ACO | 6236 | 00172059 | 18 February 2025 | 94.1 | 93.9 |
| ACO-B26 | ACO | 6236 | 00182007 | 18 February 2025 | 93.9 | 93.9 |
| ACO-B38 | ACO | 6236 | 00192029 | 18 February 2025 | 93.9 | 93.9 |
| ACO-B44 | ACO | 6236 | 00222302 | 18 February 2025 | 93.9 | 93.9 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 93.85 ± 0.10 dB | |

Calibrated by : _____
(Mr. Adul Dangklom)

Approved by : _____
(Mr. Peera Detudom)

Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : Cirrus

Model : CR:515

Serial No. : 92002

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

Calibration Procedure: CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 5 Mar. 2024

1 / 2

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

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

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

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

1. Sound Pressure Level

| Standard Microphone Type | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 1 |
|-----------------------------|---------------------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 94.04 | 0.04 | ± 0.10 | ± 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 | 1000.3 | 0.3 | ± 1.5 | $\pm 1.0\%$ |

3. Total distortion


| Standard Microphone Type | Measured Total distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 1 |
|-----------------------------|----------------------------------|--------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 1.70 | ± 0.50 | $\pm 3.0\%$ |

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluaypa)
Director

Date of Calibration : 5 Mar. 2024

Date of Issue : 6 Mar. 2024

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011267022200795002

End of Certificate

2 / 2

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Noise B_065_1/25

Sound Level Meter Calibration Report

Acoustic Calibrator Data

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

Calibration Data

| Sound Level Meter Data | | | | Calibration Data | | |
|--|--------|--------|------------|------------------|---------------------|------------------|
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| CR-B07 | Cirrus | CR161B | G301167 | 18 February 2025 | 94.0 | 94.0 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 94.04 ± 0.10 dB | |

Calibrated by :

(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 45/0268

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 : Acoustic Calibrator

Manufacturer : Cirrus Research plc

Model : CR:515

Serial No. : 92002

Ambient Environment

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

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

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

- Standards used :
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
 4. Digital Multimeter Agilent 34401A S/N MY44005560.
 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
 6. Audio Analyzer 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
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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.BL.MTC.002 Rev.5

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

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

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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0220

MTC No. EEL. BP. 45/0268

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 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, 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 | 93.98 | -0.02 | ± 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 | 1000.1 | 0.1 | ± 1.5 | $\pm 1.0\%$ |

3. Total Distortion


| Standard Microphone Type | Measured Total Distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 1 |
|-----------------------------|----------------------------------|--------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 0.65 | ± 0.50 | $\pm 3.0\%$ |

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


.....
(Mr. Weerachai Deechaiyae)

Approved by :



.....
(Mr. Prawate Kluaypa)
Director

Date of Calibration : 21 Feb. 2025

Date of Issue : 24 Feb. 2025

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Ref : 2011268021900739002

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

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Office/Laboratory

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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_151/25

Sound Level Meter Calibration Report

Acoustic Calibrator Data

| | | | |
|-------------------|----------------|------------------|------------------|
| Brand | CIRRUS | Number | AC-CR01/63 |
| Model | CR515 | Serial No. | 92002 |
| Calibration Range | 94 dB, 1000 Hz | Last Calibration | 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 |
| CR-B06 | Cirrus | CR161B | G301151 | 19 April 2025 | 94.0 | 94.0 |
| CR-B07 | Cirrus | CR161B | G301167 | 19 April 2025 | 94.0 | 94.0 |
| CR-B09 | Cirrus | CR161B | G301401 | 19 April 2025 | 94.8 | 94.0 |
| CR-B10 | Cirrus | CR161B | G301407 | 19 April 2025 | 94.9 | 94.0 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 93.98 ± 0.10 dB | |

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :

Peera Detudom

(Mr. Peera Detudom)

คุณภาพน้ำ

**QUALITY CALIBRATION CO., LTD.**

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

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



CERTIFICATE No : 24E6416

REFERENCE No : 73694-1

PAGE : 1 OF 3

Certificate of Calibration

EQUIPMENT : pH METER

MANUFACTURER : HANNA

MODEL : HI 3512

SERIAL No : TH118035

ID No : pH 04/56

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 27-Jun-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 27-Jun-24

RECEIVED DATE : 24-Jun-24

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



QUALITY CALIBRATION CO., LTD.

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

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

CERTIFICATE No : 24E6416

PAGE : 2 OF 3

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

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

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

RESULT OF CALIBRATION : ADJUSTMENT

1. DISPLAY UNIT ONLY

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

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

END OF CALIBRATION REPORT PAGE 2 OF 3

**QUALITY CALIBRATION CO., LTD.**

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CERTIFICATE No : 24E6416

PAGE : 3 OF 3

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

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

3. DISPLAY UNIT WITH TEMPERATURE

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

4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



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



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.





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



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Accredited
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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



@clccalibration

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 :



(Permpoon 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%

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CERTIFICATE No : 24M2229
REFERENCE No : 72448-3

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : SARTORIUS

MODEL : BSA224S-CW

SERIAL No : 36591843

ID No : BA 09/61

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2229

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

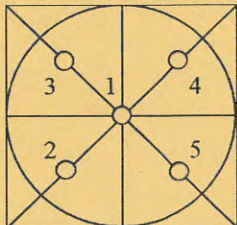
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT



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

1. ZERO SETTING FUNCTION : NORMAL

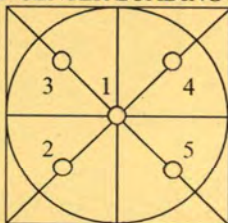
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000071 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

| NOMINAL VALUE (g) | BALANCE READING (g) | CORRECTION (g) | UNCERTAINTY (\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-V015C

