

## ภาคผนวกที่ 4

เอกสารสอบเทียบความถูกต้องของเครื่องมือตรวจวัดคุณภาพสิ่งแวดล้อม

**ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม**

| รายการตรวจวัด  | เครื่องมือเก็บตัวอย่าง   | เครื่องมือตรวจวิเคราะห์                         |
|--|--|---|
|  | ชื่อเครื่องมือ   | ชื่อเครื่องมือ                                  |
| <b>1. คุณภาพอากาศในบรรยากาศ</b>  |  |   |
| TSP  | High Volume Air Sampler No. B19, B31, B35, B42                               | Digital Balance                                 |
| PM-10  | High Volume PM-10 Air Sampler No. B01, B06, B15, B35                         | Digital Balance                                 |
| NO <sub>2</sub>  | SO <sub>2</sub> Analyzer No. B06, B11, B12, B13                              | SO <sub>2</sub> Analyzer No. B06, B11, B12, B13 |
| SO <sub>2</sub>  | NO <sub>2</sub> Analyzer No. B13, B16, B22, R09                              | NO <sub>2</sub> Analyzer No. B13, B16, B22, R09 |
| <b>2. คุณภาพอากาศจากปล่อง</b>  |  |   |
| Total Suspended Particulate (TSP)  | Console No. B04<br>Pitot Tube No. B57  | Digital Balance                                 |
| Oxides of Nitrogen (NO <sub>x</sub> )  | Vacuum Gauge   | Spectrophotometer                               |
| Sulfur Dioxide (SO <sub>2</sub> )  | Personal Pump SKC No. 16<br>Rotameter No. H-08                               | Digital Balance                                 |
| <b>3. ระดับเสียงในบรรยากาศ</b>   |  |   |
| L <sub>eq</sub> 1 hr, L <sub>eq</sub> 8 hr, L <sub>eq</sub> 24 hr, L <sub>dn</sub> , L <sub>max</sub><br>และ L <sub>90</sub> | Acoustic Calibrator<br>Sound Level Meter No. ACO-B01<br>No. CR-B06, B09, B10 | -   |
| <b>4. คุณภาพน้ำ</b>  |  |   |
| Temperature  | -  | Thermometer                                     |
| Conductivity   | -  | Conductivity Meter                              |
| Turbidity  | -  | Turbidity Meter                                 |
| Color  | -  | Spectrophotometer                               |
| pH   | -  | pH Meter  |
| BOD <sub>5</sub>   | -  | BOD Analyzer                                    |
| COD  | -  | COD Reactor                                     |
| Total Suspended Solids   | -  | Digital Balance                                 |
| Total Dissolved Solids   | -  | Digital Balance                                 |
| Grease & Oil   | -  | Digital Balance                                 |
| Nitrate-Nitrogen   | -  | Spectrophotometer                               |
| Phosphate-Phosphorus   | -  | Spectrophotometer                               |
| Cadmium  | -  | ICP   |
| Lead   | -  | ICP   |
| Mercury  | -  | AAS   |
| Manganese  | -  | ICP   |
| Fluoride   | -  | Spectrophotometer                               |
| Sulfate  | -  | Spectrophotometer                               |
| Total Iron   | -  | ICP   |

ตารางสรุปรายการเอกสารการสอบเทียบความถูกต้องของเครื่องมือเก็บตัวอย่าง  
และเครื่องมือตรวจวิเคราะห์คุณภาพสิ่งแวดล้อม (ต่อ)

| รายการตรวจวัด  | เครื่องมือเก็บตัวอย่าง                                    | เครื่องมือตรวจวิเคราะห์ |
|--|---|-------------------------|
|  | ชื่อเครื่องมือ  | ชื่อเครื่องมือ          |
| 5. ระดับเสียงในสถานที่ทำงาน<br>L <sub>eq</sub> 8 hr, L <sub>max</sub> และ Noise Dose | Acoustic Calibrator<br>Sound Level Meter No. NMD-B06, B07 | -                       |
| 6. คุณภาพอากาศในสถานประกอบการ<br>Total Dust  | Personal Pump SKC No. B61, B82<br>Rotameter No. H-B07     | Digital Balance         |
| Respirable Dust  | Personal Pump SKC No. B64, B68<br>Rotameter No. H-B07     | Digital Balance         |

คุณภาพอากาศในบรรยากาศ





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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

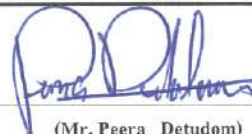
| High Volume Air Sampler Data |            | Calibration Data |  |                |
|------------------------------|------------|------------------|--|----------------|
| Recorder No.                 | Blower No. | Date             | Actual Flowrate (ft <sup>3</sup> /min) | R <sup>2</sup> |
| B01                          | B01        | 10/05/2024       | y = 1.153x-1.686                       | 1.000          |
| B02                          | B02        | 06/05/2024       | y = 1.118x+2.367                       | 0.999          |
| B03                          | B03        | 06/05/2024       | y = 1.188x-5.422                       | 1.000          |
| B04                          | B04        | 07/05/2024       | y = 1.263x-5.863                       | 0.999          |
| B05                          | B05        | 07/05/2024       | y = 1.265x-7.057                       | 0.999          |
| B06                          | B06        | 09/05/2024       | y = 1.213x-4.898                       | 0.997          |
| B07                          | B07        | 07/05/2024       | y = 1.193x-4.616                       | 0.999          |
| B08                          | B08        | 07/05/2024       | y = 1.207x-4.482                       | 0.998          |
| B09                          | B09        | 06/05/2024       | y = 1.216x-4.533                       | 1.000          |
| B10                          | B10        | 07/05/2024       | y = 1.170x-0.607                       | 1.000          |
| B11                          | B11        | 07/05/2024       | y = 1.135x-1.256                       | 0.999          |
| B12                          | B12        | 07/05/2024       | y = 1.211x-4.879                       | 0.997          |
| B13                          | B13        | 07/05/2024       | y = 1.237x-4.608                       | 1.000          |
| B14                          | B14        | 06/05/2024       | y = 1.252x-5.906                       | 0.998          |
| B15                          | B15        | 09/05/2024       | y = 1.192x-2.587                       | 0.999          |
| B16                          | B16        | 06/05/2024       | y = 1.133x-0.425                       | 0.996          |
| B17                          | B17        | 06/05/2024       | y = 1.250x-4.910                       | 0.997          |
| B18                          | B18        | 06/05/2024       | y = 1.181x-4.244                       | 0.998          |
| B19                          | B19        | 09/05/2024       | y = 1.246x-8.218                       | 0.999          |
| B20                          | B20        | 08/05/2024       | y = 1.218x-4.223                       | 0.999          |
| B21                          | B21        | 08/05/2024       | y = 1.189x-4.448                       | 0.998          |
| B22                          | B22        | 09/05/2024       | y = 1.195x-6.295                       | 0.999          |
| B23                          | B23        | 06/05/2024       | y = 1.247x-5.137                       | 0.999          |
| B24                          | B24        | 09/05/2024       | y = 1.157x-1.861                       | 0.998          |
| B25                          | B25        | 07/05/2024       | y = 1.079x+1.324                       | 1.000          |
| B26                          | B26        | 07/05/2024       | y = 1.204x-3.730                       | 0.997          |
| B27                          | B27        | 07/05/2024       | y = 1.140x-2.924                       | 0.999          |
| B28                          | B28        | 07/05/2024       | y = 1.220x-7.484                       | 0.999          |
| B29                          | B29        | 07/05/2024       | y = 1.215x-3.763                       | 1.000          |
| B30                          | B30        | 10/05/2024       | y = 1.198x-3.745                       | 0.998          |
| B31                          | B31        | 10/05/2024       | y = 1.209x-4.851                       | 1.000          |
| B32                          | B32        | 10/05/2024       | y = 1.186x-0.772                       | 0.998          |
| B33                          | B33        | 10/05/2024       | y = 1.237x-4.394                       | 0.997          |
| B34                          | B34        | 10/05/2024       | y = 1.191x-4.725                       | 0.999          |

Calibrated by :



(Mr. Adul Dangklom)

Approved by :



(Mr. Peera Detudom)



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## High Volume Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

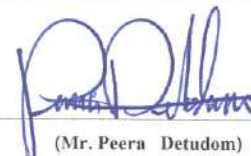
### Calibration Data

| High Volume Air Sampler Data |            | Calibration Data |  |                |
|------------------------------|------------|------------------|--|----------------|
| Recorder No.                 | Blower No. | Date             | Actual Flowrate (ft <sup>3</sup> /min) | R <sup>2</sup> |
| B35                          | B35        | 06/05/2024       | $y = 1.193x - 4.091$                   | 0.999          |
| B36                          | B36        | 10/05/2024       | $y = 1.172x - 3.010$                   | 0.998          |
| B37                          | B37        | 06/05/2024       | $y = 1.212x - 2.588$                   | 1.000          |
| B38                          | B38        | 06/05/2024       | $y = 1.187x - 3.844$                   | 0.997          |
| B39                          | B39        | 06/05/2024       | $y = 1.178x - 0.811$                   | 0.999          |
| B40                          | B40        | 06/05/2024       | $y = 1.221x - 5.480$                   | 0.998          |
| B41                          | B41        | 06/05/2024       | $y = 1.219x - 4.443$                   | 0.997          |
| B42                          | B42        | 07/05/2024       | $y = 1.167x - 2.748$                   | 0.997          |
| B43                          | B43        | 07/05/2024       | $y = 1.161x - 0.034$                   | 0.999          |
| B44                          | B44        | 07/05/2024       | $y = 1.249x - 4.278$                   | 0.999          |
| R01                          | R01        | 07/05/2024       | $y = 1.183x - 4.631$                   | 0.997          |
| R02                          | R02        | 07/05/2024       | $y = 1.237x - 5.919$                   | 0.998          |
| R03                          | R03        | 07/05/2024       | $y = 1.234x - 7.377$                   | 1.000          |
| R04                          | R04        | 10/05/2024       | $y = 1.250x - 6.680$                   | 0.996          |
| R05                          | R05        | 10/05/2024       | $y = 1.176x - 4.403$                   | 0.999          |
| R06                          | R06        | 06/05/2024       | $y = 1.195x - 4.419$                   | 0.999          |
| R07                          | R07        | 06/05/2024       | $y = 1.061x + 1.385$                   | 0.999          |
| R08                          | R08        | 06/05/2024       | $y = 1.169x - 1.426$                   | 0.999          |
| R09                          | R09        | 06/05/2024       | $y = 1.150x - 0.930$                   | 0.998          |
| R10                          | R10        | 06/05/2024       | $y = 1.246x - 6.734$                   | 0.999          |
| R11                          | R11        | 06/05/2024       | $y = 1.171x - 2.938$                   | 0.999          |
| R12                          | R12        | 10/05/2024       | $y = 1.149x - 3.415$                   | 0.998          |
| R13                          | R13        | 10/05/2024       | $y = 1.158x - 3.158$                   | 0.999          |
| R14                          | R14        | 10/05/2024       | $y = 1.236x - 4.390$                   | 1.000          |
| R15                          | R15        | 06/05/2024       | $y = 1.229x - 7.704$                   | 0.998          |
| R16                          | R16        | 06/05/2024       | $y = 1.242x - 7.570$                   | 0.998          |
| R17                          | R17        | 07/05/2024       | $y = 1.211x - 5.039$                   | 0.998          |
| R18                          | R18        | 07/05/2024       | $y = 1.226x - 5.530$                   | 0.999          |
| R19                          | R19        | 07/05/2024       | $y = 1.185x - 4.311$                   | 0.999          |
| R20                          | R20        | 09/05/2024       | $y = 1.193x - 4.417$                   | 1.000          |

Calibrated by :

  
(Mr. Adul Dangklom)

Approved by :

  
(Mr. Peera Detudom)



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## High Volume PM-10 Air Sampler Calibration Report

Calibration Method : Multipoint Orifice Flow Transfer Standard

Model : TE 5025A

S/N : 3611

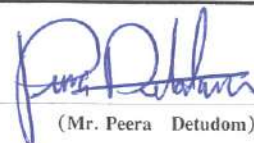
### Calibration Data

| High Volume PM-10 Data |            | Calibration Data |  |                |
|------------------------|------------|------------------|--|----------------|
| Recorder No.           | Blower No. | Date             | Actual Flowrate (ft <sup>3</sup> /min) | R <sup>2</sup> |
| B01                    | B01        | 10/05/2024       | $y = 1.208x - 2.196$                   | 0.999          |
| B02                    | B02        | 06/05/2024       | $y = 1.126x + 0.624$                   | 0.999          |
| B03                    | B03        | 06/05/2024       | $y = 1.229x - 3.954$                   | 0.999          |
| B04                    | B04        | 06/05/2024       | $y = 1.179x - 3.520$                   | 0.999          |
| B05                    | B05        | 09/05/2024       | $y = 1.194x - 4.966$                   | 0.998          |
| B06                    | B06        | 09/05/2024       | $y = 1.211x - 4.805$                   | 0.999          |
| B07                    | B07        | 06/05/2024       | $y = 1.194x - 4.491$                   | 0.998          |
| B08                    | B08        | 06/05/2024       | $y = 1.199x - 2.209$                   | 0.999          |
| B09                    | B09        | 06/05/2024       | $y = 1.229x - 6.309$                   | 0.999          |
| B10                    | B10        | 07/05/2024       | $y = 1.205x - 3.745$                   | 0.999          |
| B11                    | B11        | 10/05/2024       | $y = 1.243x - 4.611$                   | 0.998          |
| B12                    | B12        | 07/05/2024       | $y = 1.235x - 5.109$                   | 0.999          |
| B13                    | B13        | 07/05/2024       | $y = 1.216x - 4.616$                   | 0.999          |
| B14                    | B14        | 08/05/2024       | $y = 1.206x - 2.574$                   | 0.999          |
| B15                    | B15        | 09/05/2024       | $y = 1.192x - 1.864$                   | 0.999          |
| B16                    | B16        | 07/05/2024       | $y = 1.198x - 0.408$                   | 1.000          |
| B17                    | B17        | 06/05/2024       | $y = 1.215x - 4.321$                   | 0.996          |
| B18                    | B18        | 10/05/2024       | $y = 1.221x - 4.368$                   | 0.998          |
| B19                    | B19        | 09/05/2024       | $y = 1.225x - 4.263$                   | 0.999          |
| B20                    | B20        | 07/05/2024       | $y = 1.236x - 5.830$                   | 0.997          |
| B21                    | B21        | 07/05/2024       | $y = 1.146x + 0.383$                   | 0.998          |
| B22                    | B22        | 09/05/2024       | $y = 1.204x - 1.993$                   | 0.998          |
| B23                    | B23        | 07/05/2024       | $y = 1.201x - 3.338$                   | 0.999          |
| B24                    | B24        | 09/05/2024       | $y = 1.155x - 1.602$                   | 0.999          |
| B25                    | B25        | 07/05/2024       | $y = 1.224x - 5.057$                   | 0.998          |
| B26                    | B26        | 06/05/2024       | $y = 1.188x - 3.804$                   | 0.998          |
| B27                    | B27        | 07/05/2024       | $y = 1.153x - 4.016$                   | 0.998          |
| B28                    | B28        | 07/05/2024       | $y = 1.197x - 5.298$                   | 0.999          |
| B29                    | B29        | 07/05/2024       | $y = 1.206x - 4.662$                   | 0.999          |
| B30                    | B30        | 07/05/2024       | $y = 1.181x - 2.375$                   | 0.998          |
| B31                    | B31        | 08/05/2024       | $y = 1.160x + 0.847$                   | 0.999          |
| B32                    | B32        | 08/05/2024       | $y = 1.223x - 4.126$                   | 0.998          |
| B33                    | B33        | 08/05/2024       | $y = 1.184x - 1.773$                   | 0.999          |
| B34                    | B34        | 07/05/2024       | $y = 1.229x - 3.128$                   | 0.998          |

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

  
(Mr. Peera Detudom)





