

ภาคผนวก ง

เอกสารสอบเทียบเครื่องมือที่ใช้ในการวิเคราะห์



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right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

| Sample Name | Parameter | Equipment Name | ID No. | Calibrated Date | Next Cal | Freq. Calibrate (Months) |
|-------------|-----------------------------|-----------------------------|------------|-----------------|-----------|--------------------------|
| Ambient | Total Suspended Particulate | High Volume | RYG_FS0177 | - | - | On site Calibration |
| Ambient | Total Suspended Particulate | High Volume | RYG_FS0663 | - | - | On site Calibration |
| Ambient | Total Suspended Particulate | High Volume | RYG_FS0178 | - | - | On site Calibration |
| Ambient | Total Suspended Particulate | Digital Balance | RYG_EN0001 | 20-Feb-25 | 20-Feb-26 | 12 |
| Ambient | Nitrogen Dioxide | NO ₂ Analyzer | RYG_FS0453 | 4-Jan-25 | 4-Jul-25 | 6 |
| Ambient | Nitrogen Dioxide | NO ₂ Analyzer | RYG_FS0457 | 4-Jan-25 | 4-Jul-25 | 6 |
| Ambient | Nitrogen Dioxide | NO ₂ Analyzer | RYG_FS0461 | 4-Jan-25 | 4-Jul-25 | 6 |
| Ambient | Wind Speed / Wind Direction | Wind Speed / Wind Direction | RYG_FS0413 | 29-Oct-24 | 29-Apr-26 | 18 |
| Ambient | Wind Speed / Wind Direction | Wind Speed / Wind Direction | RYG_FS0412 | 29-Oct-24 | 29-Apr-26 | 18 |
| Ambient | Wind Speed / Wind Direction | Wind Speed / Wind Direction | RYG_FS0611 | 26-Jun-24 | 26-Dec-25 | 18 |
| Stack | Carbon Monoxide | Console Control Unit | BKK_FS0556 | 10-Jan-25 | 10-Jul-25 | 6 |
| Stack | Carbon Monoxide | Pitot Tube | BKK_FS0561 | 10-Jan-25 | 10-Jul-25 | 6 |
| Stack | Carbon Monoxide | Flue gas Analyzer | RYG_FS0711 | 16-Jul-24 | 16-Jul-25 | 12 |
| Stack | Carbon Monoxide | CO Analyzer | RYG_EN0034 | 26-Nov-24 | 26-Nov-25 | 12 |
| Stack | Oxides of Nitrogen | Console Control Unit | BKK_FS0556 | 10-Jan-25 | 10-Jul-25 | 6 |
| Stack | Oxides of Nitrogen | Pitot Tube | BKK_FS0561 | 10-Jan-25 | 10-Jul-25 | 6 |
| Stack | Oxides of Nitrogen | Flue gas Analyzer | RYG_FS0711 | 16-Jul-24 | 16-Jul-25 | 12 |
| Stack | Oxides of Nitrogen | Vacuum Gauge | RYG_FS0333 | 3-Oct-24 | 2-Apr-26 | 18 |
| Stack | Oxides of Nitrogen | SPECTROPHOTOMETER | RYG_EN0037 | 18-Mar-25 | 18-Sep-26 | 18 |
| Stack | Total Suspended Particulate | Console Control Unit | BKK_FS0556 | 10-Jan-25 | 10-Jul-25 | 6 |
| Stack | Total Suspended Particulate | Pitot Tube | BKK_FS0561 | 10-Jan-25 | 10-Jul-25 | 6 |
| Stack | Total Suspended Particulate | Flue gas Analyzer | RYG_FS0711 | 16-Jul-24 | 16-Jul-25 | 12 |
| Stack | Total Suspended Particulate | Digital Balance | RYG_EN0003 | 20-Feb-25 | 20-Feb-26 | 12 |
| Workplace | Total Dust | DRYCAL FLOWMETER | RYG_FS0208 | 13-Feb-24 | 13-Aug-25 | 18 |
| Workplace | Total Dust | DRYCAL FLOWMETER | RYG_FS0208 | 27-Jan-25 | 26-Jan-26 | 12 |
| Workplace | Total Dust | DRYCAL FLOWMETER | BKK_FS0614 | 21-May-24 | 21-May-25 | 12 |
| Workplace | Total Dust | DRYCAL FLOWMETER | BKK_FS0614 | 9-Sep-24 | 9-Sep-25 | 12 |
| Workplace | Total Dust | DRYCAL FLOWMETER | BKK_FS0619 | 9-Sep-24 | 9-Sep-25 | 12 |
| Workplace | Total Dust | Digital Balance | RYG_EN0004 | 20-Feb-25 | 20-Feb-26 | 12 |
| Workplace | Styrene | DRYCAL FLOWMETER | RYG_FS0208 | 13-Feb-24 | 13-Aug-25 | 18 |
| Workplace | Styrene | DRYCAL FLOWMETER | RYG_FS0208 | 27-Jan-25 | 26-Jan-26 | 12 |
| Workplace | Styrene | DRYCAL FLOWMETER | BKK_FS0614 | 21-May-24 | 21-May-25 | 12 |
| Workplace | Styrene | DRYCAL FLOWMETER | BKK_FS0614 | 9-Sep-24 | 9-Sep-25 | 12 |
| Workplace | Styrene | DRYCAL FLOWMETER | BKK_FS0619 | 9-Sep-24 | 9-Sep-25 | 12 |
| Workplace | Styrene | GC-MSD | BKK_EN0049 | 25-Oct-24 | 25-Apr-26 | 18 |
| Workplace | Total Hydrocarbon | DRYCAL FLOWMETER | RYG_FS0208 | 13-Feb-24 | 13-Aug-25 | 18 |
| Workplace | Total Hydrocarbon | DRYCAL FLOWMETER | RYG_FS0208 | 27-Jan-25 | 26-Jan-26 | 12 |
| Workplace | Total Hydrocarbon | DRYCAL FLOWMETER | BKK_FS0614 | 21-May-24 | 21-May-25 | 12 |
| Workplace | Total Hydrocarbon | DRYCAL FLOWMETER | BKK_FS0614 | 9-Sep-24 | 9-Sep-25 | 12 |
| Workplace | Total Hydrocarbon | DRYCAL FLOWMETER | BKK_FS0619 | 9-Sep-24 | 9-Sep-25 | 12 |
| Workplace | Total Hydrocarbon | Total Hydrocarbon Analyzer | RYG_EN0038 | 25-Jul-24 | 25-Jul-25 | 12 |
| Noise | Leq 24 hrs | Sound Calibrator | RYG_FS0213 | 16-Jan-25 | 16-Jan-26 | 12 |
| Noise | Leq 24 hrs | Sound Level Meter | RYG_FS0495 | 27-Jan-25 | 26-Jan-26 | 12 |
| Noise | Leq 24 hrs | Sound Level Meter | RYG_FS0613 | 23-Dec-24 | 23-Dec-25 | 12 |
| Noise | Leq 24 hrs | Sound Level Meter | RYG_FS0619 | 21-Jan-25 | 21-Jan-26 | 12 |
| Noise | Leq 8 hrs | Sound Calibrator | RYG_FS0213 | 16-Jan-25 | 16-Jan-26 | 12 |
| Noise | Leq 8 hrs | Sound Level Meter | RYG_FS0614 | 23-Dec-24 | 23-Dec-25 | 12 |
| Noise | Leq 8 hrs | Sound Level Meter | RYG_FS0615 | 23-Dec-24 | 23-Dec-25 | 12 |
| Noise | Leq 8 hrs | Sound Level Meter | RYG_FS0616 | 23-Dec-24 | 23-Dec-25 | 12 |
| Noise | Leq 8 hrs | Sound Level Meter | RYG_FS0621 | 27-Jan-25 | 26-Jan-26 | 12 |
| Noise | Leq 8 hrs | Sound Calibrator | RYG_FS0215 | 22-Oct-24 | 22-Oct-25 | 12 |
| Noise | Leq 8 hrs | Sound Level Meter | RYG_FS0019 | 21-Jan-25 | 21-Jan-26 | 12 |
| Noise | Leq 8 hrs | Sound Level Meter | RYG_FS0020 | 21-Jan-25 | 21-Jan-26 | 12 |
| Noise | Leq 8 hrs | Sound Level Meter | RYG_FS0022 | 19-Mar-25 | 19-Mar-26 | 12 |
| Noise | Leq 8 hrs | Sound Level Meter | RYG_FS0023 | 19-Mar-25 | 19-Mar-26 | 12 |
| Rayong Lab | pH at 25 °C | pH Meter | RYG_EN0183 | 19-Jan-24 | 19-Jul-25 | 18 |
| Rayong Lab | BOD | DO meter with Sensor | RYG_EN0032 | 20-Jan-25 | 20-Jul-26 | 18 |
| Rayong Lab | BOD | Incubator | RYG_EN0154 | 1-Nov-24 | 1-May-26 | 18 |
| Rayong Lab | BOD | Burette | RYG_EN0216 | 24-Sep-24 | 24-Sep-25 | 12 |