Calibration Date : 20 Mar 24
 Submitted by : ASIA LAB @ CONSULTANT CO.,LTD
 184 Soi Phutthamonthon Sai 2 Soi 12,
 Bangphai, Bangkae, Bangkok 10160

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

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

Calibration Details

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

| | | | | |
|------------------|------|------|---|---|
| Mean Measurement | 9.08 | mg/l | - | - |
| Inaccuracy | 0.01 | mg/l | - | - |

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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



Technician Signature
 (Kittipong Maekwong)



Laboratory Manager
 (Supreecha Sumaritam)

CERT.No.: HS-W015C

Certificate of Calibration

Calibration Date : 18 Mar 25

Model : YSI 5000

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

S/N : 15B100751

7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol,

Probe : YSI 5010

Chatuchak, Bangkok, Thailand 10900

S/N : 22D100097

ID NO. : -

Avg Room Temp : 20 °C

Air Temp ref : S/N. F8065C26

Avg Water Temp : 20 °C

Barometric ref : S/N. F8065C26

Air Pressure : 760.00 mmHg

Water Temp ref : -

Salinity : 0 ppt

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

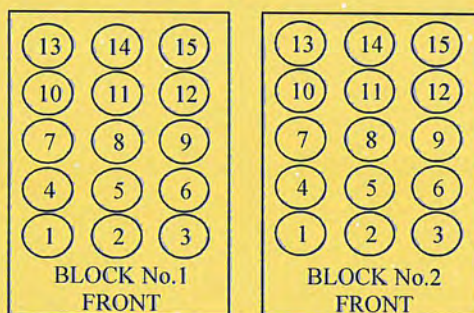
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT METHOD WITH CALIBRATED THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON POINTS AND LOCATED AS THE PICTURE.

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





MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** January 6, 2025**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401DATE TESTED : January 6, 2025

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED January 6, 2025**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.**Authorized Representative:**

(Wiphan Promlumda)

Service Engineer

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

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

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

| SERIAL NUMBER | PTCS14111103 | DATE TESTED | January 6, 2025 |
|------------------------------------|--------------|-------------|----------------------------------|
| 1. INSTRUMENT CHECKS | | | |
| A. The Mirror and Lenses Condition | | | <input type="text" value="OK"/> |
| B. Grating Condition | | | <input type="text" value="OK"/> |
| C. Replace or Clean Dust Filter | | | <input type="text" value="OK"/> |
| D. Cleaning the Contact Cylinders | | | <input type="text" value="OK"/> |
| E. Cleaning the Furnace Windows | | | <input type="text" value="OK"/> |
| F. Cleaning the Burner Head | | | <input type="text" value="OK"/> |
| G. Cleaning the Nebulizer | | | <input type="text" value="OK"/> |
| H. Cleaning the Drain System | | | <input type="text" value="OK"/> |
| 2. AUTOSAMPLE CHECK | | | |
| A. Sampling and Arm | | | <input type="text" value="OK"/> |
| B. Sampling & Rinse Pump | | | <input type="text" value="OK"/> |
| C. Sample Position & Clean | | | <input type="text" value="OK"/> |
| 3. COOLING SYSTEM CHECKS | | | |
| A. Clean and Change Distill water | | | <input type="text" value="OK"/> |
| B. Themensor | | | <input type="text" value="OK"/> |
| 4. FIAS CHECKS | | | |
| A. Pump and 5 Port Valve | | | <input type="text" value="N/A"/> |
| B. Chemifold and Tubing | | | <input type="text" value="N/A"/> |
| C. Power Supply | | | <input type="text" value="N/A"/> |
| D. Flow meter and Gas system | | | <input type="text" value="N/A"/> |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

| | | | |
|--|-----------------------------|---------------|-----------------|
| SERIAL NUMBER | PTCS14111103 | DATE TESTED | January 6, 2025 |
| PARAMETER | | SPECIFICATION | ACTUAL VAULE |
| A. Flame Mode Tests | | | |
| 1. Detector-Linearity with Barium (553.55 nm) | | | |
| Neutral Density Filter 0.2 : | 0.2042 | Abs. \pm 5% | 0.2029 Abs. |
| Neutral Density Filter 1.0 : | 0.9798 | Abs. \pm 5% | 1.0137 Abs. |
| 2. Baseline Noise at 1 Abs with Barium (553.55 nm) | | | |
| (at an integration time of 0.5 seconds | | | |
| and 99 replicates) | | | |
| | SD \leq 0.010 Abs. | | 0.0016 Abs. |
| 3. AA Baseline with Copper (Cu 324.75 nm) | | | |
| (at an integration time of 0.5 seconds | | | |
| and 99 replicates) | | | |
| | SD \leq 0.001 Abs. | | 0.0002 Abs. |
| 4. D ₂ Background Compensation (Copper 324.75 nm) | | | |
| with Neutral Density Filter 1.0 | Absorbance \leq 0.010 Abs | | 0.0020 Abs. |
| 5. AA-BG Baseline Noise with Copper (324.75 nm) | | | |
| (at an integration time of 2.0 seconds | | | |
| and 99 replicates) | | | |
| | SD \leq 0.005 Abs. | | 0.0002 Abs. |
| 6. AA-BG Baseline Noise with Arsenic (193.70 nm) | | | |
| (at an integration time of 2.0 seconds | | | |
| and 99 replicates) | | | |
| | SD \leq 0.005 Abs. | | 0.0007 Abs. |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