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| CALIBRATION REPORT                                 |                                      |                   |                                |                                |            |
|--|--------------------------------------|-------------------|--------------------------------|--------------------------------|------------|
| SO <sub>2</sub> FLUORESCENT ANALYZER               |                                      |                   |                                |                                |            |
| DATE :   | 15 July 2024                         | BRAND :           | API                            | MODEL :                        | 100E       |
| NO.  | SO <sub>2</sub> -B06                 |                   |                                | SERIAL NO.                     | 3430       |
| Calibrator (Dilution System)                       |                                      |                   |                                |                                |            |
| Brand  | : API                                |                   |                                | Model                          | : 700      |
| Last Cal. Date                                     | : 08 August 2023                     |                   |                                | Serial No.                     | : 911      |
| Reference Standard Gas                             |                                      |                   |                                |                                |            |
| Standard Gas                                       | : Sulphur Dioxide (SO <sub>2</sub> ) |                   |                                | Cylinder No.                   | : A00814SK |
| Certified Date                                     | : 21 June 2021                       | Expired Date      | : 21 June 2029                 | Cylinder Conc.                 | : 49.8 ppm |
| CALIBRATING CONDITION                              |                                      |                   |                                |                                |            |
| Pressure   | 1011                                 | mmbar             | Temp.                          | 24.5                           | °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 <sub>2</sub> Span                               | 400.0                                | 400.2             | 0.050                          | 400.0                          | 1.013      |
| API Model 100E SO <sub>2</sub> 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  | 658                                  | cc/min            | 650 ± 10%                      |                                |            |
| PMT  | 103.2                                | mV                | -20-150 with Zero Air          |                                |            |
| UV LAMP  | 3028.5                               | mV                | 1000-4900                      |                                |            |
| STR. LGT   | 61.8                                 | PPB               | <100                           |                                |            |
| DRK PMT  | 63.8                                 | mV                | -50 - 200                      |                                |            |
| DRK LMP  | 58.2                                 | mV                | -50 - 200                      |                                |            |
| HVPS   | 674                                  | V                 | 550-900 constant               |                                |            |
| DCPS   | 2528                                 | mV                | 2500 ± 200                     |                                |            |
| RCELL TEMP   | 50.1                                 | °C                | 50 ± 1                         |                                |            |
| BOX TEMP   | 29.3                                 | °C                | 5-40                           |                                |            |
| PMT TEMP   | 7.0                                  | °C                | 7 ± 2.0                        |                                |            |
| SO <sub>2</sub> Span Conc                          | 400                                  | PPB               | 20-20,000                      |                                |            |
| SO <sub>2</sub> Slope                              | 1.013                                | -                 | 1.0 ± 0.3                      |                                |            |
| SO <sub>2</sub> Offset                             | 21.9                                 | mV                | <250                           |                                |            |
| Stability at Zero                                  | 0.1                                  | PPB               | <0.2                           |                                |            |
| Stability at Span                                  | 0.2                                  | PPB               | 0.5% of reading (above 50 ppb) |                                |            |

Calibrated by : Adul Dangklom  
(Mr.Adul Dangklom)

Approved by : Peera Detudom  
(Mr.Peera Detudom)



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| CALIBRATION REPORT                                   |                                      |                   |                                |                                |            |
|--|--------------------------------------|-------------------|--------------------------------|--------------------------------|------------|
| SO <sub>2</sub> FLUORESCENT ANALYZER                 |                                      |                   |                                |                                |            |
| DATE :   | 15 July 2024                         | BRAND :           | TELEDYNE                       | MODEL :                        | TML-50     |
| NO.  | SO <sub>2</sub> -B11                 | SERIAL NO.        | SO2187                         |                                |            |
| Calibrator (Dilution System)                         |                                      |                   |                                |                                |            |
| Brand  | : API                                |                   |                                | Model                          | : 700      |
| Last Cal. Date                                       | : 08 August 2023                     |                   |                                | Serial No.                     | : 911      |
| Reference Standard Gas                               |                                      |                   |                                |                                |            |
| Standard Gas   | : Sulphur Dioxide (SO <sub>2</sub> ) |                   |                                | Cylinder No.                   | : A00814SK |
| Certified Date                                       | : 21 June 2021                       | Expired Date      | : 21 June 2029                 | Cylinder Conc.                 | : 49.8 ppm |
| CALIBRATING CONDITION                                |                                      |                   |                                |                                |            |
| Pressure   | 1011                                 | mmbar             | Temp.                          | 24.5                           | °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 <sub>2</sub> Span                                 | 400.0                                | 400.1             | 0.025                          | 400.0                          | 1.011      |
| API Model TML-50 SO <sub>2</sub> 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  | 654                                  | cc/min            | 650 ± 10%                      |                                |            |
| PMT  | 103.1                                | mV                | -20-150 with Zero Air          |                                |            |
| UV LAMP  | 3020.4                               | mV                | 1000-4900                      |                                |            |
| STR. LGT   | 61.6                                 | PPB               | <100                           |                                |            |
| DRK PMT  | 63.1                                 | mV                | -50 - 200                      |                                |            |
| DRK LMP  | 57.9                                 | mV                | -50 - 200                      |                                |            |
| HVPS   | 670                                  | V                 | 550-900 constant               |                                |            |
| DCPS   | 2519                                 | mV                | 2500 ± 200                     |                                |            |
| RCELL TEMP   | 50.3                                 | °C                | 50 ± 1                         |                                |            |
| BOX TEMP   | 29.0                                 | °C                | 5-40                           |                                |            |
| PMT TEMP   | 7.2                                  | °C                | 7 ± 2.0                        |                                |            |
| SO <sub>2</sub> Span Conc                            | 400                                  | PPB               | 20-20,000                      |                                |            |
| SO <sub>2</sub> Slope                                | 1.011                                | -                 | 1.0 ± 0.3                      |                                |            |
| SO <sub>2</sub> Offset                               | 22.2                                 | mV                | <250                           |                                |            |
| Stability at Zero                                    | 0.1                                  | PPB               | <0.2                           |                                |            |
| Stability at Span                                    | 0.2                                  | PPB               | 0.5% of reading (above 50 ppb) |                                |            |

Calibrated by :

Adul Dangklom  
(Mr.Adul Dangklom)

Approved by :

Peera Detudom  
(Mr.Peera Detudom)





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| CALIBRATION REPORT                                   |                                   |                             |                                |                                |        |
|--|-----------------------------------|-----------------------------|--------------------------------|--------------------------------|--------|
| SO <sub>2</sub> FLUORESCENT ANALYZER                 |                                   |                             |                                |                                |        |
| DATE :   | 15 July 2024                      | BRAND :                     | TELEDYNE                       | MODEL :                        | TML-50 |
| NO.  | SO <sub>2</sub> -B12              |                             |                                | SERIAL NO.                     | 1886   |
| Calibrator (Dilution System)                         |                                   |                             |                                |                                |        |
| Brand : API  |                                   |                             | Model : 700                    |                                |        |
| Last Cal. Date : 08 August 2023                      |                                   |                             | Serial No. : 911               |                                |        |
| Reference Standard Gas                               |                                   |                             |                                |                                |        |
| Standard Gas : Sulphur Dioxide (SO <sub>2</sub> )    |                                   |                             | Cylinder No. : A00814SK        |                                |        |
| Certified Date : 21 June 2021                        |                                   | Expired Date : 21 June 2029 |                                | Cylinder Conc. : 49.8 ppm      |        |
| CALIBRATING CONDITION                                |                                   |                             |                                |                                |        |
| Pressure   | 1011                              | mmbar                       | Temp.                          | 24.5                           | °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 <sub>2</sub> Span                                 | 400.0                             | 399.6                       | -0.100                         | 400.0                          | 1.007  |
| API Model TML-50 SO <sub>2</sub> 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  | 656                               | cc/min                      | 650 ± 10%                      |                                |        |
| PMT  | 103.4                             | mV                          | -20-150 with Zero Air          |                                |        |
| UV LAMP  | 3035.1                            | mV                          | 1000-4900                      |                                |        |
| STR. LGT   | 61.5                              | PPB                         | <100                           |                                |        |
| DRK PMT  | 63.0                              | mV                          | -50 - 200                      |                                |        |
| DRK LMP  | 57.7                              | mV                          | -50 - 200                      |                                |        |
| HVPS   | 673                               | V                           | 550-900 constant               |                                |        |
| DCPS   | 2524                              | mV                          | 2500 ± 200                     |                                |        |
| RCELL TEMP   | 50.5                              | °C                          | 50 ± 1                         |                                |        |
| BOX TEMP   | 29.4                              | °C                          | 5-40                           |                                |        |
| PMT TEMP   | 7.1                               | °C                          | 7 ± 2.0                        |                                |        |
| SO <sub>2</sub> Span Conc                            | 400                               | PPB                         | 20-20,000                      |                                |        |
| SO <sub>2</sub> Slope                                | 1.007                             | -                           | 1.0 ± 0.3                      |                                |        |
| SO <sub>2</sub> Offset                               | 21.8                              | mV                          | <250                           |                                |        |
| Stability at Zero                                    | 0.1                               | PPB                         | <0.2                           |                                |        |
| Stability at Span                                    | 0.2                               | PPB                         | 0.5% of reading (above 50 ppb) |                                |        |

Calibrated by :

Adul Dangklom  
(Mr.Adul Dangklom)

Approved by :

Peera Detudom  
(Mr.Peera Detudom)



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| CALIBRATION REPORT                                   |                                      |                   |                                |                                |            |
|--|--------------------------------------|-------------------|--------------------------------|--------------------------------|------------|
| SO <sub>2</sub> FLUORESCENT ANALYZER                 |                                      |                   |                                |                                |            |
| DATE :   | 15 July 2024                         | BRAND :           | TELEDYNE                       | MODEL :                        | TML-50     |
| NO.  | SO <sub>2</sub> -B13                 | SERIAL NO.        | 1891                           |                                |            |
| Calibrator (Dilution System)                         |                                      |                   |                                |                                |            |
| Brand  | : API                                |                   |                                | Model                          | : 700      |
| Last Cal. Date                                       | : 08 August 2023                     |                   |                                | Serial No.                     | : 911      |
| Reference Standard Gas                               |                                      |                   |                                |                                |            |
| Standard Gas   | : Sulphur Dioxide (SO <sub>2</sub> ) |                   |                                | Cylinder No.                   | : A00814SK |
| Certified Date                                       | : 21 June 2021                       | Expired Date      | : 21 June 2029                 | Cylinder Conc.                 | : 49.8 ppm |
| CALIBRATING CONDITION                                |                                      |                   |                                |                                |            |
| Pressure   | 1011                                 | mmbar             | Temp.                          | 24.5                           | °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 <sub>2</sub> Span                                 | 400.0                                | 399.7             | -0.075                         | 400.0                          | 1.009      |
| API Model TML-50 SO <sub>2</sub> Analyzer Check list |                                      |                   |                                |                                |            |
| Test Values  | Observed Value                       | Units             | Nominal Range                  |                                |            |
| RANGE  | 500                                  | PPB               | 0-500                          |                                |            |
| SAMPLE PRESS   | 28.5                                 | in-Hg             | 25-35                          |                                |            |
| SAMPLE FLOW  | 659                                  | cc/min            | 650 ± 10%                      |                                |            |
| PMT  | 103.0                                | mV                | -20-150 with Zero Air          |                                |            |
| UV LAMP  | 3014.7                               | mV                | 1000-4900                      |                                |            |
| STR. LGT   | 61.7                                 | PPB               | <100                           |                                |            |
| DRK PMT  | 63.2                                 | mV                | -50 - 200                      |                                |            |
| DRK LMP  | 50.8                                 | mV                | -50 - 200                      |                                |            |
| HVPS   | 669                                  | V                 | 550-900 constant               |                                |            |
| DCPS   | 2515                                 | mV                | 2500 ± 200                     |                                |            |
| RCELL TEMP   | 50.4                                 | °C                | 50 ± 1                         |                                |            |
| BOX TEMP   | 29.1                                 | °C                | 5-40                           |                                |            |
| PMT TEMP   | 7.3                                  | °C                | 7 ± 2.0                        |                                |            |
| SO <sub>2</sub> Span Conc                            | 400                                  | PPB               | 20-20,000                      |                                |            |
| SO <sub>2</sub> Slope                                | 1.009                                | -                 | 1.0 ± 0.3                      |                                |            |
| SO <sub>2</sub> 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

#### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

|        |              |            |      |         |      |
|--------|--------------|------------|------|---------|------|
| DATE : | 15 July 2024 | BRAND :    | API  | MODEL : | 200A |
| NO.    | NOX-B13      | SERIAL NO. | 1983 |         |      |

#### Calibrator (Dilution System)

|                |                  |            |       |
|----------------|------------------|------------|-------|
| Brand          | : API            | Model      | : 700 |
| Last Cal. Date | : 08 August 2023 | 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. | 24.5 | °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                                 | -0.10             | -      | 0                              | -     |
| NO Span              | 400                               | 399.6             | -0.100 | 400.0                          | 1.004 |
| NO <sub>x</sub> Span | 400                               | 399.8             | -0.050 | 400.0                          | 1.007 |

#### API Model 200E NO<sub>x</sub> 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                       | 103.3          | mV      | -20 - 150                  |
| AZERO                     | 94.0           | mV      | -20 - 150                  |
| HVPS                      | 669            | V       | 420 - 900 constant         |
| RCELL TEMP                | 50.2           | °C      | 50 ± 1                     |
| BOX TEMP                  | 29.4           | °C      | 8 - 48                     |
| PMT TEMP                  | 7.1            | °C      | 7 ± 2                      |
| MOLY TEMP                 | 314.9          | °C      | 315 ± 5                    |
| RCELL PRESS               | 8.3            | IN-Hg-A | 2 - 10 constant            |
| SAMPLE PRESS              | 28.5           | IN-Hg-A | 25 - 30 constant           |
| NO Span Conc              | 400            | PPB     | 20 - 20,000                |
| NO <sub>x</sub> Span Conc | 400            | PPB     | 20 - 20,000                |
| NO Slope                  | 1.004          | -       | 1.0 ± 0.3                  |
| NO <sub>x</sub> Slope     | 1.007          | -       | 1.0 ± 0.3                  |
| NO Offset                 | 1.2            | mV      | -20 to +150                |
| NO <sub>x</sub> 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 :

(Mr.Peera Detudom)





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| CALIBRATION REPORT   |                                   |                   |                            |                                |            |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|------------|
| CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER |                                   |                   |                            |                                |            |
| DATE :   | 15 July 2024                      | BRAND :           | API                        | MODEL :                        | 200E       |
| NO.  | NOX-B16                           | SERIAL NO.        | 249                        |                                |            |
| Calibrator (Dilution System)                                     |                                   |                   |                            |                                |            |
| Brand  | : API                             |                   |                            | Model                          | : 700      |
| Last Cal. Date   | : 08 August 2023                  |                   |                            | 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.                      | 24.5                           | °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                          | 1.010      |
| NO <sub>x</sub> Span   | 400                               | 400.2             | 0.050                      | 400.0                          | 1.013      |
| API Model 200E NO <sub>x</sub> 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  | 103.4                             | mV                | -20 - 150                  |                                |            |
| AZERO  | 94.2                              | mV                | -20 - 150                  |                                |            |
| HVPS   | 671                               | V                 | 420 - 900 constant         |                                |            |
| RCELL TEMP   | 50.3                              | °C                | 50 ± 1                     |                                |            |
| BOX TEMP   | 29.5                              | °C                | 8 - 48                     |                                |            |
| PMT TEMP   | 7.4                               | °C                | 7 ± 2                      |                                |            |
| MOLY TEMP  | 315.2                             | °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 <sub>x</sub> Span Conc  | 400                               | PPB               | 20 - 20,000                |                                |            |
| NO Slope   | 1.010                             | -                 | 1.0 ± 0.3                  |                                |            |
| NO <sub>x</sub> Slope  | 1.013                             | -                 | 1.0 ± 0.3                  |                                |            |
| NO Offset  | 1.7                               | mV                | -20 to +150                |                                |            |
| NO <sub>x</sub> 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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## CALIBRATION REPORT

### CHEMILUMINESCENT NO / NO<sub>2</sub> / NO<sub>x</sub> ANALYZER

DATE : 15 July 2024

BRAND : API

MODEL : TML-41M

NO. NOX-B22

SERIAL NO. NO1618

#### Calibrator (Dilution System)

Brand : API

Model : 700

Last Cal. Date : 08 August 2023

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. 24.5 °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                                 | 0.10              | -      | 0                              | -     |
| NO Span              | 400                               | 399.7             | -0.075 | 400.0                          | 1.006 |
| NO <sub>x</sub> Span | 400                               | 399.9             | -0.025 | 400.0                          | 1.009 |