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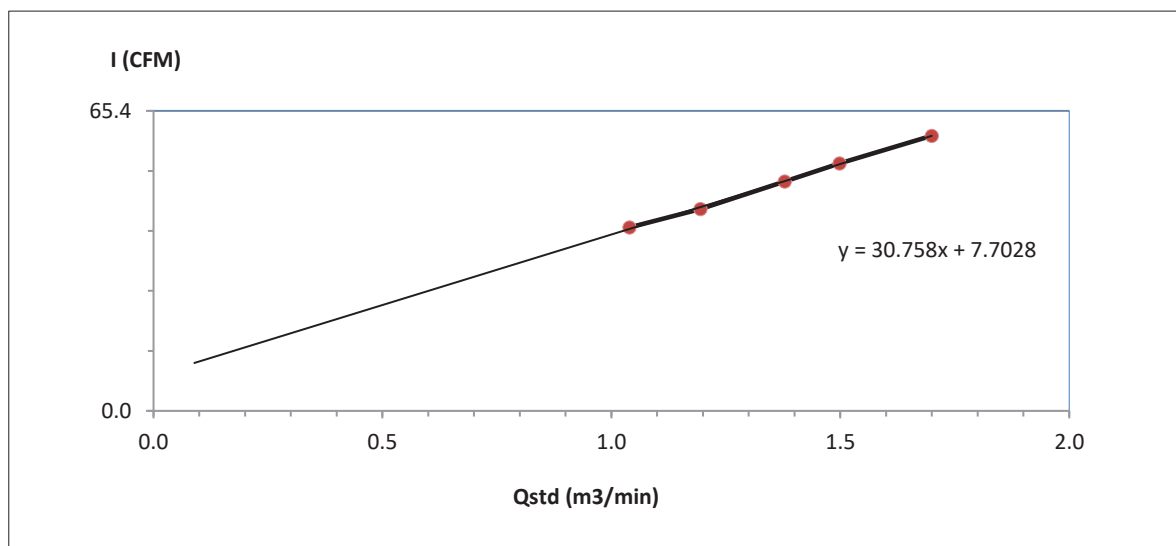
| Sample Name | Parameter | Equipment Name | ID No. | Calibrated Date | Next Cal | Freq. Calibrate (Months) |
|-------------|------------------------------|------------------------|------------|-----------------|-----------|--------------------------|
| Rayong Lab | COD | Spectrophotometer | RYG_EN0037 | 18-Mar-25 | 18-Sep-26 | 18 |
| Rayong Lab | Total Suspended Solids | Electronic Balance | RYG_EN0002 | 20-Feb-25 | 20-Feb-26 | 12 |
| Rayong Lab | Total Suspended Solids | Hot Air Oven | RYG_EN0010 | 21-Mar-24 | 21-Sep-25 | 18 |
| Rayong Lab | Total Dissolved Solids 180°C | Electronic Balance | RYG_EN0002 | 20-Feb-25 | 20-Feb-26 | 12 |
| Rayong Lab | Total Dissolved Solids 180°C | Hot Air Oven | RYG_EN0010 | 21-Mar-24 | 21-Sep-25 | 18 |
| Rayong Lab | Total Kjeldahl Nitrogen | Block Digestion Unit | RYG_EN0188 | 11-Mar-24 | 11-Sep-25 | 18 |
| Rayong Lab | Total Kjeldahl Nitrogen | pH Meter | RYG_EN0183 | 19-Jan-24 | 19-Jul-25 | 18 |
| Rayong Lab | Oil & Grease | Electronic Balance | RYG_EN0002 | 20-Feb-25 | 20-Feb-26 | 12 |
| Rayong Lab | Oil & Grease | Hot Air Oven | RYG_EN0213 | 19-Mar-25 | 19-Mar-26 | 12 |
| Rayong Lab | Oil & Grease | Water Bath | RYG_EN0061 | 21-Mar-24 | 21-Sep-25 | 18 |
| Rayong Lab | Temperature | pH meter | RYG_FS0714 | 30-Aug-24 | 30-Aug-25 | 12 |
| Rayong Lab | Color (at Original pH) | Spectrophotometer | RYG_EN0037 | 18-Mar-25 | 18-Sep-26 | 18 |
| Rayong Lab | Color (at pH 7.0) | Spectrophotometer | RYG_EN0037 | 18-Mar-25 | 18-Sep-26 | 18 |
| Rayong Lab | Cyanide | SPECTROPHOTOMETER | RYG_EN0037 | 18-Mar-25 | 18-Sep-26 | 18 |
| Rayong Lab | Formaldehyde | SPECTROPHOTOMETER | RYG_EN0037 | 18-Mar-25 | 18-Sep-26 | 18 |
| Rayong Lab | Phenol | SPECTROPHOTOMETER | RYG_EN0037 | 18-Mar-25 | 18-Sep-26 | 18 |
| Rayong Lab | Sulfide | Chamber (Cold Room) | RYG_EN0184 | 11-Jun-24 | 11-Dec-25 | 18 |
| Rayong Lab | Conductivity | Conductivity meter | RYG_EN0200 | 21-Mar-25 | 21-Mar-26 | 12 |
| Rayong Lab | Total Petroleum Hydrocarbon | Electronic Balance | RYG_EN0002 | 20-Feb-25 | 20-Feb-26 | 12 |
| Rayong Lab | Total Petroleum Hydrocarbon | Hot Air Oven | RYG_EN0213 | 19-Mar-25 | 19-Mar-26 | 12 |
| Rayong Lab | Total Petroleum Hydrocarbon | Water Bath | RYG_EN0061 | 21-Mar-24 | 21-Sep-25 | 18 |
| Water Lab | Hexavalent Chromium | Spectrophotometer | BKK_EN0018 | 13-Sep-24 | 13-Sep-25 | 12 |
| Water Lab | Barium | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Barium | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Barium | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Lead | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Lead | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Lead | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Manganese | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Manganese | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Manganese | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Nickel | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Nickel | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Nickel | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Arsenic | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Arsenic | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Arsenic | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Selenium | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Selenium | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Selenium | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Cadmium | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Cadmium | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Cadmium | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Trivalent Chromium | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Trivalent Chromium | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Trivalent Chromium | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Mercury | Mercury Analyzer | BKK_EL0128 | 6-Dec-24 | 6-Dec-25 | 12 |
| Water Lab | Copper | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Copper | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Copper | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Zinc | ICP-MS | BKK_EL0043 | 4-Oct-24 | 3-Apr-26 | 18 |
| Water Lab | Zinc | Hot Block | BKK_EL0054 | 4-Mar-25 | 4-Sep-26 | 18 |
| Water Lab | Zinc | Chamber (Cooling Room) | BKK_EN0167 | 4-Jun-25 | 4-Dec-26 | 18 |
| Water Lab | Total Organic carbon | TOC Analyzer | BKK_EN0066 | 26-Jun-24 | 26-Jun-25 | 12 |
| Water Lab | Organochlorine Pesticide | GC MSMS | BKK_EN0284 | 21-Nov-24 | 21-May-26 | 18 |



High Volume Air Sampler Calibration Worksheet

| | | | |
|------------------------|----------------------------------------------------------------------------------------------|-------------------------------|------------|
| Project Site : | Siam Polystyrene Co., Ltd. ริมรั้วด้านทิศตะวันตกของบริษัท ปิยะเอ็น เอฟซี จำกัด (มหาชน) | Barometric Pressure (mm Hg) : | 756.2 |
| Calibrate Location : | | Temperature (°C) : | 30.8 |
| Calibrate Date : | 24-Mar-25 | High Volume ID : | RYG_FS0177 |
| Calibration Sheet No.: | C-240325-RYG_FS0177 | High Volume Model : | TE-5170D |
| Calibrator ID: | RYG_FS0205 | High Volume S/N : | 4803 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.52567 |
| Calibrator S/N : | 1166 | Calibrator Intercept : | -0.03613 |

| Test No. | Delta H ₂ O (inch) | Q _{std} (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|----------------------------------|-------------------------------------------|--------------------|---------------------------------------------------------------------------|
| 1 | 2.4 | 1.0393 | 40 | Slope : 30.7580 Intercept : 7.7028 Correlation Coefficient : 0.9993 |
| 2 | 3.2 | 1.1945 | 44 | |
| 3 | 4.3 | 1.3789 | 50 | |
| 4 | 5.1 | 1.4985 | 54 | |
| 5 | 6.6 | 1.6997 | 60 | |



Calibrated by Sitpawit S

(Mr.Sitpawit Suwannarat)
RYG- Field Services Scientist(1)

Approved by Supot S

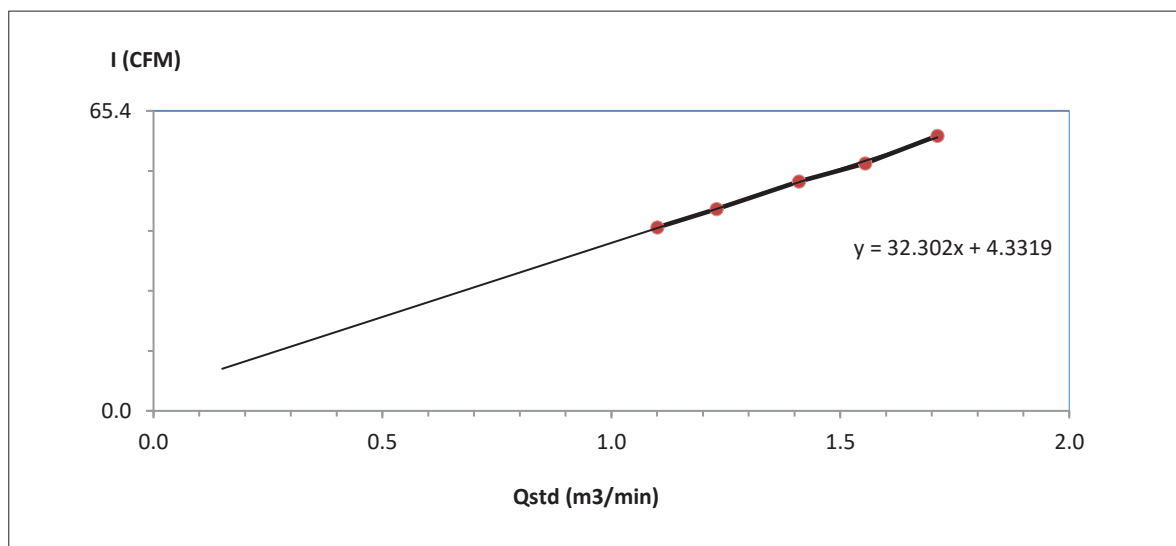
(Mr.Supot Salamteh)
RYG-Field Services Section Head



High Volume Air Sampler Calibration Worksheet

| | | | |
|-----------------------|----------------------------------------------------------------------------------------|-------------------------------|------------|
| Project Site : | Siam Styrene Monomer Co., Ltd. บ้านอ่าวประดู่(โรงพยาบาลส่งเสริม สุขภาพตำบลตากวน) | Barometric Pressure (mm Hg) : | 756.2 |
| Calibrate Location : | | Temperature (°C) : | 30.8 |
| Calibrate Date : | 24-Mar-25 | High Volume ID : | RYG_FS0663 |
| CalibrationSheet No.: | C-240325-RYG_FS0663 | High Volume Model : | TE-5009X |
| Calibrator ID: | RYG_FS0205 | High Volume S/N : | 6260 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.52567 |
| Calibrator S/N : | 1166 | Calibrator Intercept : | -0.03613 |

| Test No. | Delta H ₂ O (inch) | Q _{std} (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|----------------------------------|-------------------------------------------|--------------------|---------------------------------------------------------------------------|
| 1 | 2.7 | 1.1001 | 40 | Slope : 32.3022 Intercept : 4.3319 Correlation Coefficient : 0.9991 |
| 2 | 3.4 | 1.2301 | 44 | |
| 3 | 4.5 | 1.4098 | 50 | |
| 4 | 5.5 | 1.5547 | 54 | |
| 5 | 6.7 | 1.7122 | 60 | |



Calibrated by Sitpawit S

(Mr.Sitpawit Suwannarat)
RYG- Field Services Scientist(1)

Approved by : Supot S

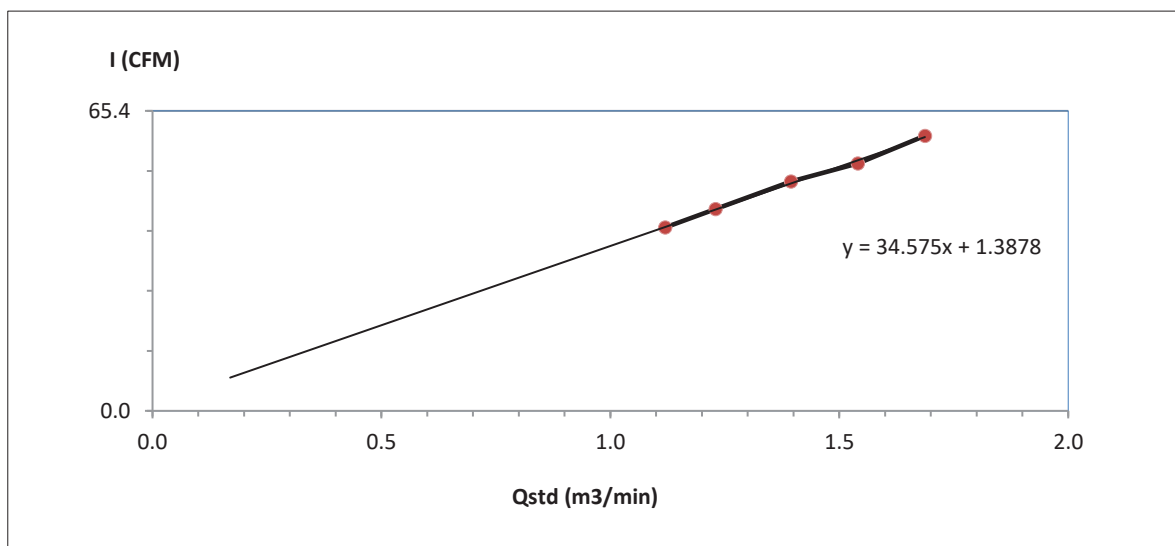
(Mr.Supot Salamteh)
RYG-Field Services Section Head