| | | | |
|--|--------------|--------------------------|--------------------|
| SERIAL NUMBER | PTCS14111103 | DATE TESTED | January 6, 2025 |
| PARAMETER | | SPECIFICATION | ACTUAL VAULE |
| 7. Flame Interlock Shutdown | | Shutdown correct? | <div>OK</div> |
| 8. Flame Sensitivity with Copper (324.75 nm) | | | |
| (5 mg/L Cu Standard a read time of 10 seconds | | | |
| 10 replicates, standard burner and Stainless stell nebulizer) | | | |
| | | Sensitivity ≥ 0.250 Abs. | <u>0.3115</u> Abs. |
| (2 mg/L Cu Standard a read time of 10 seconds | | | |
| 10 replicates, standard burner and High sensitivity nebulizer) | | | |
| | | Sensitivity ≥ 0.250 Abs. | N/A Abs. |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

| | | | |
|---|--------------------------------|--------------|-----------------|
| SERIAL NUMBER | PTCS14111103 | DATE TESTED | January 6, 2025 |
| PARAMETER | SPECIFICATION | ACTUAL VAULE | |
| B. THGA Tests | | | |
| 1. Furnace Gas Flows | | | |
| Internal Flow | 250 ± 25 mL/min | 250 | mL/min |
| External Flow | 100 ± 10 mL/min | 100 | mL/min |
| 2. Chromium Baseline Noise (357.87 nm) | | | |
| (mesure 5 furnace dry firings without any sample) | | | |
| | Baseline ≤ 0.005 Int.Abs | 0.0012 | |
| | SD ≤ 0.005 Int.Abs | 0.0002 | Int.Abs. |
| 3. Chromium Characteristic Mass(m ₀) and Precition (357.87 nm) | | | |
| (measure 5 furnace firing using 20 ul | | | |
| sample injections of 10 ug/L Cr standard) | | | |
| | m0 Results ≤ 7.0 pg/0.0044A-s | 5.4 | pg/0.0044A-s |
| | Precision ≤ 2.0% | 1.15 | % |
| 4. Copper Characteristic Mass(m ₀) and Zeeman Ratio (324.75 nm) | | | |
| (measure 5 furnace firing using 20 ul | | | |
| sample injections of 25 ug/L Cu standard) | | | |
| | m0 Results ≤ 16.5 pg/0.0044A-s | 14.4 | pg/0.0044A-s |
| | Zeeman Ratio 0.52 + 0.04 | 0.542 | |

MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio =
$$\frac{\text{Atomic Signal(peak area)}}{\text{Atomic Signal(peak area)+Background Signal(peak area)}}$$

= 0.1635/0.1635+0.1378
0.542

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



meets



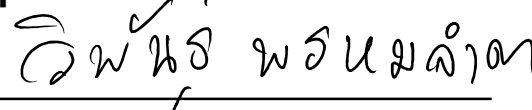
does not meet

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.

Customer Service Engineer:



(Wiphan Promlumda)

Service Engineer

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : CONDUCTIVITY METER
MANUFACTURER : METTLER TOLEDO
MODEL / TYPE : SEVEN COMPACT S230
SERIAL NO. : C141708983/5821320179
CLID. NO. : 272300452
JOB CONTROL NO. : 240213016389
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

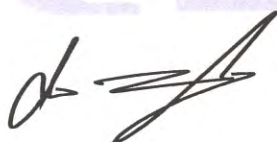
DATE OF RECEIVED : 13 February 2024

DATE OF ISSUED : 16 February 2024

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

Calibrated By :

Sukgasem Seehanart
Calibration Engineer



Approved By :

Mongkol Yotsoontorn
Authorized Signatory
16 February 2024



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

Certificate No. Q24016389

F3-011-05/12-23

page 1 of 4



@clccalibration

REPORT OF CALIBRATION FOR

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

ENVIRONMENT CONDITIONS :

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

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

REFERENCE STANDARD USED :

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



TRACEABILITY :

1. The measurements are traceable to International System of Units (SI) , through Hanna instruments.
Certificate No. 20F21 , Due Date June 2025 .
2. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.
Certificate No. HC30595403 , Due Date 31 January 2026 .
3. The measurements are traceable to International System of Units (SI) , through Sigma-Aldrich Canada Co.
Certificate No. HC20111554 , Due Date 30 September 2025.
4. The measurements are traceable to International System of Units (SI) , through Calibration Laboratory Co., Ltd.
Certificate No. Q23136342, Due Date 20 December 2024.
5. The measurements are traceable to International System of Units (SI) , through Thailand Institute of Scientific and Technological Research (TISTR). Certificate No. PSL-T 0203/67, Due Date 07 December 2024.
6. The measurements are traceable to International System of Units (SI) , through National Institute of Metrology (Thailand).
Certificate No. TT-0136-23, Due Date 12 December 2024.

UNCERTAINTY :

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

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

1. Conductivity Solution Test @ 25°C

| Standard Conductivity Solution | DUC Reading | Uncertainty of Measurement |
|--------------------------------|---|----------------------------|
| *84.00 $\mu\text{S/cm}$ | 84.05 $\mu\text{S/cm}$ [Cell Constant 0.548589] | $\pm 1.00 \mu\text{S/cm}$ |
| 1414.0 $\mu\text{S/cm}$ | 1415 $\mu\text{S/cm}$ [Cell Constant 0.548589] | $\pm 21.0 \mu\text{S/cm}$ |
| 12.83 mS/cm | 12.75 mS/cm [Cell Constant 0.548589] | $\pm 0.19 \text{mS/cm}$ |

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

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

*2. Temperature Result [Probe Conductivity]

| Immersion depth (mm) | Actual Temperature (°C) | DUC Reading (°C) | Correction (°C) | Uncertainty \pm (°C) |
|----------------------|-------------------------|------------------|-----------------|------------------------|
| 100 | 25.00 | 24.9 | +0.10 | 0.07 |

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

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

End of Certificate

Certificate No. Q24016389

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 Inchaisri

Calibration Engineer

Approved By :

Mongkol Yotsoontorn

Authorized Signatory

06 February 2025



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

Certificate No. Q25013412

F3-011-05/12-23

page 1 of 4



@clccalibration

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-I-13.