#### API Model TML-41M NO<sub>x</sub> Analyzer Check List

| Test Values               | Observed Value | Units   | Nominal Range              |
|---------------------------|----------------|---------|----------------------------|
| RANGE                     | 500            | PPB     | 500 standard               |
| STABILITY (Zero Gas)      | 0.1            | PPB     | < 2 with zero air          |
| SAMPLE FLOW               | 504            | cc/min  | 500 ± 50                   |
| OZONE FLOW                | 78             | cc/min  | 80 ± 15                    |
| PMT                       | 103.1          | mV      | -20 - 150                  |
| AZERO                     | 93.7           | mV      | -20 - 150                  |
| HVPS                      | 675            | V       | 420 - 900 constant         |
| RCELL TEMP                | 50.1           | °C      | 50 ± 1                     |
| BOX TEMP                  | 29.2           | °C      | 8 - 48                     |
| PMT TEMP                  | 7.3            | °C      | 7 ± 2                      |
| MOLY TEMP                 | 314.7          | °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 <sub>x</sub> Span Conc | 400            | PPB     | 20 - 20,000                |
| NO Slope                  | 1.006          | -       | 1.0 ± 0.3                  |
| NO <sub>x</sub> Slope     | 1.009          | -       | 1.0 ± 0.3                  |
| NO Offset                 | 1.4            | mV      | -20 to +150                |
| NO <sub>x</sub> 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 :

Peera Detudom

(Mr.Peera Detudom)





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด  
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7 Soi Phaholyothin 24, Phaholyothin Rd., Jompol, Chaluchak, Bangkok 10900  
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

| CALIBRATION REPORT   |                                   |                   |                            |                                |       |
|--|-----------------------------------|-------------------|----------------------------|--------------------------------|-------|
| CHEMILUMINESCENT NO / NO <sub>2</sub> / NO <sub>x</sub> ANALYZER |                                   |                   |                            |                                |       |
| DATE :   | 15 July 2024                      | BRAND :           | API                        | MODEL :                        | 200E  |
| NO.  | NOX-R09                           | SERIAL NO.        | 252                        |                                |       |
| Calibrator (Dilution System)                                     |                                   |                   |                            |                                |       |
| Brand  | : API                             |                   | Model                      | : 700                          |       |
| Last Cal. Date   | : 08 August 2023                  |                   | 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.                      | 24.5                           | °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                               | 399.8             | -0.050                     | 400.0                          | 1.008 |
| NO <sub>x</sub> Span   | 400                               | 400.1             | 0.025                      | 400.0                          | 1.011 |
| API Model 200E NO <sub>x</sub> Analyzer Check List               |                                   |                   |                            |                                |       |
| Test Values  | Observed Value                    | Units             | Nominal Range              |                                |       |
| RANGE  | 500                               | PPB               | 500 standard               |                                |       |
| STABILITY (Zero Gas)   | 0.1                               | PPB               | < 2 with zero air          |                                |       |
| SAMPLE FLOW  | 511                               | cc/min            | 500 ± 50                   |                                |       |
| OZONE FLOW   | 79                                | cc/min            | 80 ± 15                    |                                |       |
| PMT  | 103.2                             | mV                | -20 - 150                  |                                |       |
| AZERO  | 93.8                              | mV                | -20 - 150                  |                                |       |
| HVPS   | 670                               | V                 | 420 - 900 constant         |                                |       |
| RCELL TEMP   | 50.4                              | °C                | 50 ± 1                     |                                |       |
| BOX TEMP   | 29.1                              | °C                | 8 - 48                     |                                |       |
| PMT TEMP   | 7.2                               | °C                | 7 ± 2                      |                                |       |
| MOLY TEMP  | 315.1                             | °C                | 315 ± 5                    |                                |       |
| RCELL PRESS  | 8.4                               | IN-Hg-A           | 2 - 10 constant            |                                |       |
| SAMPLE PRESS   | 28.6                              | IN-Hg-A           | 25 - 30 constant           |                                |       |
| NO Span Conc   | 400                               | PPB               | 20 - 20,000                |                                |       |
| NO <sub>x</sub> Span Conc  | 400                               | PPB               | 20 - 20,000                |                                |       |
| NO Slope   | 1.008                             | -                 | 1.0 ± 0.3                  |                                |       |
| NO <sub>x</sub> Slope  | 1.011                             | -                 | 1.0 ± 0.3                  |                                |       |
| NO Offset  | 1.6                               | mV                | -20 to +150                |                                |       |
| NO <sub>x</sub> 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)



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

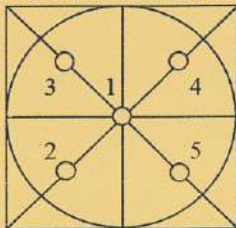
2. TARE FUNCTION : NORMAL

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

คุณภาพอากาศจากปล่องระบาย





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature  
Pressure

25  
1010

± 3  
± 15

°C  
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 <sup>2</sup> |
| B01                | SKC   | 224-PCXR4 | 262101     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,499 | 2,006 | 1.009x - 12.249              | 1.000          |
| B02                | SKC   | 224-PCXR4 | 626166     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,494 | 1,997 | 0.995x + 3.958               | 1.000          |
| B03                | SKC   | 224-PCXR4 | 612968     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,510 | 2,005 | 1.010x - 16.611              | 0.999          |
| B04                | SKC   | 224-PCXR4 | 602804     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,506 | 2,008 | 1.009x - 11.881              | 1.000          |
| B05                | SKC   | 224-PCXR4 | 612693     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,502 | 2,001 | 1.003x - 6.328               | 1.000          |
| B06                | SKC   | 224-PCXR4 | 262188     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,007           | 1,513 | 2,006 | 1.012x - 16.439              | 0.999          |
| B07                | SKC   | 224-PCXR4 | 626262     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,002           | 1,498 | 2,002 | 0.999x + 1.531               | 1.000          |
| B08                | SKC   | 224-PCXR4 | 626100     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,506 | 2,005 | 1.008x - 13.624              | 0.999          |
| B09                | SKC   | 224-PCXR4 | 626479     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,003           | 1,503 | 2,002 | 1.005x - 11.861              | 0.999          |
| B10                | SKC   | 224-PCXR4 | 091950     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 994             | 1,495 | 2,003 | 1.007x - 13.804              | 1.000          |
| B11                | SKC   | 224-PCXR8 | 564315     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,498 | 2,000 | 1.001x - 3.486               | 1.000          |
| B12                | SKC   | 224-PCXR4 | 034656     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,513 | 2,009 | 1.007x - 8.707               | 0.999          |
| B13                | SKC   | 224-PCXR4 | 602073     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,512 | 2,007 | 1.009x - 11.410              | 0.999          |
| B14                | SKC   | 224-PCXR4 | 626313     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,494 | 1,995 | 0.992x + 9.519               | 1.000          |
| B15                | SKC   | 224-PCXR4 | 626474     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 997             | 1,511 | 2,006 | 1.010x - 15.823              | 1.000          |
| B16                | SKC   | 224-PCXR4 | 626477     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,494 | 2,002 | 0.997x + 4.517               | 1.000          |
| B17                | SKC   | 224-PCXR4 | 626860     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 996             | 1,495 | 2,000 | 1.001x - 4.046               | 1.000          |
| B18                | SKC   | 224-PCXR4 | 691484     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 997             | 1,499 | 1,999 | 1.004x - 8.051               | 1.000          |
| B19                | SKC   | 224-PCXR4 | 691599     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,007           | 1,514 | 2,007 | 1.008x - 12.253              | 0.999          |
| B20                | SKC   | 224-PCXR4 | 691587     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 995             | 1,512 | 2,003 | 1.009x - 12.393              | 1.000          |
| B21                | SKC   | 224-PCXR4 | 691531     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,007           | 1,509 | 2,008 | 1.012x - 16.990              | 0.999          |
| B22                | SKC   | 224-PCXR4 | 691654     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,004           | 1,502 | 2,002 | 1.009x - 15.731              | 0.999          |
| B23                | SKC   | 224-PCXR4 | 798393     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,503 | 2,005 | 1.007x - 11.817              | 1.000          |
| B24                | SKC   | 224-PCXR4 | 626363     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 996             | 1,502 | 1,998 | 1.000x - 9.991               | 1.000          |
| B25                | SKC   | 224-PCXR4 | 798489     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,012           | 1,504 | 2,004 | 1.006x - 8.339               | 0.999          |
| B26                | SKC   | 224-PCXR4 | 798479     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,500 | 1,996 | 0.995x + 5.313               | 1.000          |
| B27                | SKC   | 224-PCXR4 | 691673     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,498 | 2,004 | 1.003x - 2.207               | 1.000          |
| B28                | SKC   | 224-PCXR4 | 691570     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 1,003           | 1,504 | 2,009 | 1.013x - 17.234              | 1.000          |
| B29                | SKC   | 224-PCXR4 | 626472     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 1,007           | 1,509 | 2,006 | 1.009x - 12.657              | 0.999          |
| B30                | SKC   | 224-PCXR4 | 691489     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,500 | 2,009 | 1.012x - 16.759              | 1.000          |
| B31                | SKC   | 224-PCXR4 | 691509     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,003           | 1,503 | 2,007 | 1.005x - 11.138              | 0.999          |
| B32                | SKC   | 224-PCXR4 | 091567     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 996             | 1,505 | 2,007 | 1.016x - 26.973              | 0.999          |
| B33                | SKC   | 224-PCXR4 | 091756     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,500 | 2,000 | 1.004x - 7.636               | 1.000          |
| B34                | SKC   | 224-PCXR4 | 612962     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,504 | 2,008 | 1.012x - 18.993              | 0.999          |
| B35                | SKC   | 224-PCXR4 | 602682     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,500 | 2,005 | 1.006x - 8.339               | 1.000          |
| B36                | SKC   | 224-PCXR4 | 626164     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,501 | 2,002 | 1.001x - 4.266               | 1.000          |
| B37                | SKC   | 224-PCXR4 | 626256     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,007           | 1,502 | 2,005 | 1.006x - 12.029              | 0.999          |
| B38                | SKC   | 224-PCXR4 | 626167     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,001           | 1,498 | 2,003 | 1.003x - 2.603               | 1.000          |
| B39                | SKC   | 224-PCXR4 | 034637     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,506 | 2,006 | 1.008x - 11.270              | 0.999          |
| B40                | SKC   | 224-PCXR4 | 798349     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,502 | 1,999 | 1.002x - 7.748               | 1.000          |

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

Peera Detudom  
(Mr. Peera Detudom)



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### Pitot Tube Calibration Report

Calibration Method

Standard Pitot Tube

#### Calibration Data

| Pitot Tube Data |               |                                  | Calibration Data |                   |        |
|-----------------|---------------|----------------------------------|------------------|-------------------|--------|
| No.             | Type of Pitot | Coefficient of Standard<br>Pitot | Date             | Avg. of Cp (test) |        |
|                 |               |                                  |                  | Side A            | Side B |
| B36             | S             | 0.99                             | 07/05/2024       | 0.84              | 0.84   |
| B37             | S             | 0.99                             | 07/05/2024       | 0.84              | 0.83   |
| B38             | S             | 0.99                             | 07/05/2024       | 0.85              | 0.84   |
| B39             | S             | 0.99                             | 09/05/2024       | 0.84              | 0.84   |
| B40             | S             | 0.99                             | 09/05/2024       | 0.84              | 0.83   |
| B41             | S             | 0.99                             | 09/05/2024       | 0.84              | 0.84   |
| B44             | S             | 0.99                             | 08/05/2024       | 0.83              | 0.84   |
| B45             | S             | 0.99                             | 08/05/2024       | 0.84              | 0.84   |
| B46             | S             | 0.99                             | 08/05/2024       | 0.84              | 0.84   |
| B47             | S             | 0.99                             | 08/05/2024       | 0.85              | 0.84   |
| B48             | S             | 0.99                             | 10/05/2024       | 0.84              | 0.84   |
| B49             | S             | 0.99                             | 06/05/2024       | 0.84              | 0.84   |
| B54             | S             | 0.99                             | 06/05/2024       | 0.85              | 0.84   |
| B56             | S             | 0.99                             | 07/05/2024       | 0.83              | 0.84   |
| B57             | S             | 0.99                             | 10/05/2024       | 0.84              | 0.84   |
| B58             | S             | 0.99                             | 10/05/2024       | 0.85              | 0.84   |

Remark : Accept value of Cp (test) is  $0.84 \pm 0.01$

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

Peera Detudom  
(Mr. Peera Detudom)





# CALIBRATION LABORATORY Co., LTD.

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



## CERTIFICATE OF CALIBRATION FOR

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

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

DATE OF RECEIVED : 20 July 2024

DATE OF ISSUED : 23 July 2024

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

Calibrated By : Sittipong Pimdee  
Calibration Engineer

Approved By : Mongkol Yotsoontorn  
Authorized Signatory  
23 July 2024



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

Certificate No. Q24076545

F3-011-05/12-23

page 1 of 3



@clccalibration

## REPORT OF CALIBRATION

### FOR

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

#### ENVIRONMENT CONDITIONS :

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

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

#### PROCEDURE USED :

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

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

#### REFERENCE STANDARD USED :

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

#### TRACEABILITY :

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

#### UNCERTAINTY :

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

Certificate No. **Q24076545**

F3-011-05/12-23

page 2 of 3



@clccalibration

**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<br>( 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  $\pm 0.2$  inHg

Transmitting fluid : Air.

Technical Note. Conversion factor 1 kPa ; 0.2953003 inHg

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

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

**### End of Certificate ###**

Certificate No. Q24076545

F3-011-05/12-23

page 3 of 3







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

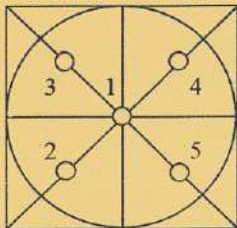
2. TARE FUNCTION : NORMAL

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



# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

## Calibration Certificate

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

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

*T. Petchur*  
( Thanakul Petchurai )

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

## Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Certified reference materials

| Material                       | Ref. type     | Cell serial No. | Cert. No.  | Due Date   |
|--------------------------------|---------------|-----------------|------------|------------|
| Holmium liquid                 | RM-HL         | 29706           | 106864     | 01/11/2024 |
| Didymium liquid                | RM-DL         | 28912           | 106905     | 02/11/2024 |
| Neutral density filter         | RM-1N2N3N     | 13877           | 106918     | 03/11/2024 |
| Potassium dichromate solutions | RM-0204060810 | 14204           | 106902     | 02/11/2024 |
| Potassium Iodide solution      | -             | KI-0701-001     | CI-0090-22 | 08/04/2024 |

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

| Material | Certified Values of<br>Reference Material (nm) | UUC* Reading<br>(nm) | Error<br>(nm) | Uncertainty<br>± (nm) | k<br>Factor |
|----------|--|----------------------|---------------|-----------------------|-------------|
| RM-HL    | 278.13   | 278.3                | 0.17          | 0.16                  | 2.00        |
|          | 361.25   | 361.3                | 0.05          | 0.16                  | 2.00        |
|          | 467.82   | 468.0                | 0.18          | 0.16                  | 2.00        |
|          | 536.56   | 536.6                | 0.04          | 0.16                  | 2.00        |
|          | 640.50   | 640.4                | -0.10         | 0.16                  | 2.00        |
| RM-DL    | 740.09   | 740.0                | -0.09         | 0.16                  | 2.00        |
|          | 864.94   | 865.0                | 0.06          | 0.16                  | 2.00        |