High Volume Air Sampler Calibration Worksheet

| | | | |
|-----------------------|--------------------------------|-------------------------------|------------|
| Project Site : | Siam Styrene Monomer Co., Ltd. | Barometric Pressure (mm Hg) : | 756.2 |
| Calibrate Location : | บ้านมาบตาพุด | Temperature (°C) : | 30.8 |
| Calibrate Date : | 24-Mar-25 | High Volume ID : | RYG_FS0178 |
| CalibrationSheet No.: | C-240325-RYG_FS0178 | High Volume Model : | TE-5170D |
| Calibrator ID: | RYG_FS0205 | High Volume S/N : | 4804 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.52567 |
| Calibrator S/N : | 1166 | Calibrator Intercept : | -0.03613 |

| Test No. | Delta H ₂ O (inch) | Q _{std} (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|----------------------------------|-------------------------------------------|--------------------|---------------------------------------------------------------------------|
| 1 | 2.8 | 1.1197 | 40 | Slope : 34.5752 Intercept : 1.3878 Correlation Coefficient : 0.9986 |
| 2 | 3.4 | 1.2301 | 44 | |
| 3 | 4.4 | 1.3944 | 50 | |
| 4 | 5.4 | 1.5409 | 54 | |
| 5 | 6.5 | 1.6870 | 60 | |



Calibrated by Sitpawit S

(Mr.Sitpawit Suwannarat)
RYG- Field Services Scientist(1)

Approved by : Supot S

(Mr.Supot Salamteh)
RYG-Field Services Section Head

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 25BKL0001

| | | |
|------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Object | Electronic non-automatic weighing instrument | This calibration certificate documents the traceability to national standards. |
| Manufacturer | Sartorius | Uncertainties of measurements are taken into account when only statements of compliance are made. |
| Type | LA130S-F | This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08. |
| Serial QM Ident. no. | 25409664 RYG_EN0001 | This certificate relate and apply this equipment only. |
| Customer | ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) | |
| | 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand. | |
| Order no. | 2230 | |
| Number of pages | 4 | |
| Date of calibration | 20 Feb 2025 | |

REVIEW BY

Thanitak.

APPROVED BY

D. Johnson.

NEXT CAL DATE.....

20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date 06 Mar 2025

Approval of the Calibration Certificate



Mr. Chonchai Inthana

Person in charge

Kachen Lalee

Calibration object

Single range instrument

| | |
|------------------------------|------------------|
| Model | LA130S-F |
| Serial Number | 25409664 |
| QM Ident. no Inventory no. | RYG_EN0001 --- |

| | |
|------------------------------|------------|
| Maximum capacity (Max. load) | 150.0000 g |
| Measured range | 150.0000 g |
| Scale interval | 0.0001 g |

Place of calibration

| | |
|-------------------------------------------------------|------------------------------|
| Address | According to page 1 |
| Department Cost center | Laboratory Department. --- |
| Building Floor | --- 1st Floor. |
| Room | Balance Room. |
| Maximum temperature variation at place of calibration | 5 K |

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

| Test equipment type | Test equipment ID | Valid until |
|------------------------------|----------------------------------------------------------------|-------------|
| Thermometer | MHB-382SD s/nB011342 Traceable to SI unit through DKSH | 21 Aug 2025 |
| Test weight set OIML R111 E2 | Certificate No.M2308197S ,E2(Traceable to SI unit through TCS) | 23 Aug 2025 |

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

| | |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Date of calibration | 20 Feb 2025 |
| Temperature at place of calibration Temp. diff. <i>T</i> _{weights} - <i>T</i> _{place} | 24.5 °C 1.0 K |
| Measuring conditions | The installation site is suitable. The device was levelled. Balance was loaded up to Max before test. |
| Comments | Humidity 58.0 %RH. |

Measurement results | Measurement uncertainties

Repeatability

| Test load (nominal): 10 g 100 g | | |
|-----------------------------------|----------------------|----------------------|
| | 10 g | 100 g |
| 1 | 10.0000 g | 100.0000 g |
| 2 | 9.9999 g | 100.0000 g |
| 3 | 10.0000 g | 99.9999 g |
| 4 | 10.0000 g | 100.0000 g |
| 5 | 10.0000 g | 99.9999 g |
| 6 | 9.9999 g | 99.9999 g |
| 7 | 10.0000 g | 100.0000 g |
| 8 | 10.0000 g | 100.0000 g |
| 9 | 10.0000 g | 100.0000 g |
| 10 | 10.0000 g | 100.0000 g |
| | <i>s</i> = 0.00004 g | <i>s</i> = 0.00005 g |

Eccentricity

| Test load (nominal): 50 g | |
|-----------------------------------------------------------------------------------------------|-----------|
| Center | 50.0000 g |
| Front left | 50.0001 g |
| Back left | 50.0000 g |
| Back right | 49.9999 g |
| Front right | 50.0001 g |
| Maximum deviation from centric loading indication $ \Delta_{ecc} _{max} = 0.0001\text{ g}$ | |

Error of indication

| Testload | Indication | Error | Expansion factor | Uncertainty | Uncertainty relative |
|-----------------------------|------------|-------------------------------|------------------|-----------------------|--------------------------------------|
| <i>L</i> | <i>I</i> | <i>E</i> | <i>k</i> | <i>U</i> (<i>E</i>) | <i>U</i> _{rel} (<i>E</i>) |
| 0.0100 g | 0.0100 g | 0.0000 g | 2.00 | 0.00012 g | 1.2 % |
| 0.0500 g | 0.0500 g | 0.0000 g | 2.00 | 0.00013 g | 0.25 % |
| 0.1000 g | 0.1000 g | 0.0000 g | 2.00 | 0.00013 g | 0.13 % |
| 0.5000 g | 0.5000 g | 0.0000 g | 2.00 | 0.00013 g | 0.026 % |
| 1.0000 g | 1.0000 g | 0.0000 g | 2.00 | 0.00013 g | 0.013 % |
| 2.0000 g | 2.0000 g | 0.0000 g | 2.00 | 0.00013 g | 0.0065 % |
| 5.0000 g | 5.0000 g | 0.0000 g | 2.00 | 0.00013 g | 0.0026 % |
| 10.0000 g | 10.0000 g | 0.0000 g | 2.00 | 0.00013 g | 0.0013 % |
| 20.0000 g | 20.0000 g | 0.0000 g | 2.00 | 0.00014 g | 0.00069 % |
| 100.0000 g | 100.0000 g | 0.0000 g | 2.00 | 0.00021 g | 0.00021 % |
| 150.0000 g | 149.9999 g | -0.0001 g | 2.00 | 0.00028 g | 0.00019 % |
| Maximum error of indication | | $ E _{max} = 0.0001\text{ g}$ | | | |

*U*_{rel}(*E*) is the quotient of *U*(*E*) and test load *L*. The uncertainty of measurement *U*(*E*) is valid only if error *E* is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

| | |
|------------------------------------|----------------------------|
| Device adjusted before measurement | Yes |
| Temperature deviation considered | 1.5 K (isoCAL active) |
| Temperature coefficient considered | $1 \cdot 10^{-6}/\text{K}$ |

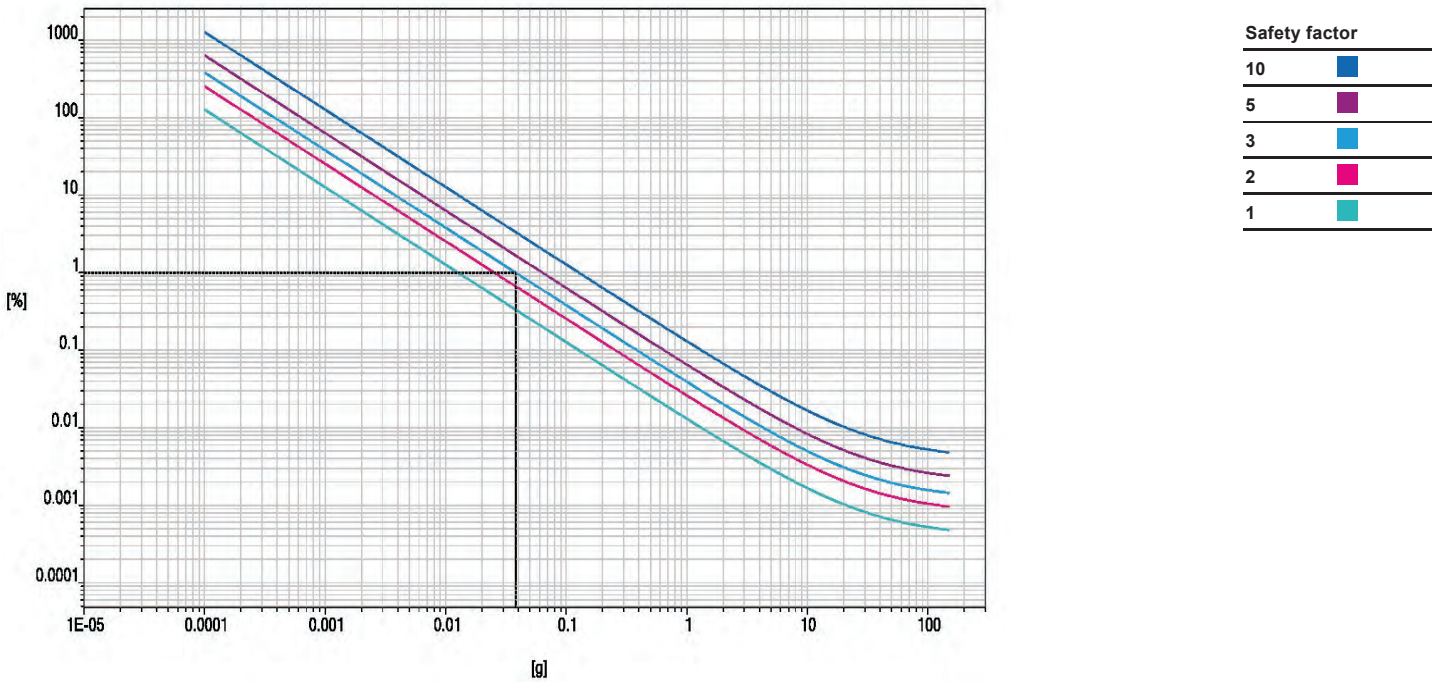
Uncertainty of the weighing result $U_{gl}(W)$

$U_{gl}(W) = 0.00013 \text{ g} + 3.96 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

| Indication in % from max load | Net indication R | Uncertainty $U_{gl}(W)$ | Uncertainty relative $U_{gl}(W)_{rel}$ |
|-------------------------------|--------------------|-------------------------|----------------------------------------|
| 1 % | 1.5000 g | 0.00014 g | 0.0091 % |
| 25 % | 37.5000 g | 0.00028 g | 0.00074 % |
| 50 % | 75.0000 g | 0.00043 g | 0.00057 % |
| 75 % | 112.5000 g | 0.00058 g | 0.00051 % |
| 100 % | 150.0000 g | 0.00072 g | 0.00048 % |

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

| | |
|-----------------------|----------|
| Process accuracy | 1.00 % |
| Safety factor | 3 |
| Minimum sample weight | 0.0380 g |