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



@clccalibration

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





MIRACLE INTERNATIONAL TECHNOLOGY CO.,LTD

214 Bangwack Rd. Bangpai Bangkac 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:

Saroyuth T.
(Saroyuth Tochua)



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

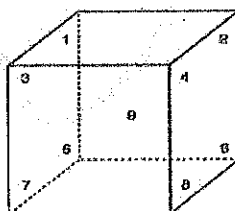
| Calibration Temperature (°C) | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | No. 6 | No. 7 | No. 8 | No. 9 | MPE (±°C) |
|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|
| 35 | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass | Pass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



CERTIFICATE No : 24T2234

REFERENCE No : 72448-8

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 : CHAICHARN CH.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24T2234

PAGE : 2 OF 2

Calibration Report

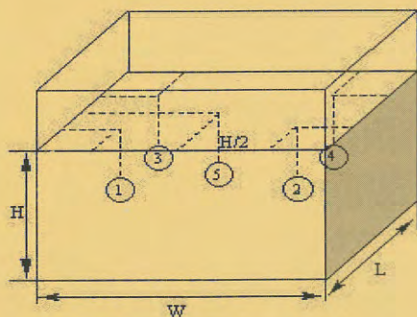
EQUIPMENT : WATER BATH
MANUFACTURER : MEMMERT
ID NUMBER : WB-05/58
RECEIVED DATE : 08-Mar-24
AMBIENT TEMPERATURE : 25 °C ± 1 °C
MODEL : WNB29
SERIAL NUMBER : L614.0123
CALIBRATION DATE : 08-Mar-24
RELATIVE HUMIDITY : 56 %RH ± 10 % RH

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 | 2635A | 7286308 | 23T6641 | 14-Jul-24 |
3. THE CERTIFICATE IS VALID FOR THE ITEM CALIBRATED AS SHOWN ON THE DATE AND PLACE OF CALIBRATION ONLY.
 4. THIS RESULT EXCLUDE LONG TERM STABILITY OF THE UNIT UNDER CALIBRATION.
 5. THIS CERTIFICATE IS TRACEABLE TO 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) : 2.1 |
| Overall Variation of Line Voltage (V) : 14 |
| Instrument Condition : Normal |
| Bath Inner Size (W*L*H) : 60*40*6 cm |

BATH PERFORMANCE

| Controller Temperature (°C) | Temperature Stability (±°C) | Radius Uniformity (°C) | Axial Uniformity (°C) | Overall Variation (°C) |
|-----------------------------|-----------------------------|------------------------|-----------------------|------------------------|
| 50.0 | 0.05 | 0.06 | 0.04 | 0.11 |
| 60.0 | 0.07 | 0.19 | 0.03 | 0.30 |

TEMPERATURE MEASUREMENT ACCURACY TEST

| Controller Temp (°C) | Indicating Temp (°C) | Measured Temperature (°C) at Spread Locations | | | | | Uncertainty (± °C) |
|----------------------|----------------------|---|-------|-------|-------|--------|--------------------|
| | | #1 | #2 | #3 | #4 | Ref. 5 | |
| 50.0 | 50.0 | 49.61 | 49.62 | 49.63 | 49.67 | 49.65 | 0.15 |
| 60.0 | 60.0 | 59.48 | 59.67 | 59.52 | 59.60 | 59.59 | 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



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 : 
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 : 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

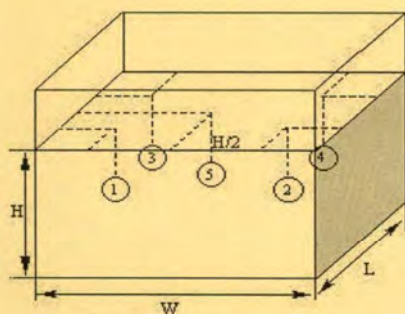
1. THIS INSTRUMENT WAS CALIBRATED ACCORDING TO ASTM E715-80 (REAPPROVED 2001) BY COMPARISON WITH CALIBRATED RTD. THE PROBES WERE PLACED ON FIVE POINTS AND LOCATED ONE PROBE IN EACH OF THE FOUR CORNERS OF THE BATH AND PLACED THE FIFTH RTD WITHIN 2.5 cm. OF THE GEOMETRIC CENTER OF THE WATER VOLUME (REFERENCE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


(Thanakul Petchurai)

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 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 \pm (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

F. Peter

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : SP24020

Job No. : VC67SP0013

Pages : 3 of 3

Result of calibration : Photometric Accuracy

(Without adjustment)