UUC\* = Unit Under Calibration



Continuation of Calibration Certificate

Cert. No. : SP23016  
Job No. : VC66SP0014  
Pages : 3 of 3

**Result of calibration : Photometric Accuracy**

(Without adjustment)

| Material                     | Wavelength<br>(nm) | Filter S/N         | Nominal<br>Absorbance (A)   | Certified<br>Absorbance (A)    | UUC* Reading<br>Absorbance (A) | Error<br>(A)         | Uncertainty<br>± (A) | k<br>Factor |
|------------------------------|--------------------|--------------------|-----------------------------|--------------------------------|--------------------------------|----------------------|----------------------|-------------|
| Neutral Density glass filter | 440.0              | 29360              | 1.0                         | 1.0517                         | 1.0564                         | 0.0047               | 0.0031               | 2.00        |
|                              |                    | 29914              | 0.7                         | 0.7445                         | 0.7460                         | 0.0015               | 0.0032               | 2.00        |
|                              |                    | 29381              | 0.5                         | 0.5416                         | 0.5429                         | 0.0013               | 0.0032               | 2.00        |
|                              | 546.1              | 29360              | 1.0                         | 0.9821                         | 0.9849                         | 0.0028               | 0.0030               | 2.00        |
|                              |                    | 29914              | 0.7                         | 0.6961                         | 0.6961                         | 0.0000               | 0.0030               | 2.00        |
|                              |                    | 29381              | 0.5                         | 0.5073                         | 0.5073                         | 0.0000               | 0.0030               | 2.00        |
|                              | 590.0              | 29360              | 1.0                         | 1.0222                         | 1.0244                         | 0.0022               | 0.0030               | 2.00        |
|                              |                    | 29914              | 0.7                         | 0.7237                         | 0.7234                         | -0.0003              | 0.0030               | 2.00        |
|                              |                    | 29381              | 0.5                         | 0.5361                         | 0.5360                         | -0.0001              | 0.0031               | 2.00        |
|                              | 635.0              | 29360              | 1.0                         | 0.9753                         | 0.9775                         | 0.0022               | 0.0030               | 2.00        |
|                              |                    | 29914              | 0.7                         | 0.6910                         | 0.6910                         | 0.0000               | 0.0030               | 2.00        |
|                              |                    | 29381              | 0.5                         | 0.5211                         | 0.5210                         | -0.0001              | 0.0032               | 2.00        |
| Material                     | Wavelength<br>(nm) | Solution<br>(mg/l) | Certified<br>Absorbance (A) | UUC* Reading<br>Absorbance (A) | Error<br>(A)                   | Uncertainty<br>± (A) | k<br>Factor          |             |
| RM-0204060810                | 235.0              | 20                 | 0.2422                      | 0.2462                         | 0.0040                         | 0.0101               | 2.00                 |             |
|                              |                    | 40                 | 0.4866                      | 0.4900                         | 0.0034                         | 0.0115               | 2.00                 |             |
|                              |                    | 60                 | 0.7414                      | 0.7390                         | -0.0024                        | 0.0068               | 2.00                 |             |
|                              |                    | 80                 | 0.9858                      | 0.9871                         | 0.0013                         | 0.0093               | 2.00                 |             |
|                              |                    | 100                | 1.2442                      | 1.2480                         | 0.0038                         | 0.0087               | 2.00                 |             |

UUC\* = Unit Under Calibration

**Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230**

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

| Stray Light** UUC* Reading at 220 nm |               |
|--------------------------------------|---------------|
| Transimission T(%)                   | Absorbance(A) |
| 0.0111                               | 3.9564        |

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

**End of Calibration Certificate**



# Certificate Of Analysis

## Special Gases Mixture

## Customer Details

Name:

S.P.S Consulting Service

Address:

House No. 7, Soi Phahon Yothin 24, Phahon  
Yotin Rd., Chatujak, Bangkok 10900

Customer Tag No.:

## Certificate Details

Number: 3991/22

Date of Issue:

6-Jan-2023

Expiry date:

6-Jan-2026

## Material Details

Production Order: 90175195

Material Code:

553600-SV-44

Cylinder No.:

D869074

Gas content: 1.25 M<sup>3</sup>

Filling pressure:

130.0 bar

Valve:

CGA 660 SS

Cylinder Owner: LINDE

Cylinder Material:

Spectra seal

Cylinder Size:

10 L

## Laboratory Report

## Analytical Result

| Component                         | Normal<br>Concentration | Analysis Result <sup>1</sup> | Uncertainty <sup>2</sup> | Method of Analysis <sup>3</sup> | Assay Date           |
|-----------------------------------|-------------------------|------------------------------|--------------------------|---------------------------------|----------------------|
| Nitric Oxide                      | 100 ppm                 | 101 ppm                      | ± 1% relative            | (6) I-PB-352                    | 23-Dec-22 & 6-Jan-23 |
| Other NOx impurity<br>In Nitrogen |                         | Less than 5.0 ppm            |                          |                                 |                      |

## Reference Standard used in Assay

Reference Standard

Nitric Oxide

In Nitrogen

Cylinder number

QA2565

Concentration

99.4 ± 0.7 ppm

Expiry date:

4-Feb-2023

## Analytical Instruments used in Assay

Instrument/Make/Model  
FTIR Spectrometers Nicolet iS50Analytical Principle  
FTIR-NOLast Multipoint Calibration  
28-Nov & 28-Dec-22

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.

Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoontorn

Signatory for and on behalf of Linde (Thailand) Co., Ltd.

Linde (Thailand) Public Company Limited

PB-002/F006  
Iss: K/2, 15 Oct 2021

PLC Registration no. 010753700785

15<sup>th</sup> Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trad KM. 6.5 Road, Bangkaew

Bangplee, Samutprakarn 10540, Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant: 105 Moo 5, T.Bangsamak, A.Bangpakong, Chachoengsao 24180

Thailand, Tel (66) 38.570-479-93

Fax (66) 38.570-323



## Certificate Of Analysis

### Special Gases Mixture

#### Customer Details

|                                     |   |                        |
|-------------------------------------|---|------------------------|
| Name:<br>S.P.S. CONSULTING SERVICE. | Address:<br>House number 7 Soi Phahon Yothin 24,<br>Phahon Yothin Rd., Chatujak, Khet<br>Chatuchak, Bangkok 10900 | Customer Tag No.:<br>- |
|-------------------------------------|---|------------------------|

#### Certificate Details

|                                  |                             |                          |
|----------------------------------|-----------------------------|--------------------------|
| Number: 0868/24                  | Date of Issue: 25-Mar-2024  | Expiry date: 25-Mar-2027 |
| <b>Material Details</b>          |                             |                          |
| Production Order: 90183126       | Material Code: 411800-AV-44 | Cylinder No.: D711640    |
| Gas content: 1.25 M <sup>3</sup> | Filling pressure: 130 bar   | Valve: CGA 660 SS        |
| Cylinder Owner: LINDE            | Cylinder Material: Aluminum | Cylinder Size: 10 L      |

#### Laboratory Report

#### Analytical Result

| Component                         | Nominal Concentration | Analysis Result <sup>1</sup> | Uncertainty <sup>2</sup> | Method of Analysis <sup>3</sup> | Assay Date     |
|-----------------------------------|-----------------------|------------------------------|--------------------------|---------------------------------|----------------|
| Nitric Oxide                      | 200 ppm               | 211 ppm                      | ± 1% relative            | (6) I-PB-352                    | 18 & 25-Mar-24 |
| Other NOx impurity<br>in Nitrogen |                       | Less than 10.5 ppm           |                          |                                 |                |

#### Reference Standard used in Assay

|   |                           |                                  |                            |
|---|---------------------------|----------------------------------|----------------------------|
| Reference Standard<br>Nitric Oxide<br>in Nitrogen | Cylinder number<br>QA4329 | Concentration<br>252.7 ± 1.8 ppm | Expiry date:<br>9-May-2024 |
|---|---------------------------|----------------------------------|----------------------------|

#### Analytical Instruments used in Assay

|  |                                 |   |
|--|---------------------------------|---|
| Instrument/Make/Model<br>FTIR Spectrometers Nicolet iS50 | Analytical Principle<br>FTIR-NO | Last Multipoint Calibration<br>21-Feb & 25-Mar-24 |
|--|---------------------------------|---|

#### Recommend usage condition

Minimum utilization: 5% of actual content or before expiry date whichever comes first.

Storage condition: Keep in well ventilation and secure area.

#### Comments

When reordering, please quote the material number

#### Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoonorn

Signatory for and on behalf of Linde (Thailand) Co., Ltd.

PB-002/F006

Iss: M/1, 01 December 2023

บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)

โทรสาร (66) 2338-6100

ถนนพหลโยธิน กม. 6.5 ด. บางเขน

อ. บางพลี จ. สมุทรปราการ 10540 โทรศัพท์ (66) 2338-6100 โทรสาร (66) 2338-6333

โรงงานเวลโกรว์: 105 หมู่ 5 ต. บางสนธิ์ อ. บางพลี จ. สมุทรปราการ 24180

โทรศัพท์ (66) 38.570-479-93

โทรสาร (66) 38.570-323

Linde (Thailand) Public Company Limited

P.L.C. Registration no. 0107537000785

15<sup>th</sup> Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trad KM. 6.5 Road, Bangkaew

Bangplee, Samutprakarn 10540, Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant : 105 Moo 5, T.Bangsamak, A.Bangpakong, Chachoengsao 24180

Thailand, Tel (66) 38.570-479-93

Fax (66) 38.570-323

Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name:

S.P.S Consulting Service

Address:

7 Soi Phahon Yothin 24, Phahon Yotin Rd.,  
Chatujak, A. Chatuchak Bangkok 10900

Customer Tag No.:

## Certificate Details

|                   |                     |                    |              |                |             |
|-------------------|---------------------|--------------------|--------------|----------------|-------------|
| Number:           | 2574/21             | Date of Issue:     | 21-Jun-2021  | Expiry date:   | 21-Jun-2029 |
| Material Details  |                     |                    |              |                |             |
| Production Order: | 90166199            | Material Code:     | 627400-SK-44 | Cylinder No.:  | A00710SK    |
| Gas content:      | 5.52 M <sup>3</sup> | Filling pressure:  | 145.0 bar    | Valve:         | CGA 660 SS  |
| Cylinder Owner:   | LINDE               | Cylinder Material: | Spectra seal | Cylinder Size: | 40 L        |

## Laboratory Report

## Analytical Result

| Component                      | Normal<br>Concentration | Analysis Result <sup>1</sup> | Uncertainty <sup>2</sup> | Method of Analysis <sup>3</sup> | Assay Date         |
|--------------------------------|-------------------------|------------------------------|--------------------------|---------------------------------|--------------------|
| Sulphur Dioxide<br>In Nitrogen | 50.0 ppm                | 50.2 ppm                     | ± 1% relative            | (6) I-PB-352                    | 12-Jun & 19-Jun-21 |

Reference Standard  
Sulphur Dioxide  
In Nitrogen

## Reference Standard used in Assay

Cylinder number  
1331885GConcentration  
50.50 ± 0.40 ppmExpiry date:  
16-Oct-2021Instrument/Make/Model  
FTIR Spectrometers Nicolet iS50

## Analytical Instruments used in Assay

Analytical Principle  
FTIR-SO2Last Multipoint Calibration  
7-Jun-2021

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.

Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/S31 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoonporn

Signatory for and on behalf of Linde (Thailand) Co., Ltd.

Linde (Thailand) Public Company Limited Issd./2, 01 April 2021

PLC Registration no.0107537000785

15<sup>th</sup> Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trad KM. 6.5 Road, Bangkaew

Bangplee, Samutprakarn 10540, Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant: 105 Moo 5, T.Bangsamak, A.Bangpakong, Chachoengsao 24180

Thailand, Tel (66) 38.570-479-93

Fax (66) 38.570-323

PB-002/R006

Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name: S.P.S Consulting Service  
Address: 7, Soi Phahon Yothin 24, Phahon Yothin Rd., Chatujak, Bangkok, 10900  
Customer Tag No.:

## Certificate Details

|                   |                      |                    |              |                |             |
|-------------------|----------------------|--------------------|--------------|----------------|-------------|
| Number:           | 2420/19              | Date of Issue:     | 25-Jul-2019  | Expiry date:   | 24-Jul-2027 |
| Material Details  |                      |                    |              |                |             |
| Production Order: | 90154858             | Material Code:     | 636400-SK-44 | Cylinder No.:  | A00797SK    |
| Gas content:      | 5.520 M <sup>3</sup> | Filling pressure:  | 145.0 bar    | Valve:         | CGA 660 SS  |
| Cylinder Owner:   | LINDE                | Cylinder Material: | Spectra seal | Cylinder Size: | 40 L        |

## Laboratory Report

## Analytical Result

| Component                   | Normal Concentration | Analysis Result <sup>1</sup> | Uncertainty <sup>2</sup> | Method of Analysis <sup>3</sup> | Assay Date         |
|-----------------------------|----------------------|------------------------------|--------------------------|---------------------------------|--------------------|
| Sulphur Dioxide In Nitrogen | 100 ppm              | 102 ppm                      | ± 1% relative            | (6) I-PB-352                    | 17-Jul & 24-Jul-19 |

## Reference Standard used in Assay

| Reference Standard          | Cylinder number | Concentration   | Expiry date |
|-----------------------------|-----------------|-----------------|-------------|
| Sulphur Dioxide In Nitrogen | 258005SG        | 103.1 ± 0.8 ppm | 9-Aug-2020  |

## Analytical Instruments used in Assay

| Instrument/Make/Model           | Analytical Principle | Last Multipoint Calibration |
|---------------------------------|----------------------|-----------------------------|
| FTIR Spectrometers Nicolet iS50 | FTIR-SO2             | 24-Jun-2019                 |

## Recommend usage condition

Minimum utilization: 5% of actual content or before expire date whichever comes first.  
Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Sukanya Parinyasoonorn  
Signatory for and on behalf of Linde (Thailand) Co., Ltd.

Certificate Of Analysis  
Special Gases Mixture

## Customer Details

Name:

S.P.S Consulting Service

Address:

7 Soi Phahon Yothin 24, Phahon Yotin Rd.,  
Chatujak, A. Chatuchak Bangkok 10900

Customer Tag No.:

## Certificate Details

Number: 0302/23

Date of Issue:

13-Feb-2023

Expiry date:

13-Feb-2031

Material Details

Production Order: 90176240

Material Code:

491600-V-44

Cylinder No.:

18K1149177

Gas content: 1.40 M<sup>3</sup>

Filling pressure:

145.0 bar

Valve:

CGA 590 BRASS

Cylinder Owner: LINDE

Cylinder Material:

STEEL

Cylinder Size:

10 L

## Laboratory Report

## Analytical Result

| Component             | Normal<br>Concentration | Analysis Result <sup>1</sup> | Uncertainty <sup>2</sup> | Method of Analysis <sup>3</sup> | Assay Date  |
|-----------------------|-------------------------|------------------------------|--------------------------|---------------------------------|-------------|
| Oxygen<br>In Nitrogen | 15.0%                   | 15.1%                        | ± 1% relative            | (2) I-PB-354                    | 13-Feb-2023 |

Reference Standard  
Oxygen  
In Nitrogen

## Reference Standard used in Assay

Cylinder number  
48664Concentration  
9.930 ± 0.025%Expiry date:  
19-Aug-2024Instrument/Make/Model  
Servomex 4100 O2 analyser

## Analytical Instruments used in Assay

Analytical Principle  
ParamagneticLast Multipoint Calibration  
14-Jan-2023

## Recommend usage condition

Minimum utilization: 5% of actual content or before expiry date whichever comes first.

Storage condition: Keep in well ventilation and secure area.

## Comments

When reordering, please quote the material number

## Note:

1. All results expressed in this report are on mole/mole basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the EPA Traceability Protocol EPA-600/R-12/531 for the Assay and Certification of Gaseous Calibration Standards using procedure G1
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to Swiss National Standard of Mass or other recognised national metrology institutes.
3. (1) Gas Chromatography, (2) Paramagnetic Oxygen Analyzer, (3) Electrochemical Oxygen Analyzer, (4) Electrochemical Moisture Analyzer, (5) Total Hydrocarbon Analyzer, (6) Other - Specified

Page 1 of 1

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บริษัท ลินด์ (ประเทศไทย) จำกัด (มหาชน)

โทรสาร (66) 010753700785

ชั้น 15 อาคารทาวเวอร์ เอ 2/3 หมู่ 14 ถนนพหลโยธิน กม. 6.5 ต.บางพลี

อ.บางพลี จ.สมุทรปราการ 10540 โทรศัพท์ (66) 2338-6100 โทรสาร (66) 2338-6333


โรงงานเวลโกรว์: 105 หมู่ 5 ต.บางพลี อ.บางพลี จ.สมุทรปราการ 24180

โทรศัพท์ (66) 38.570-479-93

โทรสาร (66) 38.570-323

Sukanya Parinyasoonorn

Signatory for and on behalf of Linde (Thailand) Co., Ltd.