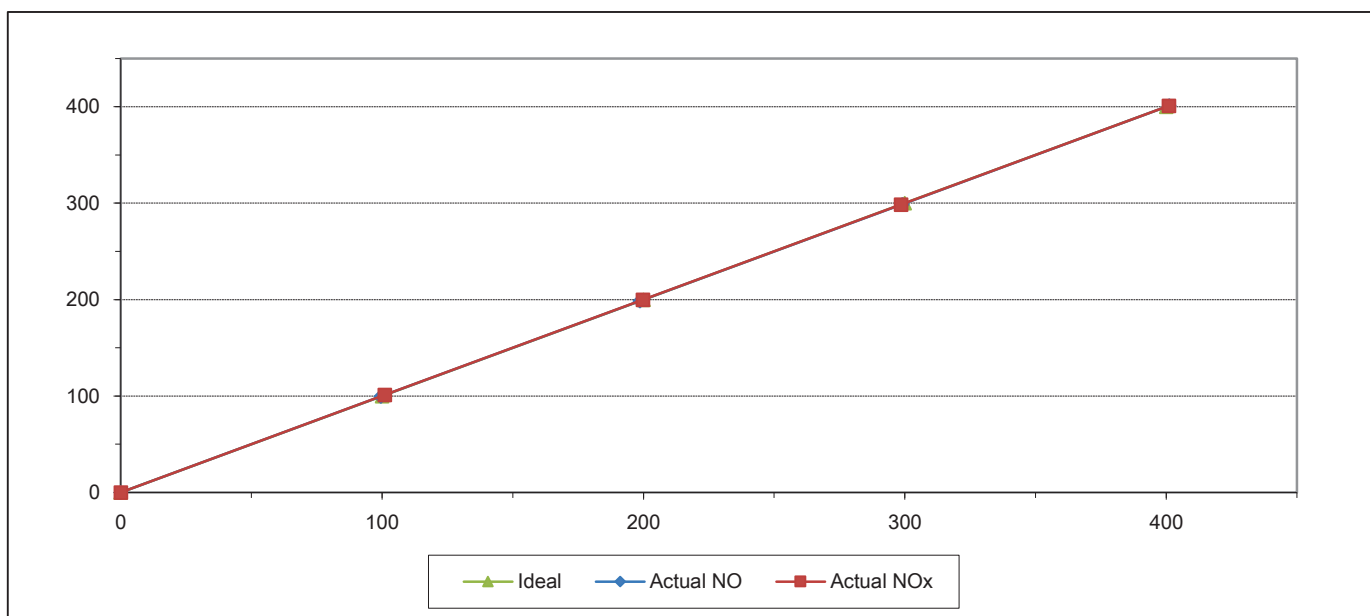


MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-25
Manufacturer HORIBA
Serial No. AWXG87CR
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID RYG_FS0453
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

| Point | CALIBRATION RESULTS | | | | | | |
|-------------|---------------------|-----------|----------|-----------|------------|-----------|------------|
| | Ideal | Actual NO | Error NO | %Error NO | Actual NOx | Error NOx | %Error NOx |
| ZERO | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| 1 | 100.00 | 99.60 | -0.40 | -0.40 | 101.10 | 1.10 | 1.10 |
| 2 | 200.00 | 198.60 | -1.40 | -0.70 | 199.80 | -0.20 | -0.10 |
| 3 | 300.00 | 299.00 | -1.00 | -0.33 | 298.60 | -1.40 | -0.47 |
| 4 | 400.00 | 401.20 | 1.20 | 0.30 | 401.10 | 1.10 | 0.28 |
| AVERAGE (%) | | | | -0.21 | | | 0.18 |



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

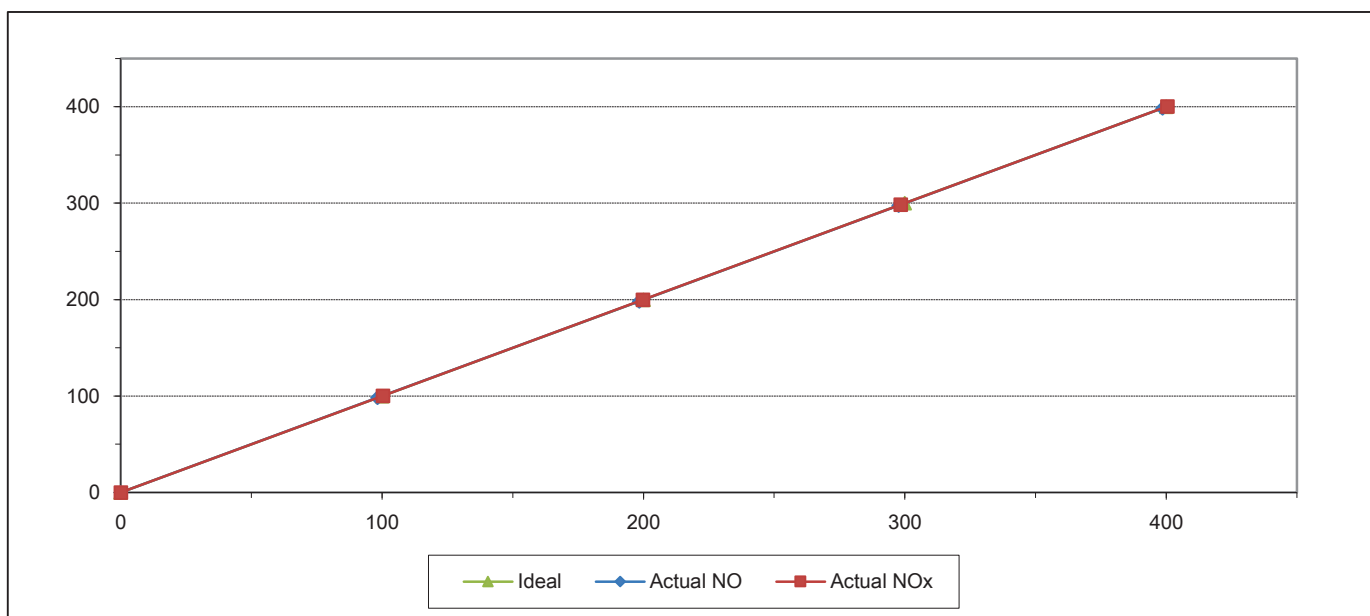


MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-25
Manufacturer HORIBA
Serial No. T2T8YRLL
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID RYG_FS0457
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

| Point | CALIBRATION RESULTS | | | | | | |
|-------------|---------------------|-----------|----------|-----------|------------|-----------|------------|
| | Ideal | Actual NO | Error NO | %Error NO | Actual NOx | Error NOx | %Error NOx |
| ZERO | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| 1 | 100.00 | 98.30 | -1.70 | -1.70 | 100.30 | 0.30 | 0.30 |
| 2 | 200.00 | 198.40 | -1.60 | -0.80 | 199.80 | -0.20 | -0.10 |
| 3 | 300.00 | 297.70 | -2.30 | -0.77 | 298.50 | -1.50 | -0.50 |
| 4 | 400.00 | 398.60 | -1.40 | -0.35 | 400.50 | 0.50 | 0.13 |
| AVERAGE (%) | | | | -0.70 | | | -0.01 |



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager

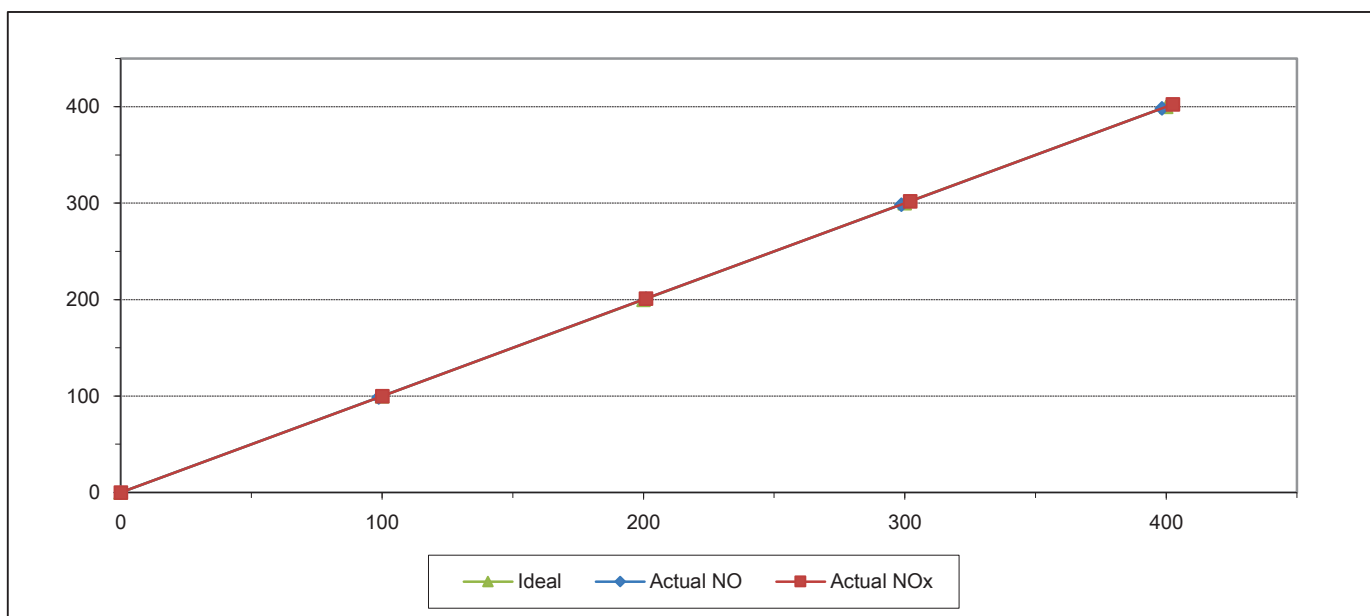


MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-25
Manufacturer HORIBA
Serial No. T95HWM41
Calibrator Manufacturer Teledyne API
Serial No. 947
Std. Gas Concentration (PPM) 55.88
Cylinder Pressure (psi) 1800
Certified Date 9-Feb-22

Equipment Name NOx Analyzer
Model APNA-370
Equipment ID RYG_FS0461
Model 700
Cylinder No. GN0027222
Certified By Airgas Inc.
Expired Date 9-Feb-30

| Point | CALIBRATION RESULTS | | | | | | |
|-------------|---------------------|-----------|----------|-----------|------------|-----------|------------|
| | Ideal | Actual NO | Error NO | %Error NO | Actual NOx | Error NOx | %Error NOx |
| ZERO | 0.00 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| 1 | 100.00 | 98.70 | -1.30 | -1.30 | 100.10 | 0.10 | 0.10 |
| 2 | 200.00 | 201.00 | 1.00 | 0.50 | 201.00 | 1.00 | 0.50 |
| 3 | 300.00 | 298.70 | -1.30 | -0.43 | 302.10 | 2.10 | 0.70 |
| 4 | 400.00 | 398.40 | -1.60 | -0.40 | 402.60 | 2.60 | 0.65 |
| AVERAGE (%) | | | | -0.31 | | | 0.41 |



Calibrated By

(Mr.Jirawut Sakarn)
Field Environmental Scientist (3)

Approved By

(Mr.Sarayuth Jittranont)
Assistant General Manager



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number

CWS-057-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM

MANUFACTURER

MODEL/TYPE

SERIAL NUMBER

ID NUMBER

CONDITION AS-RECEIVED

CUSTOMER

: Cup anemometer
: Novalynx
: Sensor: WS-02F
Data logger: 200-WS-25LB
: Sensor: WSD-A5375
Data logger: A5375
: RYG_FS0413
: Used item
: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

REVIEW BY

APPROVED BY

NEXT CAL DATE: 29 Apr 2026

Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm² cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0065-24

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

RECEIVED DATE

: 18 Oct 2024

MEASUREMENT DATE

: 29 Oct 2024

ISSUE DATE

: 29 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

PLACE OF CALIBRATION

: Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

: Wind tunnel cross-section area¹ 900 cm²
Wind direction frontal area² 100 cm²
Diameter of mounting pipe³ - mm
Blockage ratio of test object⁴ 0.111 [-]

Preconditioning

: 24 hours at ambient conditions.