| Material | Wavelength (nm) | Filter S/N | Nominal Absorbance (A) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor |
|------------------------------|--------------------|--------------------|-----------------------------|--------------------------------|--------------------------------|----------------------|----------------------|-------------|
| Neutral Density glass filter | 440.0 | 29360 | 1.0 | 1.0517 | 1.0550 | 0.0033 | 0.0029 | 2.00 |
| | | 29914 | 0.7 | 0.7445 | 0.7460 | 0.0015 | 0.0029 | 2.00 |
| | | 29381 | 0.5 | 0.5416 | 0.5431 | 0.0015 | 0.0030 | 2.00 |
| | 546.1 | 29360 | 1.0 | 0.9821 | 0.9820 | -0.0001 | 0.0028 | 2.00 |
| | | 29914 | 0.7 | 0.6961 | 0.6958 | -0.0003 | 0.0028 | 2.00 |
| | | 29381 | 0.5 | 0.5073 | 0.5080 | 0.0007 | 0.0029 | 2.00 |
| | 590.0 | 29360 | 1.0 | 1.0222 | 1.0210 | -0.0012 | 0.0028 | 2.00 |
| | | 29914 | 0.7 | 0.7237 | 0.7221 | -0.0016 | 0.0029 | 2.00 |
| | | 29381 | 0.5 | 0.5361 | 0.5361 | 0.0000 | 0.0031 | 2.00 |
| | 635.0 | 29360 | 1.0 | 0.9753 | 0.9745 | -0.0008 | 0.0028 | 2.00 |
| | | 29914 | 0.7 | 0.6910 | 0.6900 | -0.0010 | 0.0029 | 2.00 |
| | | 29381 | 0.5 | 0.5211 | 0.5210 | -0.0001 | 0.0032 | 2.00 |
| Material | Wavelength (nm) | Solution (mg/l) | Certified Absorbance (A) | UUC* Reading Absorbance (A) | Error (A) | Uncertainty ± (A) | k Factor | |
| RM-0204060810 | 235.0 | 20 | 0.2422 | 0.2418 | -0.0004 | 0.0101 | 2.00 | |
| | | 40 | 0.4866 | 0.4852 | -0.0014 | 0.0115 | 2.00 | |
| | | 60 | 0.7414 | 0.7389 | -0.0025 | 0.0067 | 2.00 | |
| | | 80 | 0.9858 | 0.9842 | -0.0016 | 0.0093 | 2.00 | |
| | | 100 | 1.2442 | 1.2414 | -0.0028 | 0.0086 | 2.00 | |

UUC* = Unit Under Calibration

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

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

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

**Specific Acceptance :

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

**Stray light not TISI Accredited

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

End of Calibration Certificate

T. Ketch

คุณภาพดิน



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

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

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401**DATE TESTED** January 6, 2025**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ N/A**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER : 077C7042401DATE TESTED : January 6, 2025

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



MAINTENANCE AND TEST CERTIFICATE MODEL

OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED January 6, 2025**Remarks :**

Commissioning follow as commissioning performance sheets.

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



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

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

Service Department PerkinElmer Ltd.

Authorized Representative:



(Wiphan Promlumda)

Service Engineer

ระดับความร้อนในสถานประกอบการ



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

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

Location of Calibration : In-Lab

Calibration Procedure : SP-CPT-04-13

Received Date : 19 Mar 2025

Calibration Date : 22 Mar 2025

Recommend Due Date : 22 Mar 2026

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 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



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 : °C

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

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

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (±) |
|---------------------|------------------|-------------|--------|-------------------|
| 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 -

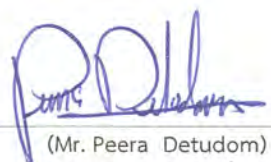


บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด
S.P.S. CONSULTING SERVICE CO., LTD.
7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Heat B_153_1

| Heat Stress WBGT Meter Verification Report | | | |
|--|----------------------|---------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. | : B07 | Verification Date | : 19 April 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 : 
(Mr. Peera Detudom)



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24100363-3

Page : 1 of 3

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

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 34

Serial Number : TEL080034

ID. Number : B11

Environmental Conditions

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

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

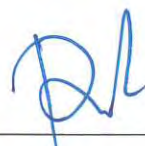
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical 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



ID LINE : IEC17025



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



ID LINE : IEC17025



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 -



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_153_2

| Heat Stress WBGT Meter Verification Report | | | |
|--|----------------------|---------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. | : B11 | Verification Date | : 19 April 2025 |
| Brand | : Quest Technologies | Ambient Temp. | : 24.5 °C |
| Model | : QUESTemp 34 | Barometric Pressure | : 1011 mmbar |
| Serial No. | : TEL080034 | Relative Humidity | : 49 % |
| Verification Module (Electronic Sensor Check) : | | | |
| Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C | | | |
| Result of Verification : Without Adjustment | | | |
| Wet Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 12.5 | 12.5 | 0.0 | ± 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)



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24100363-4

Page : 1 of 3

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

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 32

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

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

Calibrated by : Mr.Surasak Ritthikaew

Calibration Officer

Approved by :


(Mr. Prayoon Topart)

Authorized Signatory



ID LINE : IEC17025



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



ID LINE : IEC17025



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 -

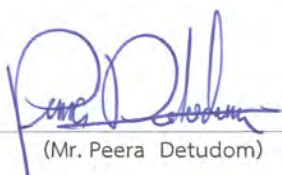


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7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900
7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chatuchak, Bangkok 10900
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com., www.spscon.com

Heat B_153_3

| Heat Stress WBGT Meter Verification Report | | | |
|--|----------------------|---------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. | : B12 | Verification Date | : 19 April 2025 |
| Brand | : Quest Technologies | Ambient Temp. | : 24.5 °C |
| Model | : QUESTemp 32 | Barometric Pressure | : 1011 mmbar |
| Serial No. | : TPA100010 | Relative Humidity | : 49 % |
| Verification Module (Electronic Sensor Check) : | | | |
| Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C | | | |
| Result of Verification : Without Adjustment | | | |
| Wet Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 12.5 | 12.6 | -0.1 | ± 0.5 |
| Dry Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 47.1 | 46.9 | 0.2 | ± 0.5 |
| Globe Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 69.3 | 69.2 | 0.1 | ± 0.5 |
| UUC* = UNIT UNDER CALIBRATION | | | |

Verified by : Adul Dangklom
(Mr.Adul Dangklom)

Approved by : 
(Mr. Peera Detudom)



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24090395-1

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 32

Serial Number : TPH050019

ID. Number : B25-TPH050019

Environmental Conditions

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

Received Date : 20 Sep 2024

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

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



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24090395-1

Page : 2 of 3

Reference Standards

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

Traceability

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

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Quality Reborn Co., Ltd



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24090395-1

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

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

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

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

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

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

Note :