PB-D02/F006

Linde (Thailand) Public Company Limited Iss:K/2, 15 Oct 2021

P.L.C. Registration no.010753700785

15<sup>th</sup> Floor, Bangna Tower A, 2/3 Moo 14, Bangna Trad KM. 6.5 Road, Bangkaew

Bangplee, Samutprakarn 10540, Tel (66) 2338-6100 Fax (66) 2338-6333

Wellgrow Plant: 105 Moo 5, T.Bangsamak, A.Bangpakong, Chachoengsao 24180

Thailand, Tel (66) 38.570-479-93

Fax (66) 38.570-323





บริษัท ยูไนเท็ดอินดัสเตรียลแก๊ส จำกัด (สำนักงานใหญ่)  
 聯育股份有限公司  
 UNITED INDUSTRIAL GASES CO., LTD. (Head Office)

29/3 หมู่ที่ 5 ถนนบางนา-ตราด ตำบลบางเสาธง อำเภอบางเสาธง จังหวัดสมุทรปราการ 10570

29/3 MOO 5 BANGNA-TRAD ROAD, TAMBOL BANGSAOTONG, AMPHUR BANGSAOTONG, SAMUTPRAKARN 10570

TEL.: 0-2338-1460-1, 0-2708-4148-9 FAX.: 0-2338-1548, 0-2708-3873 E-mail: uiggases@truemail.co.th, uiggases@gmail.com Web: http://www.uiggases.com

เลขประจำตัวผู้เสียภาษี : 0115528000610

## Certificate of Analysis

Page : 1/1

Certificate No.: QA24030256

**Client Name :** บริษัท เอส.พี.เอส. คอนสตรัคชั่น เซอร์วิส จำกัด

**Address :** 7 ซอยพหลโยธิน 24 ถนนพหลโยธิน แขวงจอมพล เขตจตุจักร กรุงเทพฯ 10900

**Telephone :** 0-2939-4370

**Fax :** 0-2513-4221

**Contact Name :** -

**Contact Email :** -

### Sample Description

**Sample Name :** Nitrogen 99.999% Ultra High Purity Grade

**Shelf Life :** 3 Years

**Sampling Condition :** Cylinder 7 M3 Pressure 2000 psig

**Valve Type :** CGA 580

**Lot No. :** -

**Test Date :** 26/02/2023

| รายการทดสอบ<br>(Test Item)           | วิธีทดสอบ<br>(Test Method)                         | หน่วย<br>(Unit) | เกณฑ์กำหนด<br>(Specification) | ผลการทดสอบ<br>(Results) |
|--------------------------------------|--|-----------------|-------------------------------|-------------------------|
| 1. Moisture (H <sub>2</sub> O)       | LT-UIG-01 (Shaw Moisture Meter)                    | ppm             | ≤ 3.0                         | < 3.0                   |
| 2. Oxygen (O <sub>2</sub> )          | LT-UIG-03 (Oxygen Analyzer)                        | ppm             | ≤ 3.0                         | < 3.0                   |
| 3. Carbon Monoxide (CO)              | In-house method : LT-UIG-05 ( Gas Chromatography ) | ppm             | ≤ 1.0                         | < 1.0                   |
| 4. Carbon Dioxide (CO <sub>2</sub> ) | In-house method : LT-UIG-05 ( Gas Chromatography ) | ppm             | ≤ 1.0                         | < 1.0                   |
| 5. THC as CH <sub>4</sub>            | In-house method : LT-UIG-06 ( Gas Chromatography ) | ppm             | ≤ 1.0                         | < 1.0                   |

Note : CYLINDER No. : NI0307-0060



Approved By :

( Miss.Nithinan Srirakham )  
 Quality Control

Date : 26 / 02 / 2023



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

### Analyzer Calibration Error Data for Sampling

Source Identification : Boiler Stack No.3 Date : 17/07/2024  
บริษัท ทิพย์กำแพงเพชร ไบโอมเนอซี จำกัด (เฟส 1)  
ตำบลเทพนิมิต อำเภอวังสามัคคี จังหวัดกำแพงเพชร 62210  
Test Personnel : Somprasong Mangmee Time : 10:15-12:30

#### NO<sub>x</sub> Analyzer Calibration Data

Analyzer Type : NO<sub>x</sub> Analyzer Analyzer Model : T200H  
Serial No. : 097 Calibration Span (ppm) : 211 ppm

|   | Certified Cylinder Value (ppm) | Analyzer Calibration Response (ppm) | Absolute Difference (ppm) | Calibration Error (% of Calibration Span) |
|---|--------------------------------|-------------------------------------|---------------------------|---|
| Zero Gas  | 0.00                           | 0.02                                | 0.02                      | 0.01                                      |
| Mid-Level Calibration Gas                                     | 101.00                         | 101.16                              | 0.16                      | 0.08                                      |
| High-Level Calibration Gas                                    | 211.00                         | 210.82                              | 0.18                      | 0.09                                      |
| Analyzer Calibration Error Average (< 2% of Calibration Span) |                                |                                     | (Pass)                    | 0.08                                      |

#### SO<sub>2</sub> Analyzer Calibration Data

Analyzer Type : SO<sub>2</sub> Analyzer Analyzer Model : T100H  
Serial No. : 94 Calibration Span (ppm) : 102 ppm

|   | Certified Cylinder Value (ppm) | Analyzer Calibration Response (ppm) | Absolute Difference (ppm) | Calibration Error (% of Calibration Span) |
|---|--------------------------------|-------------------------------------|---------------------------|---|
| Zero Gas  | 0.00                           | 0.01                                | 0.01                      | 0.01                                      |
| Mid-Level Calibration Gas                                     | 50.20                          | 50.11                               | 0.09                      | 0.09                                      |
| High-Level Calibration Gas                                    | 102.00                         | 101.84                              | 0.16                      | 0.16                                      |
| Analyzer Calibration Error Average (< 2% of Calibration Span) |                                |                                     | (Pass)                    | 0.12                                      |

#### O<sub>2</sub> Analyzer Calibration Data

Analyzer Type : NO<sub>x</sub> Analyzer (Optional Internal O<sub>2</sub> Sensor) Analyzer Model : T200H  
Serial No. : 097 Calibration Span (%) : 20.9 %

|   | Certified Cylinder Value (%) | Analyzer Calibration Response (%) | Absolute Difference (%) | Calibration Error (% of Calibration Span) |
|---|------------------------------|-----------------------------------|-------------------------|---|
| Zero Gas  | 0.00                         | 0.02                              | 0.02                    | 0.10                                      |
| Mid-Level Calibration Gas                                     | 15.10                        | 15.11                             | 0.01                    | 0.05                                      |
| High-Level Calibration Gas                                    | 20.90                        | 20.88                             | 0.02                    | 0.10                                      |
| Analyzer Calibration Error Average (< 2% of Calibration Span) |                              |                                   | (Pass)                  | 0.07                                      |



(Somprasong Mangmee)

Site Operator



(Peera Detudom)

Technical Supervisor



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., Jompoi, Chatuchak, Bangkok 10900  
Tel : (662) 939-4370-72, Fax : (662) 513-4221, E-mail : sale@spscon.com, www.spscon.com

### System Calibration Bias and Drift Data

Source Identification : Boiler Stack No.3

Date : 18/07/2024

บริษัท พิพย์กำแพงเพชร ไบโอเอเนอจี้ จำกัด (เฟส 1)

ตำบลเทพนิมิต อำเภอปรางค์สามัคคี จังหวัดกำแพงเพชร 62210

Test Personnel :

Somprasong Mangmee

Time : 09:00-09:50, 12:05-12:55

#### O<sub>2</sub> Analyzer Calibration Response

System Calibration : NO<sub>x</sub> Analyzer (Optional Internal O<sub>2</sub> Sensor)

Cylinder No. : 18K1149177

Calibration Span : 20.9 %

Cylinder Conc. : 15.10%

|   | Analyzer Calibration Response (%) | Initial Values                  |                             | Final Values                    |                             | Drift (% of Span) |
|---|-----------------------------------|---------------------------------|-----------------------------|---------------------------------|-----------------------------|-------------------|
|   |                                   | System Calibration Response (%) | System Cal Bias (% of Span) | System Calibration Response (%) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.02                              | -0.01                           | -0.15                       | 0.02                            | 0.00                        | 0.15              |
| Upscale Gas                             | 15.11                             | 15.13                           | 0.10                        | 15.12                           | 0.05                        | -0.05             |
| System Cal Bias Average (< ±5% of Span) |                                   | (Pass)                          | -0.15                       | -                               | 0.05                        | -                 |
| Drift Average (< ±3% of Span)           |                                   |                                 |                             |                                 | (Pass)                      | 0.15              |

#### NO<sub>x</sub> Analyzer Calibration Response

System Calibration : NO<sub>x</sub> Analyzer

Cylinder No. : D711640

Calibration Span : 211 ppm

Cylinder Conc. : 211 ppm

|   | Analyzer Calibration Response (ppm) | Initial Values                    |                             | Final Values                      |                             | Drift (% of Span) |
|---|-------------------------------------|-----------------------------------|-----------------------------|-----------------------------------|-----------------------------|-------------------|
|   |                                     | System Calibration Response (ppm) | System Cal Bias (% of Span) | System Calibration Response (ppm) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.02                                | -0.01                             | -0.01                       | -0.03                             | -0.02                       | -0.01             |
| Upscale Gas                             | 210.82                              | 210.96                            | 0.07                        | 210.75                            | -0.03                       | -0.10             |
| System Cal Bias Average (< ±5% of Span) |                                     | (Pass)                            | 0.07                        | -                                 | -0.03                       | -                 |
| Drift Average (< ±3% of Span)           |                                     |                                   |                             |                                   | (Pass)                      | -0.10             |

#### SO<sub>2</sub> Analyzer Calibration Response

System Calibration : SO<sub>2</sub> Analyzer

Cylinder No. : A00710SK

Calibration Span : 102 ppm

Cylinder Conc. : 50.2 ppm

|   | Analyzer Calibration Response (ppm) | Initial Values                    |                             | Final Values                      |                             | Drift (% of Span) |
|---|-------------------------------------|-----------------------------------|-----------------------------|-----------------------------------|-----------------------------|-------------------|
|   |                                     | System Calibration Response (ppm) | System Cal Bias (% of Span) | System Calibration Response (ppm) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.01                                | -0.01                             | -0.02                       | 0.02                              | 0.01                        | 0.03              |
| Upscale Gas                             | 50.11                               | 50.03                             | -0.08                       | 50.14                             | 0.03                        | 0.11              |
| System Cal Bias Average (< ±5% of Span) |                                     | (Pass)                            | -0.08                       | -                                 | 0.03                        | -                 |
| Drift Average (< ±3% of Span)           |                                     |                                   |                             |                                   | (Pass)                      | 0.11              |

*Somprasong Mangmee*

(Somprasong Mangmee)

Site Operator

*Peera Detudom*

(Peera Detudom)

Technical Supervisor





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

### System Calibration Bias and Drift Data

Source Identification : Boiler Stack No.3

Date : 18/07/2024

บริษัท ทิพย์กำแพงเพชร โบอิออนเนอจี จำกัด (เฟส 1)

ตำบลเพนนิมิต อำเภอวังสามัคคี จังหวัดกำแพงเพชร 62210

Test Personnel :

Somprasong Mangmee

Time : 12:05-12:55, 15:05-15:55

#### O<sub>2</sub> Analyzer Calibration Response

System Calibration : NO<sub>x</sub> Analyzer (Optional Internal O<sub>2</sub> Sensor)

Cylinder No. : 18K1149177

Calibration Span : 20.9 %

Cylinder Conc. : 15.10%

|   | Analyzer Calibration Response (%) | Initial Values                  |                             | Final Values                    |                             | Drift (% of Span) |
|---|-----------------------------------|---------------------------------|-----------------------------|---------------------------------|-----------------------------|-------------------|
|   |                                   | System Calibration Response (%) | System Cal Bias (% of Span) | System Calibration Response (%) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.02                              | 0.02                            | 0.00                        | -0.02                           | -0.20                       | -0.20             |
| Upscale Gas                             | 15.11                             | 15.12                           | 0.05                        | 15.10                           | -0.05                       | -0.10             |
| System Cal Bias Average (< ±5% of Span) |                                   | (Pass)                          | 0.05                        | -                               | -0.20                       | -                 |
| Drift Average (< ±3% of Span)           |                                   |                                 |                             |                                 | (Pass)                      | -0.20             |

#### NO<sub>x</sub> Analyzer Calibration Response

System Calibration : NO<sub>x</sub> Analyzer

Cylinder No. : D711640

Calibration Span : 211 ppm

Cylinder Conc. : 211 ppm

|   | Analyzer Calibration Response (ppm) | Initial Values                    |                             | Final Values                      |                             | Drift (% of Span) |
|---|-------------------------------------|-----------------------------------|-----------------------------|-----------------------------------|-----------------------------|-------------------|
|   |                                     | System Calibration Response (ppm) | System Cal Bias (% of Span) | System Calibration Response (ppm) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.02                                | -0.03                             | -0.02                       | 0.02                              | 0.00                        | 0.02              |
| Upscale Gas                             | 210.82                              | 210.75                            | -0.03                       | 210.60                            | -0.10                       | -0.07             |
| System Cal Bias Average (< ±5% of Span) |                                     | (Pass)                            | -0.03                       | -                                 | -0.10                       | -                 |
| Drift Average (< ±3% of Span)           |                                     |                                   |                             |                                   | (Pass)                      | -0.07             |

#### SO<sub>2</sub> Analyzer Calibration Response

System Calibration : SO<sub>2</sub> Analyzer

Cylinder No. : A00710SK

Calibration Span : 102 ppm

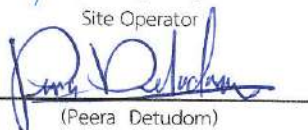
Cylinder Conc. : 50.2 ppm

|   | Analyzer Calibration Response (ppm) | Initial Values                    |                             | Final Values                      |                             | Drift (% of Span) |
|---|-------------------------------------|-----------------------------------|-----------------------------|-----------------------------------|-----------------------------|-------------------|
|   |                                     | System Calibration Response (ppm) | System Cal Bias (% of Span) | System Calibration Response (ppm) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.01                                | 0.02                              | 0.01                        | -0.02                             | -0.03                       | -0.04             |
| Upscale Gas                             | 50.11                               | 50.14                             | 0.03                        | 50.26                             | 0.15                        | 0.12              |
| System Cal Bias Average (< ±5% of Span) |                                     | (Pass)                            | 0.03                        | -                                 | 0.15                        | -                 |
| Drift Average (< ±3% of Span)           |                                     |                                   |                             |                                   | (Pass)                      | 0.12              |



(Somprasong Mangmee)

Site Operator



(Peera Detudom)

Technical Supervisor



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

### System Calibration Bias and Drift Data

Source Identification : Boiler Stack No.3

Date : 18/07/2024

บริษัท ทิพย์กำแพงเพชร ไบโอเอนเนอจี จำกัด (เฟส 1)

ตำบลเทพนิมิต อำเภอวังสามัคคี จังหวัดกำแพงเพชร 62210

Test Personnel : Somprasong Mangmee

Time : 15:05-15:55, 18:05-18:55

#### O<sub>2</sub> Analyzer Calibration Response

System Calibration : NO<sub>x</sub> Analyzer (Optional Internal O<sub>2</sub> Sensor)

Cylinder No. : 18K1149177

Calibration Span : 20.9 %

Cylinder Conc. : 15.10%

|   | Analyzer Calibration Response (%) | Initial Values                  |                             | Final Values                    |                             | Drift (% of Span) |
|---|-----------------------------------|---------------------------------|-----------------------------|---------------------------------|-----------------------------|-------------------|
|   |                                   | System Calibration Response (%) | System Cal Bias (% of Span) | System Calibration Response (%) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.02                              | -0.02                           | -0.20                       | 0.01                            | -0.05                       | 0.15              |
| Upscale Gas                             | 15.11                             | 15.10                           | -0.05                       | 15.09                           | -0.10                       | -0.05             |
| System Cal Bias Average (< ±5% of Span) |                                   | (Pass)                          | -0.20                       | -                               | -0.10                       | -                 |
| Drift Average (< ±3% of Span)           |                                   |                                 |                             |                                 | (Pass)                      | 0.15              |