Measurement Condition

: The average values during measurement are (22.9) °C, (42.4) %RH and (1004.2) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol

Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager



Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS⁵

The Cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

| V_{std} ⁶ (m/s) | Temp. wind tunnel (°C) | Temp. room (°C) | V_{UUC} ⁷ (m/s) | Error (m/s) | $U (k=2)$ (m/s) |
|---------------------------------|---------------------------|--------------------|---------------------------------|----------------|--------------------|
| 1.004 | 23.00 | 22.90 | 0.9 | -0.1 | 0.31 |
| 2.178 | 22.80 | 22.90 | 2.0 | -0.2 | 0.31 |
| 3.006 | 22.90 | 22.90 | 2.9 | -0.1 | 0.31 |
| 4.200 | 22.92 | 22.90 | 4.0 | -0.2 | 0.31 |
| 4.93 | 22.70 | 22.90 | 4.9 | 0.0 | 0.31 |
| 5.95 | 22.72 | 22.90 | 5.9 | -0.1 | 0.31 |
| 7.00 | 22.78 | 22.90 | 7.0 | 0.0 | 0.31 |
| 7.95 | 22.64 | 22.90 | 7.9 | -0.1 | 0.31 |
| 8.94 | 22.88 | 22.90 | 9.0 | 0.0 | 0.31 |
| 9.94 | 22.94 | 22.90 | 10.1 | 0.1 | 0.31 |
| 11.07 | 22.54 | 22.90 | 11.1 | 0.0 | 0.31 |
| 12.00 | 22.90 | 22.90 | 12.0 | 0.0 | 0.31 |
| 12.93 | 22.64 | 22.90 | 13.0 | 0.1 | 0.31 |
| 13.92 | 22.84 | 22.90 | 14.1 | 0.1 | 0.31 |
| 14.95 | 22.70 | 22.90 | 15.1 | 0.2 | 0.33 |
| 15.94 | 22.70 | 22.90 | 16.3 | 0.3 | 0.32 |

Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set- up is not true to scale due to imaging geometry.

End of Certificate of Calibration





JIRANATEE ASSOCIATES CO., LTD.

Jiranatee Associates Co., Ltd.
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Air speed measurement laboratory
Calibration services department.



NSC – TISI – TIS 17025
CALIBRATION 0367

Certificate Number

CWS-056-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM
MANUFACTURER
MODEL/TYPE

SERIAL NUMBER

ID NUMBER
CONDITION AS-RECEIVED
CUSTOMER

: Cup anemometer
: Novalynx
: Sensor: WS-02F
Data logger: 200-WS 25LB
: Sensor: WSD-A5374
Data logger: A5374
: RYG_FS0412
: Used item
: ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

REVIEW BY *Supt S.*

APPROVED BY *[Signature]*

NEXT CAL DATE..... 29 Apr 2026

Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm² cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0065-24

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

RECEIVED DATE : 18 Oct 2024
MEASUREMENT DATE : 29 Oct 2024
ISSUE DATE : 29 Oct 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

PLACE OF CALIBRATION : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

CALIBRATION CONDITIONS

| | | |
|-----------------------------------------------|-------|-----------------|
| : Wind tunnel cross-section area ¹ | 900 | cm ² |
| Wind direction frontal area ² | 100 | cm ² |
| Diameter of mounting pipe ³ | - | mm |
| Blockage ratio of test object ⁴ | 0.111 | [-] |

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.2) °C, (40.9) %RH and (1002.8) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

[Signature]

Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS⁵

The Cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

| V_{std} ⁶ (m/s) | Temp. wind tunnel (°C) | Temp. room (°C) | V_{UUC} ⁷ (m/s) | Error (m/s) | $U (k=2)$ (m/s) |
|---------------------------------|---------------------------|--------------------|---------------------------------|----------------|--------------------|
| 0.998 | 23.04 | 23.20 | 0.8 | -0.2 | 0.31 |
| 2.215 | 23.30 | 23.20 | 2.0 | -0.2 | 0.31 |
| 3.002 | 22.96 | 23.20 | 3.0 | 0.0 | 0.31 |
| 4.228 | 22.96 | 23.20 | 4.0 | -0.2 | 0.31 |
| 4.94 | 23.04 | 23.20 | 5.0 | 0.0 | 0.31 |
| 5.96 | 22.90 | 23.20 | 6.0 | 0.1 | 0.31 |
| 7.02 | 22.74 | 23.20 | 7.2 | 0.1 | 0.31 |
| 7.97 | 23.14 | 23.20 | 8.0 | 0.0 | 0.31 |
| 8.97 | 22.70 | 23.20 | 9.0 | 0.0 | 0.31 |
| 9.96 | 22.94 | 23.20 | 10.1 | 0.1 | 0.34 |
| 11.08 | 22.80 | 23.20 | 11.0 | -0.1 | 0.31 |
| 12.02 | 22.90 | 23.20 | 12.0 | 0.0 | 0.36 |
| 12.93 | 22.88 | 23.20 | 13.1 | 0.1 | 0.40 |
| 13.94 | 22.90 | 23.20 | 14.0 | 0.0 | 0.44 |
| 15.00 | 22.90 | 23.20 | 15.2 | 0.2 | 0.33 |
| 15.97 | 23.00 | 23.20 | 16.2 | 0.3 | 0.48 |

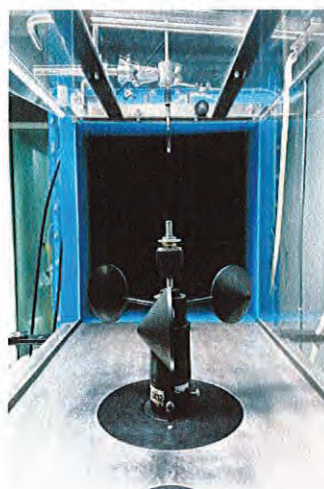
Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP



Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set-up is not true to scale due to imaging geometry.

End of Certificate of Calibration

JIRANATEE ASSOCIATES CO., LTD.

Certificate Number

CWS-017-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Cup anemometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-A5912
Data logger: A5912
ID NUMBER : RYG_FS0611
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 26 Jun 2024
ISSUE DATE : 26 Jun 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

| | | |
|----------------------|---------------|-----|
| Temperature | : 23.0 ± 3.0 | °C |
| Relative Humidity | : 55.0 ± 15.0 | %RH |
| Atmospheric Pressure | : 1010 ± 10 | hPa |

PLACE OF CALIBRATION : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

| | | | |
|-------------------------------|-----------------------------------------------|-------|-----------------|
| CALIBRATION CONDITIONS | : Wind tunnel cross-section area ¹ | 900 | cm ² |
| | Wind direction frontal area ² | 100 | cm ² |
| | Diameter of mounting pipe ³ | - | mm |
| | Blockage ratio of test object ⁴ | 0.111 | [-] |

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (24.0) °C, (44.0) %RH and (1003.0) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

Calibration procedure:

The Cup anemometer was calibrated against Standard air velocity transducer model: 8455-12 and pitot tube with precision differential pressure meter model: DPM2500 in an close test-section of Eiffel-type wind tunnel with 900 cm² cross test section area. The WI-CL-007 based on IEC 61400-12-1, Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines, March 2017 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0007-24 and MW-0055-23

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor k=2, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

REVIEW BY

APPROVED BY

NEXT CAL DATE

26/12/25

Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

MEASUREMENT RESULTS⁵

The Cup anemometer, Unit Under Calibration (UUC) was exercise at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 5 m/s was calculated by a standard air velocity transducer which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section and the standard air velocity 5 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 50 mm away from wind tunnel nozzle and installed 40 mm away from top of the test section, UUC was mounted on a round vertical tube of the lower plate at center of test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 16 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.

| V_{std}^6 (m/s) | Temp. wind tunnel (°C) | Temp. room (°C) | V_{UUC}^7 (m/s) | Error (m/s) | $U (k=2)$ (m/s) |
|----------------------|---------------------------|--------------------|----------------------|----------------|--------------------|
| 1.000 | 24.00 | 24.00 | 0.8 | -0.2 | 0.31 |
| 1.993 | 24.08 | 24.00 | 1.7 | -0.3 | 0.31 |
| 2.971 | 24.00 | 24.00 | 2.8 | -0.2 | 0.31 |
| 4.094 | 24.00 | 24.00 | 3.8 | -0.3 | 0.31 |
| 4.99 | 23.82 | 24.00 | 5.0 | 0.0 | 0.31 |
| 6.03 | 24.22 | 24.00 | 6.0 | 0.0 | 0.31 |
| 7.04 | 23.80 | 24.00 | 7.0 | 0.0 | 0.31 |
| 7.97 | 24.18 | 24.00 | 8.0 | 0.0 | 0.31 |
| 8.99 | 23.54 | 24.00 | 9.1 | 0.1 | 0.31 |
| 9.99 | 23.98 | 24.00 | 10.1 | 0.1 | 0.31 |
| 11.00 | 23.80 | 24.00 | 11.2 | 0.2 | 0.31 |
| 11.99 | 23.92 | 24.00 | 12.2 | 0.2 | 0.31 |
| 13.00 | 23.80 | 24.00 | 13.3 | 0.3 | 0.31 |
| 14.06 | 23.82 | 24.00 | 14.4 | 0.4 | 0.31 |
| 15.04 | 23.80 | 24.00 | 15.4 | 0.4 | 0.31 |
| 15.99 | 23.80 | 24.00 | 16.4 | 0.4 | 0.31 |

Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Velocity of standard

⁷ Velocity of Unit Under Calibration

PHOTO OF CALIBRATION SET-UP

Calibration set-up of the Cup anemometer calibration in the wind tunnel of Jiranatee Associates Co., Ltd. The Cup anemometer shown may differ from the calibrated one. Remark: The proportion of the set- up is not true to scale due to imaging geometry.

Certificate Number

CWD-017-67

CERTIFICATE OF CALIBRATION

Page 1 of 2 Pages

MEASUREMENT ITEM : Wind Direction Sensor
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: WS-02F
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: WSD-A5912
Data logger: A5912
ID NUMBER : RYG_FS0611
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.

RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 26 Jun 2024
ISSUE DATE : 26 Jun 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

| | | |
|----------------------|---------------|-----|
| Temperature | : 23.0 ± 3.0 | °C |
| Relative Humidity | : 55.0 ± 15.0 | %RH |
| Atmospheric Pressure | : 1010 ± 10 | hPa |

PLACE OF CALIBRATION : Eiffel-type wind tunnel of Jiranatee Associates Co., Ltd.

| | | | |
|------------------------------|-----------------------------------------------|-------|-----------------|
| CALIBRATION CONDITION | : Wind tunnel cross-section area ¹ | 900 | cm ² |
| | Wind direction frontal area ² | 129 | cm ² |
| | Diameter of mounting pipe ³ | - | mm |
| | Blockage ratio of test object ⁴ | 0.143 | [-] |

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are (23.9)°C, (52.6) %RH and (1005.3) hPa.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory: _____



Mr. Parinya Booncharoen
Calibration Department Manager

Remark:

- ¹ Nozzle cross-section area of the wind tunnel
² Projected cross-section area of the tested object include mounting pipe
³ Diameter of mounting pipe
⁴ Ratio ² to ¹

MEASUREMENT RESULTS⁵

The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counterclockwise directions after offset adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around its vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.

| Air speed m/s | D^{std} Degree (°) | D^{uuc} Degree (°) | Error Degree (°) | $U (k=2)$ Degree (°) |
|------------------|--------------------------------|--------------------------------|---------------------|-------------------------|
| 5.01 | 0.000 | 0 | 0 | 0.80 |
| | 45.000 | 43 | -2 | 0.80 |
| | 90.000 | 87 | -3 | 0.80 |
| | 135.000 | 131 | -4 | 0.80 |
| | 180.000 | 177 | -3 | 0.80 |
| | 225.000 | 225 | 0 | 0.80 |
| | 270.000 | 271 | 1 | 0.80 |
| | 315.000 | 318 | 3 | 0.80 |

Remark:

⁵ Calibration results only count for the tested circumstances and environmental conditions during which calibration took place

⁶ Direction of standard

⁷ Direction of Unit Under Calibration

End of Certificate of Calibration





JIRANATEE ASSOCIATES CO.,LTD.