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

Measurement Uncertainty

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

– End of Certificate –



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

Heat B_056_1

| Heat Stress WBGT Meter Verification Report | | | |
|--|----------------------|---------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. | : B25 | Verification Date | : 18 February 2025 |
| Brand | : Quest Technologies | Ambient Temp. | : 24.5 °C |
| Model | : QUESTemp 32 | Barometric Pressure | : 1011 mmbar |
| Serial No. | : TPH050019 | Relative Humidity | : 49 % |
| Verification Module (Electronic Sensor Check) : | | | |
| Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C | | | |
| Result of Verification : Without Adjustment | | | |
| Wet Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 12.5 | 12.3 | 0.2 | ± 0.5 |
| Dry Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 47.1 | 47.2 | -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)



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24080586-4

Page : 1 of 3

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

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 34

Serial Number : TPH050041

ID. Number : B26

Environmental Conditions

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

Received Date : 30 Aug 2024

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

Calibration Date : 30 Aug 2024

Location of Calibration : In-Lab

Recommend Due Date : 30 Aug 2025

Calibration Procedure : SP-CPT-04-13

Date of Issue : 31 Aug 2024

Method of Calibration

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

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

Calibrated by : Ms. Apinya Pinyo

Calibration Officer

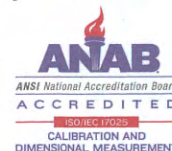
Approved by :

(Mr. Prayoon Topart)

Authorized Signatory



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24080586-4

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 |

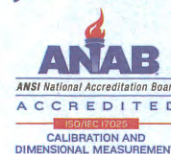
Traceability

This certification is traceable to the International System of Unit maintained at :
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Quality Reborn Co., Ltd



ID LINE : IEC17025



Result of Calibration

Certificate No. : SPR24080586-4

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (±) |
|---------------------|------------------|-------------|--------|-------------------|
| 30.0 | 30.011 | 29.9 | -0.111 | 0.20 |
| 35.0 | 35.016 | 34.9 | -0.116 | 0.20 |
| 40.0 | 40.018 | 39.9 | -0.118 | 0.20 |

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (±) |
|---------------------|------------------|-------------|-------|-------------------|
| 30.0 | 30.011 | 30.2 | 0.189 | 0.20 |
| 35.0 | 35.016 | 35.2 | 0.184 | 0.20 |
| 40.0 | 40.018 | 40.2 | 0.182 | 0.20 |

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

| Temperature Setting | Standard Reading | UUC Reading | Error | Uncertainty (±) |
|---------------------|------------------|-------------|-------|-------------------|
| 30.0 | 30.011 | 30.3 | 0.289 | 0.20 |
| 35.0 | 35.016 | 35.3 | 0.284 | 0.20 |
| 40.0 | 40.018 | 40.3 | 0.282 | 0.20 |

Note:

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

Measurement Uncertainty

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

- End of Certificate -



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

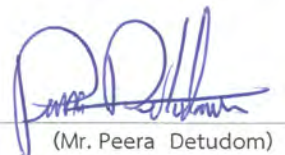
Heat B_056_2

| Heat Stress WBGT Meter Verification Report | | | |
|--|----------------------|---------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. | : B26 | Verification Date | : 18 February 2025 |
| Brand | : Quest Technologies | Ambient Temp. | : 24.5 °C |
| Model | : QUESTemp 34 | Barometric Pressure | : 1011 mmbar |
| Serial No. | : TPH050041 | Relative Humidity | : 49 % |
| Verification Module (Electronic Sensor Check) : | | | |
| Verification Module No. : 21 WB = 12.5 °C, DB = 47.1 °C, G = 69.3 °C | | | |
| Result of Verification : Without Adjustment | | | |
| Wet Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 12.5 | 12.6 | -0.1 | ± 0.5 |
| Dry Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 47.1 | 46.9 | 0.2 | ± 0.5 |
| Globe Probe Temperature Measurement | | | |
| Verification Module Reading (°C) | UUC* Reading (°C) | Correction (°C) | Tolerance Limit (°C) |
| 69.3 | 69.2 | 0.1 | ± 0.5 |
| UUC* = UNIT UNDER CALIBRATION | | | |

Verified by :

Adul Dangklom
(Mr.Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



ID LINE : IEC17025



Certificate of Calibration

Certificate Number : SPR24090395-6

Page : 1 of 3

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

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

Equipment Name : Area Heat Stress Monitor

Manufacturer : Quest Technologies

Model : QUESTemp 32

Serial Number : TPH050046

ID. Number : B28-TPH050046

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



ID LINE : IEC17025



Calibration Report

Certificate Number : SPR24090395-6

Page : 2 of 3

Reference Standards

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

Traceability

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

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

Quality Reborn Co., Ltd



ID LINE : IEC17025



Result of Calibration

Certificate Number : SPR24090395-6

Page : 3 of 3

Temperature Accuracy in the Measurement. (WET)

Unit : °C

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

Temperature Accuracy in the Measurement. (DRY)

Unit : °C

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

Temperature Accuracy in the Measurement. (GLOBE)

Unit : °C

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

Note :

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

Measurement Uncertainty

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

- End of Certificate -



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

Heat B_056_3

| Heat Stress WBGT Meter Verification Report | | | |
|--|----------------------|---------------------|----------------------|
| Verification Data | | | |
| Heat Stress WBGT Meter No. | : B28 | Verification Date | : 18 February 2025 |
| Brand | : Quest Technologies | Ambient Temp. | : 24.5 °C |
| Model | : QUESTemp 32 | Barometric Pressure | : 1011 mmbar |
| Serial No. | : TPH050046 | 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)