#### NO<sub>x</sub> Analyzer Calibration Response

System Calibration : NO<sub>x</sub> Analyzer

Cylinder No. : D711640

Calibration Span : 211 ppm

Cylinder Conc. : 211 ppm

|   | Analyzer Calibration Response (ppm) | Initial Values                    |                             | Final Values                      |                             | Drift (% of Span) |
|---|-------------------------------------|-----------------------------------|-----------------------------|-----------------------------------|-----------------------------|-------------------|
|   |                                     | System Calibration Response (ppm) | System Cal Bias (% of Span) | System Calibration Response (ppm) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.02                                | 0.02                              | 0.00                        | -0.02                             | -0.02                       | -0.02             |
| Upscale Gas                             | 210.82                              | 210.60                            | -0.10                       | 210.88                            | 0.03                        | 0.13              |
| System Cal Bias Average (< ±5% of Span) |                                     | (Pass)                            | -0.10                       | -                                 | 0.03                        | -                 |
| Drift Average (< ±3% of Span)           |                                     |                                   |                             |                                   | (Pass)                      | 0.13              |

#### SO<sub>2</sub> Analyzer Calibration Response

System Calibration : SO<sub>2</sub> Analyzer

Cylinder No. : A00710SK

Calibration Span : 102 ppm

Cylinder Conc. : 50.2 ppm

|   | Analyzer Calibration Response (ppm) | Initial Values                    |                             | Final Values                      |                             | Drift (% of Span) |
|---|-------------------------------------|-----------------------------------|-----------------------------|-----------------------------------|-----------------------------|-------------------|
|   |                                     | System Calibration Response (ppm) | System Cal Bias (% of Span) | System Calibration Response (ppm) | System Cal Bias (% of Span) |                   |
| Zero Gas                                | 0.01                                | -0.02                             | -0.03                       | 0.02                              | 0.01                        | 0.04              |
| Upscale Gas                             | 50.11                               | 50.26                             | 0.15                        | 50.07                             | -0.04                       | -0.19             |
| System Cal Bias Average (< ±5% of Span) |                                     | (Pass)                            | 0.15                        | -                                 | -0.04                       | -                 |
| Drift Average (< ±3% of Span)           |                                     |                                   |                             |                                   | (Pass)                      | -0.19             |

*Somprasong Mangmee.*  
(Somprasong Mangmee)

Site Operator

*Peera Detudom*  
(Peera Detudom)  
Technical Supervisor





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

### Verified Standard Gas for Sampling

Source Identification : Boiler Stack No.3

Date : 12/07/2024

บริษัท ทิพย์กำแพงเพชร โบอิเล่อร์เนอวี่ จำกัด (เฟส 1)

ตำบลเทพนิมิต อำเภอบึงสามัคคี จังหวัดกำแพงเพชร 62210

Test Personnel : Somprasong Mangmee

Time : 13:50-16:30

#### NO<sub>x</sub> Standard Gas Data

Cylinder Number : D869074

Certification Date : 6-Jan-2023

Certified Concentration : 101 ppm

Expiration Date : 6-Jan-2026

#### NO<sub>x</sub> Standard Gas Verified Data

Analyzer Type : NO<sub>x</sub> Analyzer

Analyzer Model : T200H

Serial No. : 097

| Number of Sample                                    | Certified Cylinder Value (ppm) | Verified Data Response (ppm) | Difference Value (ppm) | % Diff. |
|---|--------------------------------|------------------------------|------------------------|---------|
| 1   | 101.0                          | 101.18                       | 0.18                   | 0.178   |
| 2   | 101.0                          | 101.06                       | 0.06                   | 0.059   |
| 3   | 101.0                          | 101.14                       | 0.14                   | 0.139   |
| % Diff. Average (< ±1% of Certified Cylinder Value) |                                |                              | (Pass)                 | 0.125   |

#### NO<sub>x</sub> Standard Gas Data

Cylinder Number : D711640

Certification Date : 25-Mar-2024

Certified Concentration : 211 ppm

Expiration Date : 25-Mar-2027

#### NO<sub>x</sub> Standard Gas Verified Data

Analyzer Type : NO<sub>x</sub> Analyzer

Analyzer Model : T200H

Serial No. : 097

| Number of Sample                                     | Certified Cylinder Value (ppm) | Verified Data Response (ppm) | Difference Value (ppm) | % Diff. |
|--|--------------------------------|------------------------------|------------------------|---------|
| 1  | 211.0                          | 210.88                       | -0.12                  | -0.057  |
| 2  | 211.0                          | 210.75                       | -0.25                  | -0.118  |
| 3  | 211.0                          | 210.92                       | -0.08                  | -0.038  |
| % Diff. Average (< ± 1% of Certified Cylinder Value) |                                |                              | (Pass)                 | -0.071  |

*Somprasong Mangmee*

(Somprasong Mangmee)

Site Operator

*Peera Detudom*

(Peera Detudom)

Technical Supervisor





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

### Verified Standard Gas for Sampling

Source Identification : Boiler Stack No.3

Date : 12/07/2024

บริษัท หิพย์กำแพงเพชร โบอิเอนเนอีย จำกัด (เฟส 1)

ตำบลเทพนิมิต อำเภอบึงสามัคคี จังหวัดกำแพงเพชร 62210

Test Personnel :

Somprasong Mangmee

Time : 13:50-16:30

#### SO<sub>2</sub> Standard Gas Data

Cylinder Number : A00710SK

Certification Date : 21-Jun-2021

Certified Concentration : 50.2 ppm

Expiration Date : 21-Jun-2029

#### SO<sub>2</sub> Standard Gas Verified Data

Analyzer Type : SO<sub>2</sub> Analyzer

Analyzer Model :

T100H

Serial No. :

94

| Number of Sample                                    | Certified Cylinder Value (ppm) | Verified Data Response (ppm) | Difference Value (ppm) | % Diff. |
|---|--------------------------------|------------------------------|------------------------|---------|
| 1   | 50.2                           | 50.13                        | -0.07                  | -0.139  |
| 2   | 50.2                           | 50.08                        | -0.12                  | -0.239  |
| 3   | 50.2                           | 50.10                        | -0.10                  | -0.199  |
| % Diff. Average (< ±1% of Certified Cylinder Value) |                                |                              | (Pass)                 | -0.193  |

#### SO<sub>2</sub> Standard Gas Data

Cylinder Number : A00797SK

Certification Date : 25-Jul-2019

Certified Concentration : 102 ppm

Expiration Date : 24-Jul-2027

#### SO<sub>2</sub> Standard Gas Verified Data

Analyzer Type : SO<sub>2</sub> Analyzer

Analyzer Model :

T100H

Serial No. :

94

| Number of Sample                                    | Certified Cylinder Value (ppm) | Verified Data Response (ppm) | Difference Value (ppm) | % Diff. |
|---|--------------------------------|------------------------------|------------------------|---------|
| 1   | 102.0                          | 101.90                       | -0.10                  | -0.098  |
| 2   | 102.0                          | 101.76                       | -0.24                  | -0.235  |
| 3   | 102.0                          | 101.84                       | -0.16                  | -0.157  |
| % Diff. Average (< ±1% of Certified Cylinder Value) |                                |                              | (Pass)                 | -0.163  |



(Somprasong Mangmee)



(Peera Detudom)

Technical Supervisor



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

### Verified Standard Gas for Sampling

Source Identification : Boiler Stack No.3

Date : 12/07/2024

บริษัท หิพย์ก้าแพงเพชร โบอิเอนเนอีย จำกัด (เฟส 1)

ตำบลเทพนิมิต อำเภอวังสามัคคี จังหวัดกำแพงเพชร 62210

Test Personnel :

Somprasong Mangmee

Time : 13:50-16:30

#### O<sub>2</sub> Standard Gas Data

Cylinder Number : 18K1149177

Certification Date : 13-Feb-2023

Certified Concentration : 15.1%

Expiration Date : 13-Feb-2031

#### O<sub>2</sub> Standard Gas Verified Data


Analyzer Type : NO<sub>x</sub> Analyzer (Optional Internal O<sub>2</sub> Sensor)

Analyzer Model :

T200H

Serial No. : 097

| Number of Sample                                    | Certified Cylinder Value (%) | Verified Data Response (%) | Difference Value (%) | % Diff. |
|---|------------------------------|----------------------------|----------------------|---------|
| 1   | 15.10                        | 15.12                      | 0.02                 | 0.132   |
| 2   | 15.10                        | 15.11                      | 0.01                 | 0.066   |
| 3   | 15.10                        | 15.11                      | 0.01                 | 0.066   |
| % Diff. Average (< ±1% of Certified Cylinder Value) |                              |                            | (Pass)               | 0.088   |

  
(Somprasong Mangmee)

Site Operator  
  
(Peera Detudom)  
Technical Supervisor

ระดับเสียงในบรรยากาศ



Request No. 21-67/0304

MTC No. EEL. BP. 110/0267

## CALIBRATION CERTIFICATE

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

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

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

### Instrument Calibrated :

Description : Acoustic Calibrator

Manufacturer : Cirrus

Model : CR:515

Serial No. : 92002

### Ambient Environment

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

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

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

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

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

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

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

Date of Receipt : 22 Feb. 2024

Date of Calibration : 5 Mar. 2024

1 / 2

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

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

FM.BL.MTC.002 Rev.4

#### Head Office

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

Tel. (66) 0 2577 9000

Fax. (66) 0 2577 9009

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

#### Office/Laboratory

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Amphoe Muang, Changwat Samutprakan 10280, Thailand

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#### Office

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Thailand

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

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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 $\mu$ Pa at 1000 Hz

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

1. Sound Pressure Level

| Standard Microphone<br>Type | Measured Sound Pressure<br>Level (dB) | Deviated value<br>(dB) | Uncertainty<br>(dB) | Tolerance limit<br>IEC60942:2003 Class 1 |
|-----------------------------|---------------------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer 4180   | 94.04                                 | 0.04                   | $\pm 0.10$          | $\pm 0.40$ dB                            |

2. Frequency

| Standard Microphone<br>Type | Measured Frequency<br>(Hz) | Deviated value<br>(Hz) | Uncertainty<br>(Hz) | Tolerance limit<br>IEC60942:2003 Class 1 |
|-----------------------------|----------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer 4180   | 1000.3                     | 0.3                    | $\pm 1.5$           | $\pm 1.0\%$                              |

3. Total distortion


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

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

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

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

FM.BL.MTC.002 Rev.4

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E-mail : sumalee@tistr.or.th





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

Noise B\_313\_1/24

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

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

### Calibration Data

| Sound Level Meter Data  |        |        |            | Calibration Data |                     |                  |
|---|--------|--------|------------|------------------|---------------------|------------------|
| SLM No.   | Brand  | Model  | Serial No. | Date             | Actual Reading [dB] |                  |
|   |        |        |            |                  | Before Adjustment   | After Adjustment |
| CR-B06  | Cirrus | CR161B | G301151    | 14 July 2024     | 94.0                | 94.0             |
| CR-B09  | Cirrus | CR161B | G301401    | 14 July 2024     | 94.1                | 94.0             |
| CR-B10  | Cirrus | CR161B | G301407    | 14 July 2024     | 94.0                | 94.0             |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research<br>(TISTR) |        |        |            |                  | 94.04 ± 0.10 dB     |                  |

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

Peera Detudom  
(Mr. Peera Detudom)



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.

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#### Head Office

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0304

MTC No. EEL. BP. 109/0267

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

Nominal Output of Unit Under Test = 94 dB re 20 $\mu$ Pa at 1000 Hz

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

1. Sound Pressure Level

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

2. Frequency


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

3. Total Distortion

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

- 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.

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





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\_313\_2/24

## Sound Level Meter Calibration Report

### Acoustic Calibrator Data

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

### Calibration Data

| Sound Level Meter Data   |       |       |            | Calibration Data |   |
|--|-------|-------|------------|------------------|---|
| SLM No.  | Brand | Model | Serial No. | Date             | Actual Reading [dB]                     |
|  |       |       |            |                  | Before Adjustment      After Adjustment |
| ACO-C1-B01   | ACO   | 6238  | 00223038   | 14 July 2024     | 94.0      93.9                          |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research (TISTR) |       |       |            |                  | 93.85 ± 0.10 dB                         |

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

Peera Detudom  
(Mr. Peera Detudom)



คุณภาพน้ำ

## Certificate of Calibration

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

**Page : 1 of 2**

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

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

**Equipment :** Liquid in Glass Thermometer

Manufacturer : SK

Model : N/A

Range : 0 °C to 100 °C

Resolution : 1 °C

Serial No. : N/A

Immersion : Total

ID No. : TM21/59

**Environment :** Ambient Temperature : (23 ± 2) °C

Relative Humidity : (50 ± 15) %

Line Voltage : (220 ± 22) VAC

**Date of Received :** 23 January 2024

**Date of Calibration :** 03 February 2024

**Date of Issue :** 03 February 2024

**Calibrated by :** Chortip Samchusri

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

The temperature scale used was based on ITS-90

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

1. Platinum Resistance Thermometer (PRT)

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

2. Standard Digital Thermometer

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

Approved by :

( Surachai Promthong )

Laboratory Manager

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full except with the prior written approval of the Calibratech Co.,Ltd.



## Certificate of Calibration

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

**Page :** 2 of 2

**Result of Calibration :** Without Adjustment

**UUC Condition As-Received :** Good

**Function :** Temperature measurement

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

| Standard Reading<br>( °C ) | UUC Reading<br>( °C ) | Correction<br>( °C ) | Uncertainty<br>( ± °C ) |
|----------------------------|-----------------------|----------------------|-------------------------|
| 20.5609                    | 20                    | 0.6                  | 0.31                    |

### Remark

UUC : Unit Under Calibration

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

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

- ๐0๐ -





## 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 µS/cm                   | 84.05 µS/cm [Cell Constant 0.548589] | ± 1.00 µS/cm               |
| 1414.0 µS/cm                   | 1415 µS/cm [Cell Constant 0.548589]  | ± 21.0 µS/cm               |
| 12.83 mS/cm                    | 12.75 mS/cm [Cell Constant 0.548589] | ± 0.19 mS/cm               |

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

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

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

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

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

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

**### End of Certificate ###**

Certificate No. Q24016389

F3-011-05/12-23

page 4 of 4



@clccalibration



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3 : EQUIPMENT CALIBRATION AND TESTING SERVICES

534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

TEL. 0-2717-3000-29 FAX. 0-2719-9484

## Certificate of Calibration

Cert.No.: 24CH285

Page.: 1 of 2

**Equipment :** Turbidity Meter  
**Manufacturer :** Eutech  
**Model :** CyberScan WLTB1000  
**Serial No. :** 201802206  
**ID. No. :** TB 03/61  
**Condition As-Received:** Used Item  
**Received Date :** 05 March 2024  
**Calibration Date :** 06 March 2024  
**Reference :** 2403-0144WN-1  
**Submitted by :** S.P.S. Consulting Service Co.,Ltd.  
7 Phaholyothin 24, Phaholyothin Road.,  
Jompol, Chatuchak, Bangkok 10900  
**Ambient Temperature :** (25 ± 2.5) °C  
**Relative Humidity :** (50 ± 20) %  
**Calibration Procedure :** In - house method : CP-CH11  
based on direct measurement by  
using Formazin standard solution

**Calibrated by :** Walalak Sirithean

**Approved by :**

Approved Signatory

( ) Pornthippa Tameyakul

( ) Unnopphol Harachai

(✓) Saithip Meangmai

**Issue Date :** 06 March 2024

**The Uncertainties are for a confidence probability of approximately 95%.**

This certificate may not be reproduced other than in full, except with the prior written  
approval of the head of Calibration and Testing Equipment Services.