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ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-007-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Digital barometer
MANUFACTURER : Novalynx
MODEL/TYPE : Sensor: 110-WS-25BP
Data logger: 110-WS-25DL-D
SERIAL NUMBER : Sensor: BP-A5912
Data logger: A5912
ID NUMBER : RYG_FS0611
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.
RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 26 Jun 2024
ISSUE DATE : 26 Jun 2024

Calibration procedure:

The Digital barometer was calibrated against Digital pressure calibrator. The WI-CL-003 was used as a calibration guideline.

Traceability:

The measurement results are traceable to the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MP-0009-24

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

CONDITION OF THIS RESULT OF CALIBRATION:

1. Reference Standard Instrument:

| Instrument | Model | Serial No. | Certificate No. | Due Date |
|------------------------------|---------|------------|-----------------|-------------|
| Absolute Pressure Transducer | CPG2500 | 4100126P | MP-0009-24 | 27 Dec 2024 |

1. Calibration effort for calibration sequence B

2. The UUC* was installed in vertical orientation above reference standard instrument and center of UUC* was used as the reference level.

3. Calibration conditions:

4. Condition : ☒ Normal ☐ Abnormal

Pressure transmitting medium : Air

ρ_{H_2O} (20°C, 1 bar) : 1.19 kg/m³

H_{amb} : (55±15) %

t_{amb} : (23±3) °C

p_{amb} : (1010±10) mbar

5. The certificate is valid only to the item calibrated on date and place of calibration

Calibrated by:

- ☒ Mr. Sorawit Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager



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Pressure measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CPR-007-67

Page 2 of 2 Pages

MEASUREMENT RESULTS : ☐ Without adjustment ☒ With adjustment

CALIBRATION IN THE RANGE OF : 950 mbar to 1050 mbar

The results of calibration and associated measurement uncertainties are reported in the table below.

| STD (mbar) | UUC* (mbar) | Error (mbar) | Uncertainty (k=2) (mbar) |
|---------------|----------------|-----------------|-----------------------------|
| 950.11 | 951.9 | 1.8 | 0.37 |
| 970.08 | 971.3 | 1.2 | 0.37 |
| 990.08 | 991.0 | 0.9 | 0.37 |
| 1010.09 | 1010.4 | 0.3 | 0.37 |
| 1030.05 | 1029.9 | -0.2 | 0.37 |
| 1050.08 | 1049.3 | -0.8 | 0.37 |

Note: UUC* Unit Under Calibration

: To convert the result in report unit to Pa should be multiply by 100

End of certificate





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ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Temperature measurement laboratory
Calibration services department.



CERTIFICATE OF CALIBRATION

Certificate No. : CDT-104-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Data Logger with Temperature sensor
MANUFACTURER : Novalynx
MODEL/TYPE : 110-WS-25DL-D
SERIAL NUMBER : A5912
ID NUMBER : RYG_FS0611
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand.

RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 26 Jun 2024
ISSUE DATE : 26 Jun 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability:

The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0047-24, Certificate number: ER-0101-23

Reference Used During Calibration:

1. Standard Temperature Probe
Model: STS-100 A500, Serial No.: 667682-09,
Due date: 26 Mar 2025
2. Digital Temperature Indicator
Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 14 Sep 2024

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved signatory: _____

Mr. Parinya Booncharoen
Calibration Department Manager



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number CDT-104-67

Page 2 of 2 Pages

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C to 40 °C

Function:

Table 3: This equipment was connected with temperature sensor Model: HMP60 S/N: U3911247.
Dimension: Diameter 12 mm. Length 80 mm.

| <u>Immersion Depth</u> (mm) | <u>Standard Reading</u> (°C) | <u>UUC Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (°C) |
|--------------------------------|---------------------------------|----------------------------|----------------------|----------------------------|
| 80 | 20.065 | 19.6 | -0.5 | 0.099 |
| 80 | 25.058 | 24.6 | -0.5 | 0.099 |
| 80 | 30.048 | 29.7 | -0.3 | 0.099 |
| 80 | 35.033 | 34.7 | -0.4 | 0.14 |
| 80 | 40.045 | 39.5 | -0.5 | 0.099 |

UUC*: Unit Under Calibration

Remark: The reported uncertainty of measurement is 0.14, based on standard uncertainty multiplied by a coverage factor k=2.14 providing a level of confidence of approximately 95%.

End of Certificate of Calibration





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NSC-TISI-TIS 17025
CALIBRATION 0367

Relative humidity and Air Temperature measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CRT-016-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Relative humidity with data logger
MANUFACTURER : Novalynx
MODEL/TYPE : Data Logger: 110-WS-25DL-D
Sensor: HMP60
SERIAL NUMBER : Data Logger: A5912
Sensor: U3911247
ID NUMBER : RYG_FS0611
CONDITION AS-RECEIVED : Used item
CUSTOMER : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Suan Luang,
Khet Suan Luang, Bangkok 10250 Thailand.
RECEIVED DATE : 10 Jun 2024
MEASUREMENT DATE : 26 Jun 2024
ISSUE DATE : 26 Jun 2024

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

| | | |
|-------------------|---------------|-----|
| Temperature | : 23.0 ± 3.0 | °C |
| Relative Humidity | : 55.0 ± 15.0 | %RH |

NOTED: The certificate is valid only to the item calibrated on date and place of calibration.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Relative humidity and Air Temperature calibration was done by In-House calibration method as WI-CL-009 and WI-CL-010 according to comparison method with Standard Chilled Mirror hygrometer with Temperature sensor and standard Humidity generator chamber.

Traceability:

The measurements are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: TH-0079-23 and through Jiranatee Associates Co., Ltd. Certificate number: CDT-001-67.

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

Calibrated by:

- ☐ Mr. Sorawit Thachalad
☒ Miss Jittrapun Lertsomphol
☐ Miss Ruangrumpai Phoommit



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number: CRT-016-67

Page 2 of 2 Pages

Measurement Results:

The results of calibration and associated measurement uncertainties are reported in the table below.

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Table 1: The results of calibration of relative humidity at 30 °C are reported in table below.

Calibration Range: 20%RH to 80%RH

| <u>Air Temperature</u> (°C) | <u>Standard Reading</u> (%RH) | <u>UUC Reading</u> (%RH) | <u>Error</u> (%RH) | <u>Uncertainty</u> ± (%RH) |
|--------------------------------|----------------------------------|-----------------------------|-----------------------|-------------------------------|
| 29.80 | 19.60 | 18.6 | -1.0 | 0.83 |
| 29.80 | 50.55 | 48.0 | -2.6 | 1.3 |
| 29.81 | 81.61 | 77.8 | -3.8 | 2.3 |

UUC*: Unit Under Calibration

End of Certificate of Calibration





CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration of Date : 10-Jan-25
Next Cal. Date : 10-Jul-25

Barometric Pressure (mmHg) : 756.2
Relative Humidity (%) : 37.9
Temperature (C°) : 28.1

Console Control Meter Data

Reference Dry Gas Meter Data

Calibration No. : C-100125-BKK_FS0556
Dry Gas Meter ID : BKK_FS0556
Serial No. : 1606041
Model No. : XC-572-V
Reference Dry Gas Meter ID : BKK_FS1122
Serial No. : A2003240
Correction Factor (Y) : 1.0000
Next Calibration Date : 25-Feb-26

| ΔH (mm.H ₂ O) | Θ Minutes | Reference Dry Gas Meter Calibration | | | | Console Control ; Drygas Meter | | | | | | Dry Gas Meter Correction Factor (Y) | Orifice Calibration Factor ΔH_Q |
|-------------------------------------|---------------------|-------------------------------------|---------|--------|------------|--------------------------------|----------|--------|------------|------------|----------------|----------------------------------------------|--------------------------------------------------|
| | | Vr (Liters) | | | Tr (°C) | Vm (Liters) | | | Ti (°C) | To (°C) | Avg.Tm (°C) | | |
| | | Final | Initial | Total | | Final | Initial | Total | | | | | |
| 15 | 11.41 | 150.00 | 0.00 | 150.00 | 31.0 | 464658.0 | 464513.0 | 145.00 | 31.0 | 31.0 | 31.0 | 1.0330 | 40.1599 |
| 25 | 8.87 | 150.00 | 0.00 | 150.00 | 31.0 | 464808.0 | 464663.0 | 145.00 | 31.0 | 31.0 | 31.0 | 1.0320 | 40.4499 |
| 50 | 6.42 | 150.00 | 0.00 | 150.00 | 32.0 | 464968.0 | 464823.0 | 145.00 | 31.0 | 31.0 | 31.0 | 1.0261 | 42.6601 |
| 80 | 5.05 | 150.00 | 0.00 | 150.00 | 32.0 | 465126.0 | 464982.0 | 144.00 | 31.0 | 31.0 | 31.0 | 1.0302 | 42.2333 |
| 120 | 4.08 | 150.00 | 0.00 | 150.00 | 32.0 | 465297.0 | 465153.0 | 144.00 | 31.0 | 31.0 | 31.0 | 1.0263 | 41.3508 |
| | | | | | | | | | | Avg. | | 1.0295 | 41.3708 |

Y : Ratio of reading of reference to dry gas meter : tolerance for individual values ± 0.02 from average .

ΔH_Q : Orifice pressure differential that equates to 21.24 lm of air @ 25 C and 760 mm of mercury , mmH₂O ; tolerance for individual values ± 5.08 from average .

Procedure; 40 CFR 60,APP A,METH ,SEC 5.3 & 7

Calibrated by:

(Mr. Warawut Pubpa)

Approved by:

(Mr.Nattapol Jengwareewong)

RYG Field Service Scientist(3)

RYG Field Service Specialist(1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

| | | | |
|--------------------------|---------------------|--------------------------|------------------|
| Calibration Date : | 10 Jan 25 | Ambient Temperature (°C) | 28.1 |
| Calibration sheet No. : | C-100125-BKK_FS0557 | Relative Humidity (%) : | 37.9 |
| Digital Temperature ID : | BKK_FS0557 | Reference Temperature ID | RYG_FS0681 |
| Serial No. : | 1606041 | Serial No. : | 201090014918 |
| Model : | XC-572-V | Model : | Digicon-CC-VT-MS |
| | | Next Calibrate : | 13 May 25 |

| Location | Reference Temperature °C | Digital Temperature °C | Error °C | MPE | Pass / Fail |
|----------|-----------------------------|---------------------------|-------------|-----|-------------|
| Stack | 0 | 0 | 0 | ±3 | Pass |
| | 25 | 24 | -1 | ±3 | Pass |
| | 50 | 49 | -1 | ±3 | Pass |
| | 100 | 99 | -1 | ±3 | Pass |
| | 150 | 149 | -1 | ±3 | Pass |
| | 200 | 199 | -1 | ±3 | Pass |
| | 250 | 249 | -1 | ±3 | Pass |
| | 300 | 299 | -1 | ±3 | Pass |
| Probe | 500 | 499 | -1 | ±3 | Pass |
| | 100 | 99 | -1 | ±3 | Pass |
| | 120 | 119 | -1 | ±3 | Pass |
| | 140 | 139 | -1 | ±3 | Pass |
| Oven | 100 | 99 | -1 | ±3 | Pass |
| | 120 | 119 | -1 | ±3 | Pass |
| | 140 | 139 | -1 | ±3 | Pass |
| Filter | 100 | 100 | 0 | ±3 | Pass |
| | 120 | 120 | 0 | ±3 | Pass |
| | 140 | 141 | 1 | ±3 | Pass |
| Exit | 0 | 0 | 0 | ±3 | Pass |
| | 10 | 10 | 0 | ±3 | Pass |
| | 20 | 20 | 0 | ±3 | Pass |
| Meter | 0 | 0 | 0 | ±3 | Pass |
| | 25 | 25 | 0 | ±3 | Pass |
| | 50 | 50 | 0 | ±3 | Pass |
| AUX | 0 | 0 | 0 | ±3 | Pass |
| | 25 | 24 | -1 | ±3 | Pass |
| | 50 | 49 | -1 | ±3 | Pass |