คุณภาพอากาศในสถานประกอบการ



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

| Personal Pump Data | | | | Calibration Data | | | | | | | | |
|--------------------|-------|-----------|------------|------------------|--------------------|-------|-------|-----------------|-------|-------|------------------------------|----------------|
| No. | Brand | Model | Serial No. | Date | Flow Rate (mL/min) | | | | | | Value From Calibration Curve | |
| | | | | | Setting | | | Actual (Q std.) | | | | |
| | | | | | 1 | 2 | 3 | 1 | 2 | 3 | y | R ² |
| B80 | SKC | 224-PCXR3 | 504569 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,497 | 2,011 | 1.009x – 11.282 | 1.000 |
| B81 | SKC | 224-PCXR3 | 503480 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 1,004 | 1,505 | 2,008 | 1.010x - 16.107 | 0.999 |
| B82 | SKC | 224-PCXR3 | 505673 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,509 | 2,005 | 1.014x – 24.323 | 0.999 |
| B83 | SKC | 224-PCXR3 | 510785 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,506 | 1,998 | 0.998x + 5.669 | 1.000 |
| B84 | SKC | 224-PCXR3 | 508333 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 993 | 1,492 | 2,004 | 1.009x - 21.129 | 1.000 |
| B85 | SKC | 224-PCXR3 | 505757 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,503 | 2,008 | 1.007x - 9.639 | 1.000 |
| B86 | SKC | 224-PCXR3 | 512625 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 996 | 1,495 | 2,001 | 1.005x - 11.406 | 1.000 |
| B87 | SKC | 224-PCXR3 | 504324 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,498 | 1,999 | 1.004x – 12.097 | 1.000 |
| B88 | SKC | 224-PCXR3 | 508307 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 994 | 1,502 | 1,994 | 0.999x - 1.619 | 1.000 |
| B89 | SKC | 224-PCXR3 | 509860 | 06/01/2025 | 1,000 | 1,500 | 2,000 | 995 | 1,507 | 2,003 | 1.008x – 14.844 | 1.000 |
| B90 | SKC | 224-PCXR3 | 508366 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,496 | 1,995 | 0.999x – 1.143 | 1.000 |
| B91 | SKC | 224-PCXR3 | 510919 | 07/01/2025 | 1,000 | 1,500 | 2,000 | 1,005 | 1,503 | 2,012 | 1.008x - 11.670 | 0.999 |
| B92 | SKC | 224-PCXR3 | 510987 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 999 | 1,494 | 2,010 | 1.013x - 24.882 | 0.999 |
| B93 | SKC | 224-PCXR3 | 509845 | 03/01/2025 | 1,000 | 1,500 | 2,000 | 997 | 1,507 | 1,998 | 1.002x – 3.102 | 1.000 |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



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Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

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

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

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

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)



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

Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

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

Calibrated by :

Adul Dangklom
 (Mr.Adul Dangklom)

Approved by :

Peera Detudom
 (Mr. Peera Detudom)



CERTIFICATE No : 24M2227

REFERENCE No : 72448-1

PAGE : 1 OF 2

Certificate of Calibration

EQUIPMENT : DIGITAL BALANCE

MANUFACTURER : METTLER TOLEDO

MODEL : XS105DU

SERIAL No : 1126422905


ID No : BA05/50

CONDITION AS RECEIVED : USED ITEM

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 08-Mar-24

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 14-Mar-24

RECEIVED DATE : 08-Mar-24



CERTIFICATE No : 24M2227

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

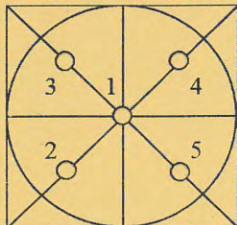
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 200 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

5. OFF CENTER LOADING ERROR



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

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

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

END OF CALIBRATION REPORT



CERTIFICATE No : 25M2254
REFERENCE No : 76365-1

PAGE : 1 OF 2

Certificate of Calibration

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

CALIBRATED BY : ATSAWIN Y.

CALIBRATION DATE : 07-Mar-25

APPROVED BY : 
PONGSAK J.

ISSUED DATE : 13-Mar-25

RECEIVED DATE : 07-Mar-25

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





CERTIFICATE No : 25M2254

PAGE : 2 OF 2

Calibration Report

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

CONDITION OF THIS RESULTS OF CALIBRATION

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

2. REFERENCE STANDARD INSTRUMENTS :-

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

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

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

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

RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT

1. ZERO SETTING FUNCTION : NORMAL

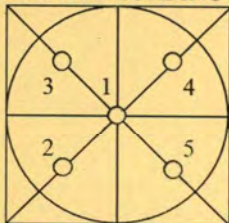
2. TARE FUNCTION : NORMAL

3. REPEATABILITY OF READING AT 120 g WAS 0.000055 g

4. DEPARTURE FROM NOMINAL VALUE/ LINEARITY

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

Date: June 24, 2024

(Mr. Ponwut Kornthongnimit)

Test Engineer

ระดับเสียงในสถานประกอบการ



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : ACO

Model : 2127

Serial No. : 130006

Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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 : 22 Feb. 2024

Date of Calibration : 4 Mar. 2024

1 / 2 ✓

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

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

FM.BL.MTC.002 Rev.4

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

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

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

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

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

1. Sound Pressure Level

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

2. Frequency

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

3. Total Distortion


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

Note : 1. No adjustment.