A 0013024



Cert.No. : 24CH285

Page. : 2 of 2

### Condition of this calibration result

#### 1. Reference Standard Instruments :

This certification is traceable to the International System of unit (SI unit) through:-  
- Technology Promotion Association (Thailand-Japan).

| <u>Instruments</u>    | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due date</u> |
|-----------------------|-------------------|---------------|------------------------|-----------------|
| 1) Thermo-Hygograph   | 1103328           | 130EC010      | 23H1361                | 13 June 2024    |
| 2) Electronic Balance | 14233821          | 110RC001      | 23MM405                | 16 July 2024    |

#### 2. Standard Material : The Formazin suspension has been prepared gravimetric from

| <u>Material</u>           | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Assay</u> |
|---------------------------|---------------------|----------------|--------------|
| 1) Hexamethylenetetramine | HIMEDIA             | 0000493947     | 99.65%       |
| 2) Hydrazinium Sulfate    | HIMEDIA             | 0000522014     | 99.40%       |

#### 3. This certificate is valid only to the item calibrated on date and place of calibration.

### Calibration result

Performing three - Formazin suspension standard curve by using 0,10,1000 NTU

Turbidity Meter Serial Number : 201802206

| Standard<br>Formazine suspension<br>( NTU ) | UUC* Reading<br>( NTU ) | Uncertainty of<br>Measurement<br>( $\pm$ NTU ) | Coverage<br>Factor<br><i>k</i> |
|---|-------------------------|--|--------------------------------|
| 20  | 19.2                    | 0.38   | 2.00                           |
| 40  | 39.4                    | 0.40   | 2.00                           |
| 100   | 99.0                    | 0.70   | 2.00                           |
| 400   | 389                     | 1.5  | 2.00                           |

**Remark** - UUC\* = Unit Under Calibration  
- NTU = Nephelometric Turbidity Units

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

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Saitrip



# SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

NSC-TISI-TIS 17025  
CALIBRATION 0394

Cert. No. : SP23016

Pages : 1 of 3

## Calibration Certificate

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

**Calibrated by :**

Nathakorn Pisutpaisan

**Approved by :**

  
( Thanakul Petchurai )

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

## Continuation of Calibration Certificate

Cert. No. : SP23016

Job No. : VC66SP0014

Pages : 2 of 3

**Calibration Method :**

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

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

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

**Condition of this result of calibration :**

## 1. Certified reference materials

| Material                       | Ref. type     | Cell serial No. | Cert. No.  | Due Date   |
|--------------------------------|---------------|-----------------|------------|------------|
| Holmium liquid                 | RM-HL         | 29706           | 106864     | 01/11/2024 |
| Didymium liquid                | RM-DL         | 28912           | 106905     | 02/11/2024 |
| Neutral density filter         | RM-1N2N3N     | 13877           | 106918     | 03/11/2024 |
| Potassium dichromate solutions | RM-0204060810 | 14204           | 106902     | 02/11/2024 |
| Potassium Iodide solution      | -             | KI-0701-001     | CI-0090-22 | 08/04/2024 |

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

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

3.1 The UK National Physical Laboratory (NPL)

3.2 The National Institute of Standards and Technology, NIST.

**Result of calibration : Wavelength Accuracy**

(Without adjustment)

| Material | Certified Values of<br>Reference Material (nm) | UUC* Reading<br>(nm) | Error<br>(nm) | Uncertainty<br>± (nm) | k<br>Factor |
|----------|--|----------------------|---------------|-----------------------|-------------|
| RM-HL    | 278.13   | 278.3                | 0.17          | 0.16                  | 2.00        |
|          | 361.25   | 361.3                | 0.05          | 0.16                  | 2.00        |
|          | 467.82   | 468.0                | 0.18          | 0.16                  | 2.00        |
|          | 536.56   | 536.6                | 0.04          | 0.16                  | 2.00        |
|          | 640.50   | 640.4                | -0.10         | 0.16                  | 2.00        |
| RM-DL    | 740.09   | 740.0                | -0.09         | 0.16                  | 2.00        |
|          | 864.94   | 865.0                | 0.06          | 0.16                  | 2.00        |

UUC\* = Unit Under Calibration



Continuation of Calibration Certificate

Cert. No. : SP23016  
Job No. : VC66SP0014  
Pages : 3 of 3

**Result of calibration : Photometric Accuracy**

(Without adjustment)

| Material                     | Wavelength<br>(nm) | Filter S/N         | Nominal<br>Absorbance (A)   | Certified<br>Absorbance (A)    | UUC* Reading<br>Absorbance (A) | Error<br>(A)         | Uncertainty<br>± (A) | k<br>Factor |
|------------------------------|--------------------|--------------------|-----------------------------|--------------------------------|--------------------------------|----------------------|----------------------|-------------|
| Neutral Density glass filter | 440.0              | 29360              | 1.0                         | 1.0517                         | 1.0564                         | 0.0047               | 0.0031               | 2.00        |
|                              |                    | 29914              | 0.7                         | 0.7445                         | 0.7460                         | 0.0015               | 0.0032               | 2.00        |
|                              |                    | 29381              | 0.5                         | 0.5416                         | 0.5429                         | 0.0013               | 0.0032               | 2.00        |
|                              | 546.1              | 29360              | 1.0                         | 0.9821                         | 0.9849                         | 0.0028               | 0.0030               | 2.00        |
|                              |                    | 29914              | 0.7                         | 0.6961                         | 0.6961                         | 0.0000               | 0.0030               | 2.00        |
|                              |                    | 29381              | 0.5                         | 0.5073                         | 0.5073                         | 0.0000               | 0.0030               | 2.00        |
|                              | 590.0              | 29360              | 1.0                         | 1.0222                         | 1.0244                         | 0.0022               | 0.0030               | 2.00        |
|                              |                    | 29914              | 0.7                         | 0.7237                         | 0.7234                         | -0.0003              | 0.0030               | 2.00        |
|                              |                    | 29381              | 0.5                         | 0.5361                         | 0.5360                         | -0.0001              | 0.0031               | 2.00        |
|                              | 635.0              | 29360              | 1.0                         | 0.9753                         | 0.9775                         | 0.0022               | 0.0030               | 2.00        |
|                              |                    | 29914              | 0.7                         | 0.6910                         | 0.6910                         | 0.0000               | 0.0030               | 2.00        |
|                              |                    | 29381              | 0.5                         | 0.5211                         | 0.5210                         | -0.0001              | 0.0032               | 2.00        |
| Material                     | Wavelength<br>(nm) | Solution<br>(mg/l) | Certified<br>Absorbance (A) | UUC* Reading<br>Absorbance (A) | Error<br>(A)                   | Uncertainty<br>± (A) | k<br>Factor          |             |
| RM-0204060810                | 235.0              | 20                 | 0.2422                      | 0.2462                         | 0.0040                         | 0.0101               | 2.00                 |             |
|                              |                    | 40                 | 0.4866                      | 0.4900                         | 0.0034                         | 0.0115               | 2.00                 |             |
|                              |                    | 60                 | 0.7414                      | 0.7390                         | -0.0024                        | 0.0068               | 2.00                 |             |
|                              |                    | 80                 | 0.9858                      | 0.9871                         | 0.0013                         | 0.0093               | 2.00                 |             |
|                              |                    | 100                | 1.2442                      | 1.2480                         | 0.0038                         | 0.0087               | 2.00                 |             |

UUC\* = Unit Under Calibration

**Condition of this result of calibration : Spectrophotometer PERKINELMER Model Lambda 25 S/N 501S141230**

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

| Stray Light** UUC* Reading at 220 nm |               |
|--------------------------------------|---------------|
| Transimission T(%)                   | Absorbance(A) |
| 0.0111                               | 3.9564        |

\*\*Specific Acceptance :

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

\*\*Stray light not TISI Accredited

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

**End of Calibration Certificate**



**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, Banglumru, 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<br>Reference Material (nm) | UUC* Reading<br>(nm) | Error<br>(nm) | Uncertainty<br>± (nm) | k<br>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

*G. Petch*

# 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<br>(nm) | Filter S/N         | Nominal<br>Absorbance (A)   | Certified<br>Absorbance (A)    | UUC* Reading<br>Absorbance (A) | Error<br>(A)         | Uncertainty<br>± (A) | k<br>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<br>(nm) | Solution<br>(mg/l) | Certified<br>Absorbance (A) | UUC* Reading<br>Absorbance (A) | Error<br>(A)                   | Uncertainty<br>± (A) | k<br>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*



**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, Bangkac, 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 :-

| <u>INSTRUMENT</u>         | <u>MODEL</u> | <u>SERIAL No/</u><br><u>LOT No</u> | <u>CERTIFICATE No</u> | <u>DUE DATE</u> |
|---------------------------|--------------|------------------------------------|-----------------------|-----------------|
| 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<br>APPLIED | UUC<br>READING (mV) | CORRECTION<br>(mV) | UUC<br>READING (pH) | UNCERTAINTY OF<br>MEASUREMENT<br>(± mV) | COVERAGE<br>FACTOR<br>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.

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 : 3 OF 3

## Calibration Report

### RESULT OF CALIBRATION (CONTINUE) :

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

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

#### 4. PERCENT SLOPE 100%

UUC : UNIT UNDER CALIBRATION

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

END OF CALIBRATION REPORT



CERT.No.: HS-V015C

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

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

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

#### Calibration Details

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

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

Overall Status (PASS)

#### Manufacturer Specification

Accuracy = +/- 0.02 mg/l

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



Technician Signature  
 (Kittipong Maekwong)



Laboratory Manager  
 (Supreecha Sumaritam)

**QUALITY CALIBRATION CO.,LTD.**

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

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

[www.qcalibration.com](http://www.qcalibration.com)

CERTIFICATE No : 24T0774

REFERENCE No : 71986-2

PAGE : 1 OF 2

**Certificate of Calibration**

**EQUIPMENT** : COD REACTOR

**MANUFACTURER** : HACH

**MODEL** : DRB 200

**SERIAL No** : 15110C0235

**ID No** : CRB 05/59

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

**CALIBRATED BY** : CHAICHARN CH.

**CALIBRATION DATE** : 5-Feb-24

**APPROVED BY** :   
PONGSAK J.

**ISSUED DATE** : 5-Feb-24

**RECEIVED DATE** : 5-Feb-24





CERTIFICATE No : 24T0774

PAGE : 2 OF 2

## Calibration Report

EQUIPMENT : COD REACTOR  
MANUFACTURER : HACH  
ID NUMBER : CRB 05/59  
RECEIVED DATE : 5-Feb-24  
AMBIENT TEMPERATURE : 23° C ± 1° C

MODEL : DRB 200  
SERIAL NUMBER : 15110C0235  
CALIBRATION DATE : 5-Feb-24  
RELATIVE HUMIDITY : 52 %RH ± 10 % RH

### CONDITION OF THIS RESULTS OF CALIBRATION

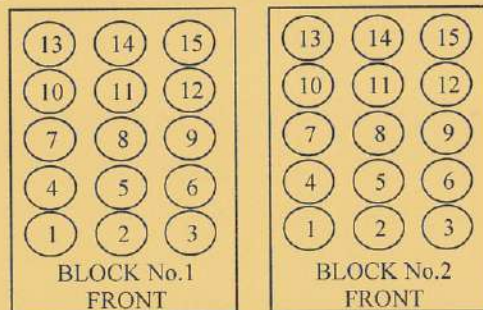
1. THIS INSTRUMENT WAS CALIBRATED BY DIRECT MEASUREMENT TEMPERATURE RECORDER WITH THERMOCOUPLE TYPE K UNDER NO LOAD CONDITION. THE THERMOCOUPLES WERE PLACED ON 15 POINTS AND LOCATED ONE THERMOCOUPLE IN EACH OF THE FOUR CORNERS OF THE REACTOR AND PLACED THE EIGHTH THERMOCOUPLE AT THE CENTER OF THE REACTOR.

### 2. REFERENCE STANDARD INSTRUMENTS :-

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

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

### RESULT OF CALIBRATION :- WITHOUT ADJUSTMENT



### TEMPERATURE MEASUREMENT ACCURACY TEST

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

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

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

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

END OF CALIBRATION REPORT





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

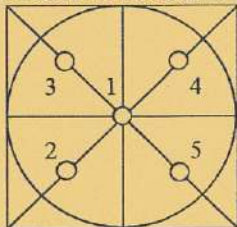
2. TARE FUNCTION : NORMAL

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





## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

|   |  |  |
|---|--|--|
| <b>Customer :</b> <u>S.P.S.Consulting Service Co.,Ltd</u> | <b>Date Tested:</b> <u>July 4, 2024</u>              |  |
|   | <b>Recommendation Recertification</b>                |  |
| <b>Address :</b> <u>7 Soi Phaholyothin 24</u>             | <b>Period</b> <u>6</u> <b>Months</b>                 |  |
| <u>Paholyothin Road</u>                                   | <b>Recertification Due:</b> <u>January 4, 2025</u>   |  |
| <u>Jompol Chatuchak, Bangkok 1090</u>                     | <b>Date Last Certified:</b> <u>January 4, 2024</u>   |  |
| <b>User Name:</b> <u>K.Phenpha Vipasthawatt</u>           | <b>Visit Number:</b> <u>1 of 2</u>                   |  |
| <b>Phone:</b> <u>083-9269252</u>                          | <b>PerkinElmer Phone:</b> <u>02-719-6420 ext 206</u> |  |
| <b>Fax:</b> <u>02-513-4221</u>                            | <b>PerkinElmer Fax:</b> <u>02-318-5597</u>           |  |

| CONFIGURATION TESTED         |                           | ACCESSORIES/COMPONENT NOT INCLUDED |
|------------------------------|---------------------------|------------------------------------|
| <b>MODEL</b>                 | <b>SERIAL NUMBER</b>      |                                    |
| <u>OPTIMA 5300DV</u>         | <u>077C7042401</u>        |                                    |
| <b>TESTED EQUIPMENT</b>      | <b>CALIBRATION NUMBER</b> | <b>EXPIRATION</b>                  |
| <u>IPV Methods</u>           |                           |                                    |
| <b>TEST STANDARD USED</b>    | <b>PART NUMBER</b>        | <b>EXPIRATION DATE</b>             |
| <u>Multielement Standard</u> | <u>N069-1579</u>          | <u>December 30, 2024</u>           |
| <u>Wavecal Solution</u>      | <u>N058-2152</u>          | <u>September 30, 2024</u>          |
| <u>VIS Wavecal solution</u>  | <u>N930-2946</u>          | <u>January 30, 2025</u>            |
| <u>Instrument Cal. STD4</u>  | <u>N930-0221</u>          | <u>November 30, 2024</u>           |
| <b>CUSTOMER SUPPLIED</b>     | <b>COMMENTS</b>           | <b>CUSTOMER INITIALS</b>           |
| <u>2 % HNO3</u>              |                           |                                    |
| <u>10 % HNO3</u>             |                           |                                    |



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

**SERIAL NUMBER** 077C7042401**DATE TESTED** July 4, 2024**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 :** July 4, 2024

| PARAMETER                               |               | SPECIFICATION |       | FINAL VALUE |     |
|---|---------------|---------------|-------|-------------|-----|
| <b>Spectral Resolution : UV</b>         | As 193.696 nm | ≤ 0.007       |       | 0.00550     |     |
|   | Ni 231.604 nm | ≤ 0.008       |       | 0.00714     |     |
|   | Ni 341.476 nm | ≤ 0.012       |       | 0.00790     |     |
| <b>Spectral Resolution : VIS</b>        | La 408.672 nm | ≤ 0.020       |       | 0.01655     |     |
|   | Ba 455.403 nm | ≤ 0.025       |       | 0.02391     |     |
| <b>Precision</b>                        |               |               |       |             |     |
|   | As 193.656 nm | % RSD         | < 1.0 | 0.72        | %   |
|   | Zn 213.856 nm | % RSD         | < 1.0 | 0.66        | %   |
|   | Mn 257.610 nm | % RSD         | < 1.0 | 0.30        | %   |
|   | La 379.478 nm | % RSD         | < 1.0 | 0.98        | %   |
|   | Ba 455.403 nm | % RSD         | < 1.0 | 0.95        | %   |
|   | Ba 493.408 nm | % RSD         | < 1.0 | 0.78        | %   |
| <b>Detection Limits : Axial</b>         | Tl 190.080 nm | 3(sd)         |       | 6.22        | ppb |
|   | As 193.696 nm | 3(sd)         |       | 6.44        | ppb |
|   | Pb 220.353 nm | 3(sd)         |       | 2.06        | ppb |
| <b>Detection Limits : Radial</b>        | As 193.696 nm | 3(sd)         |       | 78.26       | ppb |
|   | Zn 213.856 nm | 3(sd)         |       | 2.07        | ppb |
|   | Mn 257.610 nm | 3(sd)         |       | 0.52        | ppb |
|   | La 379.478 nm | 3(sd)         |       | 2.63        | ppb |
|   | Ba 455.403 nm | 3(sd)         |       | 0.08        | ppb |
|   | Ba 493.408 nm | 3(sd)         |       | 0.75        | ppb |
| <b>BEC : Axial (IB X 500)/(IS-IB)</b>   | Cd 226.502 nm | ≤ 150 ppb     |       | 64.72       |     |
| <b>BEC : Radial (IB X 1000)/(IS-IB)</b> | Mn 257.610 nm | ≤ 45 ppb      |       | 15.04       |     |



## MAINTENANCE AND TEST CERTIFICATE MODEL

### OPTIMA 5300DV

SERIAL NUMBER 077C7042401DATE TESTED July 4, 2024**Remarks :**

Commissioning follow as commissioning performance sheets.