MPE : (Maximum permissible error of measurement) ค่าความผิดพลาดสูงสุดของการวัดที่ยอมรับได้

Calibrated by :

Mr. Warawut Pubpa

RYG Field Service Scientist (3)

Approved by :

Mr. Natthapol Jiengwareewong

RYG Field Service Specialist (1)



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

| | |
|---------------------------------------------|---------------------------------|
| Calibration Date : 10 Jan 25 | Nozzle Set ID. : BKK_FS0562 |
| Calibration Sheet No. : C-100125-BKK_FS0562 | Vernier Caliper ID.: BKK_FS1123 |

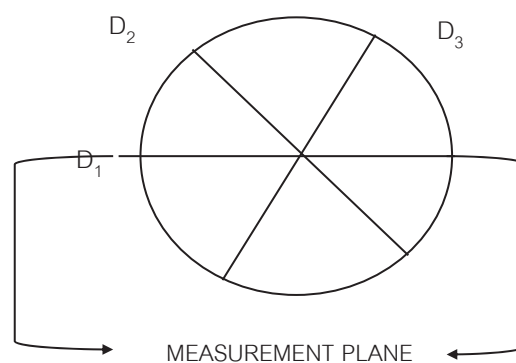
| Nozzle ID # | Nozzle Diameter (cm.) | | | Hi - Lo | $(D_1 + D_2 + D_3) / 3$ |
|-------------|-----------------------|-------|-------|------------|-------------------------|
| | D_1 | D_2 | D_3 | ΔD | D_{avg} |
| 1 | 0.300 | 0.300 | 0.305 | 0.005 | 0.302 |
| 2 | 0.485 | 0.475 | 0.485 | 0.010 | 0.482 |
| 3 | 0.530 | 0.535 | 0.530 | 0.005 | 0.532 |
| 4 | 0.625 | 0.630 | 0.630 | 0.005 | 0.628 |
| 5 | 0.760 | 0.760 | 0.765 | 0.005 | 0.762 |
| 6 | 0.975 | 0.980 | 0.980 | 0.005 | 0.978 |
| 7 | 1.085 | 1.085 | 1.081 | 0.004 | 1.084 |
| 8 | 1.275 | 1.275 | 1.275 | 0.000 | 1.275 |
| 9 | 1.605 | 1.610 | 1.615 | 0.010 | 1.610 |

Where :

D_1, D_2, D_3 = There different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.

D_{avg} = $(D_1 + D_2 + D_3) / 3$



Calibrated by : 

(Mr. Warawut Pubpa)

RYG Field Service Scientist (3)

Approved by : 

(Mr. Natthapol Jiengwareewong)

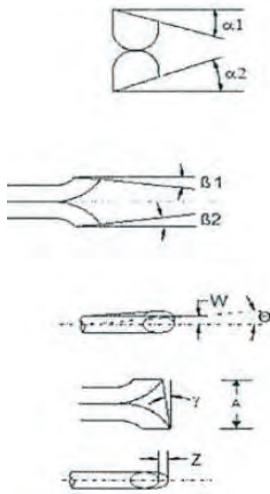
RYG Field Service Specialist (1)



Type S Pitot Tube Calibration


Date Calibration 10-Jan-25
Pitot ID BKK_FS0561
Pitot SN —

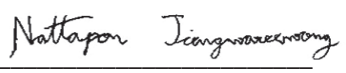
Due Date 10-Jul-25
Inclinometer ID BKK_FS1131
Vernier ID RYG_FS0539



| Parameter | Value | Allowable Range | Check |
|---------------------|-------|----------------------------------------|-------|
| $\alpha 1$ | -2.4 | $-10^{\circ} < \alpha 1 < +10^{\circ}$ | OK |
| $\alpha 2$ | -1.2 | $-10^{\circ} < \alpha 2 < +10^{\circ}$ | OK |
| $\beta 1$ | -2.0 | $-5^{\circ} < \beta 1 < +5^{\circ}$ | OK |
| $\beta 2$ | 1.3 | $-5^{\circ} < \beta 2 < +5^{\circ}$ | OK |
| γ | 0.3 | - | - |
| θ | 0.2 | - | - |
| $Z = A \tan \gamma$ | 0.005 | $Z \leq 0.125"$ | OK |
| $W = A \tan \theta$ | 0.003 | $W \leq 0.031"$ | OK |
| Dt | 0.310 | 0.188" to 0.375" | OK |
| $A/2Dt$ | 1.468 | $1.05 \leq PA/Dt \leq 1.5$ | OK |
| A | 0.91 | $2.1Dt \leq A \leq 3Dt$ | OK |

Certify that pitot tube/porbe meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a pitot tube certification fact of 0.84 . See 40 CFR Pt. 60, App. A,EPA Method 2.

Calibrated by : 
 (Mr. Warawut Pubpa)
 RYG Field Services Scientist (3)

Approved By : 
 (Mr.Natthapol Jiengwareewong)
 RYG Field Services Specialist (1)

Calibration certificate Kalibrier-Zertifikat

5753561

| | | |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Object Gegenstand | Control Unit t350 | Measuring Box testo 350 |
| Manufacturer Hersteller | TESTO SE & Co. KGaA | TESTO SE & Co. KGaA |
| Type description Typ | 0632 3511 | 0632 3510 |
| Serial no. Serien Nr. | 64554897 | 64749498 |
| Inventory no. Inventar Nr. | --- | --- |
| Test equipment no. Prüfmittel Nr. | --- | --- |
| Equipment no. Equipment Nr. | 15862485 | 15861584 |
| Location Standort | --- | --- |
| Customer Auftraggeber | ALS Laboratory Group (Thailand) Co., Ltd 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang TH Bangkok 10250 Thailand | |
| Customer ID no. Kunden Nr. | 1031994 | |
| Order no. Auftrags Nr. | 12459724 / 0520 0055 | |

Hereby we confirm that the performing calibration laboratory is working with a management system according to ISO 9001:2015 and DIN EN ISO/IEC 17025:2018. Accreditation certificates can be found under www.testotis.de. The measuring installations used for calibration are regularly calibrated and traceable to the national standards of the German Federal Physical Technical Institute (PTB) or other national standards. Should no national standards exist, the measuring procedure corresponds with the technical regulations and norms valid at the time of the measurement. The documents established for this procedure are available for viewing. All the necessary measured data can be found on this calibration certificate.

Hiermit bestätigen wir, dass das durchführende Kalibrierlabor ein Managementsystem nach ISO 9001:2015, sowie DIN EN ISO/IEC 17025:2018 eingeführt hat. Die Urkunden finden Sie auf www.testotis.de. Die für die Kalibrierung verwendeten Messeinrichtungen werden regelmäßig kalibriert und sind rückführbar auf die nationalen Normale der Physikalisch Technischen Bundesanstalt (PTB) Deutschlands oder auf andere nationale Normale. Wo keine nationalen Normale existieren, entspricht das Messverfahren den derzeit gültigen technischen Regeln und Normen. Die für diesen Vorgang angefertigte Dokumentation kann eingesehen werden. Alle erforderlichen Messdaten sind in diesem Kalibrier-Zertifikat aufgelistet.

Date of calibration
Datum der Kalibrierung 16.07.2024

Date of the recommended re-calibration
Datum der empfohlenen Rekalibrierung 16.07.2025

Conformity statement
Konformitätsaussage Pass

| | |
|----------------|--------------------|
| REVIEW BY | <i>Marathon P.</i> |
| APPROVED BY | <i>Micha</i> |
| NEXT CAL. DATE | 16/7/25 |

The expanded uncertainty of measurement was calculated according to EA-4/02 M:2022 with a coverage probability of about 95% and contains the uncertainty of the reference, the uncertainty of the method and the uncertainty of the test specimen. The conformity statement is made according to the decision rule "confidence level 50".

Die erweiterte Messunsicherheit wurde nach EA-4/02 M:2022 mit einer Überdeckungswahrscheinlichkeit von etwa 95% berechnet und enthält die Unsicherheit der Referenz, des Verfahrens sowie die Unsicherheit des Prüflings. Die Konformitätsaussage erfolgt nach der Entscheidungsregel "Vertrauensniveau 50".

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Seal Stempel



Supervisor Fachverantwortlicher

Martin Förderer

Martin Förderer

Technician Bearbeiter

S. Garcia

Samuel Garcia Zlodi

Calibration certificate Kalibrier-Zertifikat

5753561

Measuring equipment Messeinrichtungen

| Index | Reference Referenz | Traceability Rückführung | Next cal. Rekal. | Certificate-no. Zertifikat-Nr. | Eq.-no. Eq.-Nr. |
|-------|--------------------------------------|-----------------------------|---------------------|-----------------------------------|--------------------|
| a | Test gas medium 1 Prüfgas Medium 1 | SCS-SCS0026 2024-02 | 2025-02 | 5514470 | 12898976 |
| b | Test gas medium 3 Prüfgas Medium 3 | SCS-SCS0026 2024-02 | 2025-02 | 5524380 | 12898982 |
| c | Test gas medium 5 Prüfgas Medium 5 | SCS-SCS0026 2024-02 | 2025-02 | 5501047 | 12898984 |
| d | Test gas medium 8 Prüfgas Medium 8 | SCS-SCS0026 2023-07 | 2024-07 | 5163030 | 12898987 |
| e | Test gas medium 7 Prüfgas Medium 7 | SCS-SCS0026 2024-02 | 2025-02 | 5514483 | 12898986 |
| f | Test gas medium 11 Prüfgas Medium 11 | SCS-SCS0026 2023-08 | 2024-08 | 5163035 | 14087964 |

Reference certificates are available at www.primasonline.com Referenzzertifikate sind auf www.primasonline.com abrufbar

Ambient conditions Umgebungsbedingungen

Temperature Temperatur (20...26) °C

Humidity Feuchte (20...60) % RH % rF

Measuring procedure Messverfahren

The calibration was carried out by comparison measurement with calibrated test gases.
Die Kalibrierung erfolgte durch Vergleichsmessung mit kalibrierten Prüfgasen.