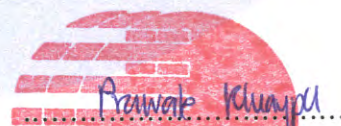
2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


(Mr. Weerachai Deechaiyae)

Approved by :


(Mr. Prawate Kluaypa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 4 Mar. 2024

Date of Issue : 5 Mar. 2024

Ref : 2011267022200795001

End of Certificate

2 / 2

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

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

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand

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

Office/Laboratory

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Road,
Amphoe Muang, Changwat Samutprakan 10280, Thailand

Tel. (66) 0 2323 1672-80 ext. 115, 116

Fax. (66) 0 2323 9165

E-mail : mtc@tistr.or.th

Office

196 Phahonyothin Road, Chatuchak, Bangkok 10900,
Thailand

Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217

Fax. (66) 0 2579 8592

E-mail : sumalee@tistr.or.th



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

Noise B_055/25

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 |

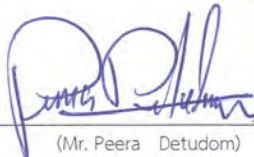
Calibration Data

| Sound Level Meter Data | | | | Calibration Data | | |
|--|-------|-------|------------|------------------|---------------------|------------------|
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| ACO-B18 | ACO | 6236 | 00172048 | 18 February 2025 | 94.0 | 93.9 |
| ACO-B29 | ACO | 6236 | 00182011 | 18 February 2025 | 94.0 | 93.9 |
| ACO-B33 | ACO | 6236 | 00182015 | 18 February 2025 | 93.9 | 93.9 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 93.85 ± 0.10 dB | |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :


(Mr. Peera Detudom)



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

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 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
W

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

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

FM.BL.MTC.002 Rev.5

Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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Office/Laboratory

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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

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 20 μ Pa at 1000 Hz

Acoustic Output in dB re 20 μ Pa, 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 | $\pm 1.0\%$ |

3. Total Distortion

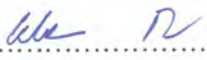
| Standard Microphone Type | Measured Total Distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 1 |
|-----------------------------|----------------------------------|--------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 0.95 | ± 0.50 | $\pm 3.0\%$ |

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


.....
(Mr. Weerachai Deechaiyae)

Approved by :


.....
(Mr. Prawate Kluaypa)
Director

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.BL.MTC.002 Rev.5

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

Noise B_152/25

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-B29 | ACO | 6236 | 00182011 | 19 April 2025 | 93.7 | 93.9 |
| ACO-R40 | ACO | 6236 | 00192052 | 19 April 2025 | 93.9 | 93.9 |
| ACO-R50 | ACO | 6236 | 00192062 | 19 April 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)

ปริมาณเสียงสะสมติดตัวบุคคล



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0562

MTC No. EEL. BP. 72/0767

CALIBRATION CERTIFICATE

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

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

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

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : SVANTEK

Model : SV34

Serial No. : 83820

Ambient Environment

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

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 : 31 Jul. 2024

Date of Calibration : 6 Aug. 2024

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FM.BL.MTC.002 Rev.4

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0562

MTC No. EEL. BP. 72/0767

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

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

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

1. Sound Pressure Level

| Standard Microphone Type | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 2 |
|-----------------------------|---------------------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 114.03 | 0.03 | ± 0.10 | ± 0.75 dB |

2. Frequency

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

3. Total Distortion


| Standard Microphone Type | Measured Total Distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 2 |
|-----------------------------|----------------------------------|--------------------|--|
| 1/2 inch Bruel&Kjaer 4180 | 0.27 | ± 0.50 | $\pm 4.0\%$ |

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :


.....
(Mr. Weerachai Deechaiyae)

Approved by :


.....
(Mr. Prawate Khuaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 6 Aug. 2024

Date of Issue : 7 Aug. 2024

Ref : 2011267073102836003

End of Certificate

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Noise Dose B_055_1/25

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

| | | | |
|-------------------|-----------------|------------------|----------------|
| Brand | SVANTEK | Number | SV 03/60 |
| Model | SV34 | Serial No. | 83820 |
| Calibration Range | 114 dB, 1000 Hz | Last Calibration | 06 August 2024 |
| | | Due Date | 06 August 2025 |

Calibration Data

| Sound Level Meter Data | | | | Calibration Data | | |
|--|---------|----------|------------|------------------|---------------------|------------------|
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| NMD-B01 | SVANTEK | SV-104IS | 80840 | 18 February 2025 | 114.0 | 114.0 |
| NMD-B02 | SVANTEK | SV-104IS | 80842 | 18 February 2025 | 114.0 | 114.0 |
| NMD-B03 | SVANTEK | SV-104IS | 80852 | 18 February 2025 | 113.9 | 114.0 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 114.03± 0.10 dB | |

Calibrated by :

Adul Dangklom
(Mr. Adul Dangklom)

Approved by :

Peera Detudom
(Mr. Peera Detudom)



บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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Noise Dose B_152_1/25

Noise Dose Meter Calibration Report

Acoustic Calibrator Data

| | | | |
|-------------------|-----------------|------------------|----------------|
| Brand | SVANTEK | Number | SV 03/60 |
| Model | SV34 | Serial No. | 83820 |
| Calibration Range | 114 dB, 1000 Hz | Last Calibration | 06 August 2024 |
| | | Due Date | 06 August 2025 |

Calibration Data

| Sound Level Meter Data | | | | Calibration Data | | |
|--|---------|----------|------------|------------------|---------------------|------------------|
| SLM No. | Brand | Model | Serial No. | Date | Actual Reading [dB] | |
| | | | | | Before Adjustment | After Adjustment |
| NMD-B05 | SVANTEK | SV-104IS | 80856 | 19 April 2025 | 114.0 | 114.0 |
| NMD-B07 | SVANTEK | SV-104IS | 80817 | 19 April 2025 | 113.9 | 114.0 |
| NMD-B11 | SVANTEK | SV-104IS | 80831 | 19 April 2025 | 114.0 | 114.0 |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) | | | | | 114.03± 0.10 dB | |

Calibrated by :

Adul Dangklom

(Mr. Adul Dangklom)

Approved by :

Peera Detudom

(Mr. Peera Detudom)