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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

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

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

# MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

## ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

| SERIAL NUMBER                      | PTCS14111103 | DATE TESTED | July 4, 2024                     |
|------------------------------------|--------------|-------------|----------------------------------|
| <b>1. INSTRUMENT CHECKS</b>        |              |             |                                  |
| 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"/>  |
| <b>2. AUTOSAMPLE CHECK</b>         |              |             |                                  |
| 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"/>  |
| <b>3. COOLING SYSTEM CHECKS</b>    |              |             |                                  |
| A. Clean and Change Distill water  |              |             | <input type="text" value="OK"/>  |
| B. Themensor                       |              |             | <input type="text" value="OK"/>  |
| <b>4. FIAS CHECKS</b>              |              |             |                                  |
| 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                 | July 4, 2024       |
|--|--------------|-----------------------------|--------------------|
| PARAMETER  |              | SPECIFICATION               | ACTUAL VAULE       |
| A. Flame Mode Tests  |              |                             |                    |
| 1. Detector-Linearity with Barium (553.55 nm)                |              |                             |                    |
| Neutral Density Filter 0.2 :                                 |              | <u>0.2042</u> Abs. $\pm$ 5% | <u>0.1815</u> Abs. |
| Neutral Density Filter 1.0 :                                 |              | <u>0.9798</u> Abs. $\pm$ 5% | <u>1.0220</u> 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.        | <u>0.0016</u> 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.        | <u>0.0001</u> Abs. |
| 4. D <sub>2</sub> Background Compensation (Copper 324.75 nm) |              |                             |                    |
| with Neutral Density Filter 1.0                              |              | Absorbance $\leq$ 0.010 Abs | <u>0.0079</u> 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.        | <u>0.0007</u> 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.        | <u>0.0024</u> Abs. |



## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

|  |                               |                     |                     |
|--|-------------------------------|---------------------|---------------------|
| <b>SERIAL NUMBER</b>   | <u>PTCS14111103</u>           | <b>DATE TESTED</b>  | <u>July 4, 2024</u> |
| <b>PARAMETER</b>   | <b>SPECIFICATION</b>          | <b>ACTUAL VAULE</b> |                     |
| 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 $\geq 0.250$ Abs. | <u>0.3118</u>       | Abs.                |
| (2 mg/L Cu Standard a read time of 10 seconds                  |                               |                     |                     |
| 10 replicates, standard burner and High sensitivity nebulizer) |                               |                     |                     |
|  | Sensitivity $\geq 0.250$ Abs. | <u>N/A</u>          | Abs.                |

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

PinAAcle 900T

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

## MAINTENANCE REPORT AND CALIBRATION CERTIFICATE

### ATOMIC ABSORPTION SPECTROPHOTOMETER MODEL

**PinAAcle 900T**

**SERIAL NUMBER** PTCS14111103 **DATE TESTED** July 4, 2024

Remarks :

- Neutral Density Filter refer to data sheet

- Zeeman Ratio = 
$$\frac{\text{Atomic Signal(peak area)}}{\text{Atomic Signal(peak area)+Background Signal(peak area)}}$$
  
= 0.1491/0.1491+0.1176  
0.559

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



meets



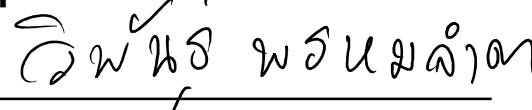
does not meet

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



ระดับเสียงในสถานที่ทำงาน และระดับเสียงติดตัวบุคคล (Noise Dose)

Request No. 21-66/0639

MTC No. EEL. BP. 40/0866

## 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 Bruel&Kjaer 4180 S/N 2633526.

**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 : 11 Aug. 2023

Date of Calibration : 22 Aug. 2023

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

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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

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-66/0639

MTC No. EEL. BP. 40/0866

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 $\mu$ Pa at 1000 Hz

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

1. Sound Pressure Level

| Standard Microphone<br>Type | Measured Sound Pressure<br>Level (dB) | Deviated value<br>(dB) | Uncertainty<br>(dB) | Tolerance limit<br>IEC60942:2003 Class 2 |
|-----------------------------|---------------------------------------|------------------------|---------------------|--|
| 1/2 inch Bruel&Kjaer 4180   | 114.01                                | 0.01                   | $\pm 0.10$          | $\pm 0.75$ dB                            |

2. Frequency

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

3. Total distortion

| Standard Microphone<br>Type | Measured Total distortion<br>(%) | Uncertainty<br>(%) | Tolerance limit<br>IEC60942:2003 Class 2 |
|-----------------------------|----------------------------------|--------------------|--|
| 1/2 inch Bruel&Kjaer 4180   | 0.19                             | $\pm 0.50$         | $\pm 4.0\%$                              |

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  
TISTR

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 22 Aug. 2023

Date of Issue : 24 Aug. 2023

Ref : 2011266081103146003

End of Certificate

2 / 2

The results relate only to the items tested/calibrated or value assigned.  
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FM.BL.MTC.002 Rev.4

Head Office  
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Amphoe Muang, Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
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Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
Fax. (66) 0 2579 8592  
E-mail : sumatee@tistr.or.th





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

Noise Dose B\_308\_/24

## 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 | 22 August 2023 |
|                   |                 | Due Date         | 22 August 2024 |

### Calibration Data

| Sound Level Meter Data  |         |          |            | Calibration Data |                     |                  |
|---|---------|----------|------------|------------------|---------------------|------------------|
| SLM No.   | Brand   | Model    | Serial No. | Date             | Actual Reading [dB] |                  |
|   |         |          |            |                  | Before Adjustment   | After Adjustment |
| NMD-B06   | SVANTEK | SV-104IS | 80816      | 14 July 2024     | 114.0               | 114.0            |
| NMD-B07   | SVANTEK | SV-104IS | 80817      | 14 July 2024     | 114.1               | 114.0            |
| Acoustic Certified Value : Thailand Institute of Scientific and Technological Research<br>(TISTR) |         |          |            |                  | 114.01± 0.10 dB     |                  |

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

Peera Detudom  
(Mr. Peera Detudom)

คุณภาพอากาศในสถานประกอบการ



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

Personal Pump Calibration Report

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Environmental Conditions

Temperature : 25  $\pm$  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 <sup>2</sup> |
|                    |       |           |            |                  | 1                  | 2     | 3     | 1               | 2     | 3     |                              |                |
| B41                | SKC   | 224-PCXR4 | 612669     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,009           | 1,502 | 2,005 | 1.006x - 11.146              | 0.999          |
| B42                | SKC   | 224-PCXR4 | 626041     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,499 | 2,005 | 0.997x + 6.432               | 1.000          |
| B43                | SKC   | 224-PCXR4 | 034636     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,004           | 1,505 | 2,013 | 1.010x - 15.091              | 0.999          |
| B44                | SKC   | 224-PCXR8 | 529341     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,004           | 1,506 | 2,005 | 1.005x - 9.731               | 0.999          |
| B45                | SKC   | 224-PCXR8 | 529594     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 996             | 1,491 | 2,002 | 1.009x - 16.399              | 1.000          |
| B46                | SKC   | 224-PCXR8 | 566743     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 996             | 1,495 | 2,001 | 1.001x - 5.621               | 1.000          |
| B47                | SKC   | 224-PCXR8 | 566747     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,003           | 1,496 | 1,996 | 0.995x + 7.632               | 1.000          |
| B48                | SKC   | 224-PCXR8 | 566753     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,007           | 1,503 | 2,005 | 1.007x - 9.047               | 0.999          |
| B49                | SKC   | 224-PCXR8 | 566780     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,492 | 2,001 | 0.998x + 2.047               | 1.000          |
| B50                | SKC   | 224-PCXR8 | 500400     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 997             | 1,513 | 2,006 | 1.008x - 10.870              | 1.000          |
| B51                | SKC   | 224-PCXR8 | 500363     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,007           | 1,496 | 2,010 | 1.003x - 3.758               | 1.000          |
| B52                | SKC   | 224-PCXR8 | 093186     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,003           | 1,496 | 2,002 | 0.999x + 1.439               | 1.000          |
| B53                | SKC   | 224-PCXR8 | 707670     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,501 | 1,998 | 1.002x - 4.254               | 0.999          |
| B54                | SKC   | 224-PCXR3 | 509821     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,503 | 1,998 | 1.003x - 5.249               | 1.000          |
| B55                | SKC   | 224-PCXR3 | 510710     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,519 | 2,003 | 1.006x - 5.785               | 0.999          |
| B56                | SKC   | 224-PCXR3 | 511450     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,003           | 1,506 | 2,001 | 1.004x - 7.748               | 1.000          |
| B57                | SKC   | 224-PCXR3 | 510798     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 1,008           | 1,505 | 2,008 | 1.010x - 16.191              | 0.999          |
| B58                | SKC   | 224-PCXR3 | 509852     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 1,002           | 1,505 | 2,007 | 1.012x - 20.201              | 0.999          |
| B59                | SKC   | 224-PCXR3 | 509862     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 997             | 1,501 | 1,999 | 1.000x + 0.760               | 1.000          |
| B60                | SKC   | 224-PCXR3 | 512655     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,014           | 1,507 | 2,003 | 1.002x - 1.563               | 0.999          |
| B61                | SKC   | 224-PCXR3 | 503915     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,517 | 2,000 | 0.998x + 5.213               | 0.999          |
| B62                | SKC   | 224-PCXR3 | 505975     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,501 | 2,010 | 1.008x - 7.876               | 1.000          |
| B63                | SKC   | 224-PCXR3 | 511432     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,506 | 2,009 | 1.010x - 11.514              | 1.000          |
| B64                | SKC   | 224-PCXR3 | 508302     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,512 | 2,009 | 1.009x - 11.825              | 1.000          |
| B65                | SKC   | 224-PCXR3 | 508310     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,499 | 2,004 | 1.008x - 11.573              | 1.000          |
| B66                | SKC   | 224-PCXR3 | 509861     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,517 | 2,000 | 0.999x + 4.094               | 0.999          |
| B67                | SKC   | 224-PCXR3 | 506295     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 997             | 1,505 | 2,006 | 1.011x - 17.514              | 1.000          |
| B68                | SKC   | 224-PCXR3 | 505872     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,517 | 1,999 | 0.999x + 3.174               | 0.999          |
| B69                | SKC   | 224-PCXR3 | 508375     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 1,008           | 1,505 | 2,009 | 1.013x - 17.610              | 0.999          |
| B70                | SKC   | 224-PCXR3 | 510623     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 996             | 1,504 | 2,002 | 1.006x - 9.583               | 1.000          |
| B71                | SKC   | 224-PCXR3 | 508367     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 997             | 1,499 | 1,996 | 1.001x - 8.495               | 1.000          |
| B72                | SKC   | 224-PCXR3 | 505977     | 01/07/2024       | 1,000              | 1,500 | 2,000 | 997             | 1,496 | 1,999 | 1.005x - 12.009              | 1.000          |
| B73                | SKC   | 224-PCXR3 | 512606     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,007           | 1,504 | 2,007 | 1.006x - 15.183              | 0.999          |
| B74                | SKC   | 224-PCXR3 | 505993     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,004           | 1,504 | 2,002 | 1.007x - 14.720              | 0.999          |
| B75                | SKC   | 224-PCXR3 | 509820     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,493 | 2,002 | 1.000x - 3.606               | 1.000          |
| B76                | SKC   | 224-PCXR3 | 509811     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,495 | 2,002 | 0.999x - 0.580               | 1.000          |
| B77                | SKC   | 224-PCXR3 | 508301     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,005           | 1,505 | 2,010 | 1.008 - 12.453               | 0.999          |
| B78                | SKC   | 224-PCXR3 | 510677     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,503 | 2,005 | 1.009x - 17.250              | 1.000          |
| B79                | SKC   | 224-PCXR3 | 510920     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,509 | 1,996 | 1.002x - 3.822               | 1.000          |

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

(Mr. Peera Detudom)





บริษัท เอส.พี.เอส. คอนซัลติ้ง เซอร์วิส จำกัด

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

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

### 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 <sup>2</sup> |
| B80                | SKC   | 224-PCXR3 | 504569     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,505 | 2,003 | 1.009x - 14.904              | 0.999          |
| B81                | SKC   | 224-PCXR3 | 503480     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,503 | 2,006 | 1.011x - 19.229              | 0.999          |
| B82                | SKC   | 224-PCXR3 | 505673     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,004           | 1,504 | 2,007 | 1.010x - 14.060              | 1.000          |
| B83                | SKC   | 224-PCXR3 | 510785     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,504 | 2,002 | 1.000x - 0.396               | 1.000          |
| B84                | SKC   | 224-PCXR3 | 508333     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,508 | 2,005 | 1.009x - 17.242              | 0.999          |
| B85                | SKC   | 224-PCXR3 | 505757     | 04/07/2024       | 1,000              | 1,500 | 2,000 | 1,009           | 1,493 | 2,004 | 0.999x + 1.151               | 1.000          |
| B86                | SKC   | 224-PCXR3 | 512625     | 05/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,495 | 2,003 | 1.002x - 3.458               | 1.000          |
| B87                | SKC   | 224-PCXR3 | 504324     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,003           | 1,505 | 2,006 | 1.005x - 5.057               | 1.000          |
| B88                | SKC   | 224-PCXR3 | 508307     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,517 | 2,000 | 0.999x + 2.575               | 0.999          |
| B89                | SKC   | 224-PCXR3 | 509860     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 998             | 1,518 | 2,006 | 1.010x - 14.096              | 0.999          |
| B90                | SKC   | 224-PCXR3 | 508366     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,000           | 1,501 | 2,000 | 1.005x - 8.991               | 1.000          |
| B91                | SKC   | 224-PCXR3 | 510919     | 03/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,503 | 2,008 | 1.014x - 22.160              | 0.999          |
| B92                | SKC   | 224-PCXR3 | 510987     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,006           | 1,503 | 2,006 | 1.012x - 20.401              | 0.999          |
| B93                | SKC   | 224-PCXR3 | 509845     | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,003           | 1,504 | 2,008 | 1.006x - 6.113               | 1.000          |
| B94                | SKC   | 224-PCXR8 | A127871    | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,012           | 1,496 | 1,998 | 0.997x - 0.876               | 0.999          |
| B95                | SKC   | 224-PCXR8 | A127921    | 01/07/2024       | 1,000              | 1,500 | 2,000 | 999             | 1,502 | 2,000 | 1.001x - 0.460               | 1.000          |
| B96                | SKC   | 224-PCXR8 | A127942    | 01/07/2024       | 1,000              | 1,500 | 2,000 | 997             | 1,501 | 2,001 | 1.005x - 7.496               | 1.000          |
| B97                | SKC   | 224-PCXR8 | A127955    | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,011           | 1,496 | 1,998 | 0.998x - 1.995               | 0.999          |
| B98                | SKC   | 224-PCXR8 | A127956    | 02/07/2024       | 1,000              | 1,500 | 2,000 | 1,011           | 1,496 | 1,998 | 0.997x - 0.476               | 0.999          |

Calibrated by :

Adul Dangklom  
(Mr. Adul Dangklom)

Approved by :

Peera Detudom  
(Mr. Peera Detudom)



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Rotameter Calibration Report (For Personal Pump High Flow Adjust)

Calibration Method : Dry Cal Primary Flowmeter

Model : Defender 510-H

S/N : 136164

Calibration Data

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

Calibrated by :

Adul 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

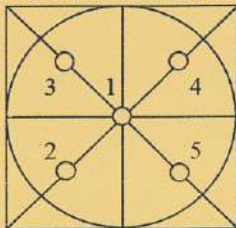
2. TARE FUNCTION : NORMAL

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