Measuring results Messergebnisse

Channel Kanal ---

| Reference value Bezugswert | | Indicated measured value probe Angezeigter Messwert Ka- libriergegenstand | | Deviation Abweichung | | Allowed deviation ²⁾ Zulässige Abweichung ²⁾ | | Measurement uncertainty (k=2) Messunsicherheit (k=2) | | Confirmation Bewertung |
|-------------------------------|-------------------|------------------------------------------------------------------------------------|--------|-------------------------|--------|--------------------------------------------------------------------------|--------|------------------------------------------------------------|--------|---------------------------|
| ppm | Vol.-% | ppm | Vol.-% | ppm | Vol.-% | ppm | Vol.-% | ppm | Vol.-% | |
| CO | | | | | | | | | | |
| 100,6 ^a | --- | 100 | --- | -0,6 | --- | ± 11 | --- | 3,3 | --- | pass |
| 401,0 ^b | --- | 403 | --- | 2,0 | --- | ± 21 | --- | 8,4 | --- | pass |
| 700,0 ^c | --- | 702 | --- | 2,0 | --- | ± 36 | --- | 14,4 | --- | pass |
| NO | | | | | | | | | | |
| 150,2 ^a | --- | 151 | --- | 0,8 | --- | ± 9 | --- | 4,0 | --- | pass |
| 300 ^d | --- | 302 | --- | 2 | --- | ± 16 | --- | 6,9 | --- | pass |
| NO2 | | | | | | | | | | |
| 100,4 ^e | --- | 102,3 | --- | 1,9 | --- | ± 5,1 | --- | 3,20 | --- | pass |
| SO2 | | | | | | | | | | |
| 97,9 ^f | --- | 96 | --- | -1,9 | --- | ± 6 | --- | 3,5 | --- | pass |
| O2 | | | | | | | | | | |
| --- | 0,00 ^a | --- | 0,09 | --- | 0,09 | --- | ± 0,21 | --- | 0,027 | pass |
| --- | 2,52 ^c | --- | 2,57 | --- | 0,05 | --- | ± 0,21 | --- | 0,055 | pass |
| --- | 5,01 ^b | --- | 5,17 | --- | 0,16 | --- | ± 0,21 | --- | 0,102 | pass |

2) in accordance with the following table

²⁾ in accordance with the manufacturer gemäß Hersteller

Remarks Bemerkungen

MULTI POINT CALIBRATION REPORT

CUSTOMER NAME : ALS Laboratory Group (Thailand) Co.Ltd. (สาขาระยอง)

EQUIPMENT NAME : CO Analyzer

MANUFACTURER : Teledyne - API

MODEL : T300

SERIAL NO : 1215

STANDARD GAS CONCENTRATION (PPM) : 808.9

CERTIFIED DATE : CC739972

CYLINDER PRESSURE (psig) : 900

CERTIFIED DATE : Nov ,05 ,2020

CERTIFIED BY : AIRGAS SPECIALTY GASES

EXPIRED DATE : Nov ,05 ,2028

CALIBRATION RESULTS

| POINT NO | CALIBRATION RESULTS | | | |
|-------------|---------------------|-----------------|----------------|------------|
| | IDEAL (PPM) | ACTUAL CO (PPM) | ERROR CO (PPM) | % ERROR CO |
| ZERO | 0.00 | 0.011 | 0.011 | - |
| 1 | 40.00 | 40.037 | 0.037 | 0.092 |
| 2 | 80.00 | 79.642 | -0.358 | -0.448 |
| 3 | 199.20 | 196.853 | -2.347 | -1.178 |
| 4 | 400.60 | 397.132 | -3.468 | -0.866 |
| 5 | 808.90 | 809.250 | 0.350 | 0.043 |
| AVERAGE (%) | | | | 0.525 |

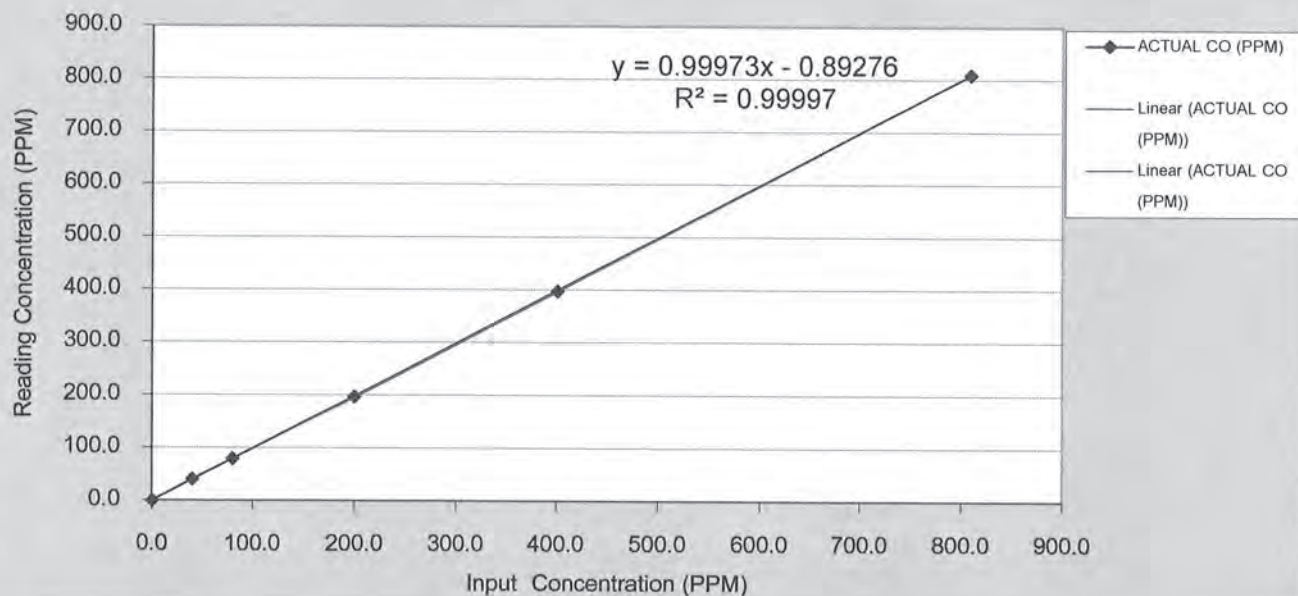
REVIEW BY

Thanitall.

APPROVED BY

NEXT CAL. DATE

26-11-2025



CALIBRATED BY : คุณธนาคม มหาอาจ

DATE : 26 พฤศจิกายน 2567

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : คุณธนาคม มหาอาจ โทรศัพท์ : 02-515-8987

รายงานผลการซ่อมและปรับเทียบอุปกรณ์ตรวจวัดคุณภาพอากาศ

ลูกค้า / หน่วยงาน : ALS Laboratory Group (Thailand) Co.Ltd. (สาขาระยอง)

วันที่ : 26 พฤศจิกายน 2567

รายชื่ออุปกรณ์ / เครื่องมือ : CO Analyzer

บริษัทผู้ผลิต : Teledyne API

รุ่นของอุปกรณ์ / เครื่องมือ : T300

หมายเลขอุปกรณ์ / เครื่องมือ : 1215

| TEST VALUES | | | |
|----------------|-------------------------------------|-------------------------------|-------------------------------|
| API MODEL T300 | | BEFORE | AFTER |
| 1 | RANGE 1 - 1000 PPM | 100 | 100 |
| 2 | STABILITY ≤ 1 PPM | 0.015 | 0.019 |
| 3 | CO MEASURE 2500 - 4800 mV | 3124.1 | 4122.9 |
| 4 | CO REFERENCE 2000 - 4800 mV | 2587.9 | 3406.3 |
| 5 | MR RATIO 1.1 - 1.3 | 1.218 | 1.218 |
| 6 | PRESSEURE 25 - 35 in - Hg-A | 29 | 29.3 |
| 7 | SAMPLE FLOW $800 \pm 10\%$ cc/min | 795 | 801 |
| 8 | SAMPLE TEMP 48 ± 4 °C | 45.1 | 45.5 |
| 9 | BENCH TEMP 48 ± 2 °C | 48 | 48 |
| 10 | WHEEL TEMP 68 ± 2 °C | 68 | 68.2 |
| 11 | BOX TEMP AMBIENT ± 5 °C | 34.5 | 34.6 |
| 12 | PHT DRIVE 250 - 4750 mV | 4166 | 4090.2 |
| 13 | CO SLOPE 1.0 ± 0.3 | 0.923 | 0.908 |
| 14 | CO OFFSET 0.0 ± 0.3 | 0.007 | 0.008 |
| 15 | CO READING (AMBIENT) PPM | 0.001 | 0.318 |
| 17 | VOLTAGE TEST +5 V +12 V +15 V -15 V | 5.21 / 12.11 / 16.92 / -15.29 | 5.21 / 12.11 / 16.92 / -15.29 |
| 18 | ZERO GAS 0.00 PPM | -0.403 | 0.011 |
| 19 | SPAN GAS 40.00 PPM | 39.635 | 40.037 |

หมายเหตุ

- ทำการเปลี่ยนวัสดุสิ้นเปลือง SS, Filter 1 ชิ้น, O-ring 2 ชิ้น, Spring 1 ชิ้น, Sample filter 47 mm. 1 ชิ้น

- ทำการ Calibrate Multi-Point



(คุณธนาคม มหาอาจ)

ลงนามเจ้าหน้าที่ (Signature)

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : QUALITYWELL
MODEL / TYPE : N/A
SERIAL NO. : VG02[RYG_FS0333]
CLID. NO. : 212300696
JOB CONTROL NO. : 241002105107
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN RD.,
KHWANG PHATTHANAKAN, KHET SUAN LUANG, BANGKOK 10250, THAILAND

DATE OF RECEIVED : 02 October 2024

DATE OF ISSUED : 04 October 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
04 October 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. Q24105107

F3-011-05/12-23

page 1 of 3



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VACUUM GAUGE
MANUFACTURER : QUALITYWELL
MODEL / TYPE : N/A
SERIAL NO. : VG02[RYG_FS0333]
DATE OF CALIBRATION : 03 October 2024

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. **Q24105107**

F3-011-05/12-23

page 2 of 3



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

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

CALIBRATION DATA

CORRECTION OF PRESSURE

| DUC Test point (inHg) | STD Reading (kPa) | | Conversion to inHg | | Correction (inHg) | |
|----------------------------|---------------------|--------|--------------------|--------|---------------------|-------|
| | Up | Down | Up | Down | Up | Down |
| -10.0 | -33.62 | -33.66 | -9.93 | -9.94 | +0.07 | +0.06 |
| -20.0 | -67.79 | -67.82 | -20.02 | -20.03 | -0.02 | -0.03 |
| -26.0 | -88.41 | -88.41 | -26.11 | -26.11 | -0.11 | -0.11 |
| -27.0 | -91.86 | -91.90 | -27.13 | -27.14 | -0.13 | -0.14 |
| -28.0 | -95.35 | -95.35 | -28.16 | -28.16 | -0.16 | -0.16 |

Uncertainty of measurement ± 0.08 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.

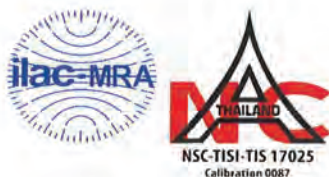
End of Certificate

Certificate No. Q24105107

F3-011-05/12-23

page 3 of 3

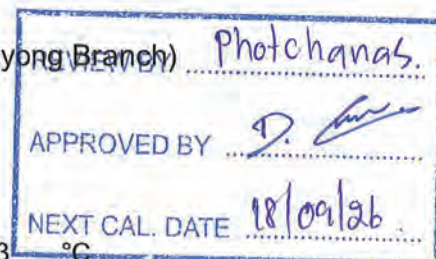




Certificate of Calibration

| | | | |
|-----------------------------|----------------------|-------------------------|---------------|
| Equipment: | SPECTROPHOTOMETER | Certificate No.: | C06250108 |
| Model: | DR6000 | Issued Date: | 18 March 2025 |
| Serial No. (or ID.): | 1627845 (RYG_EN0037) | Job No.: | WO-00064379 |
| Manufacturer: | HACH | Page: | 1 of 3 |
| Condition: | In Condition | | |

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.



Environment Condition:


| | | | | | |
|-------------|------|-----|---|-----|-----|
| Temperature | 24.4 | °C | ± | 0.3 | °C |
| Humidity | 60.8 | %RH | ± | 3.5 | %RH |

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.


Calibration By: Mr.Preecha Phooarsai
Calibration Date: 18 March 2025
The Method used: In house method, CAL-WI-24, base on ASTM E 275-08 and ASTM E 387-04

Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 111583 and 111584
The standard for Photometric Certificate No. 9114984 and 111588
The standard for Stray light Certificate No. 111586 and 111585
The standard for Spectral resolution Certificate No. 111587



 (Mr. Preecha Phooarsai)
 Person in charge



 (Miss Kaewkan Suradech)
 Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:
Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 2 nm and UUC at 2 nm

| Standard Wavelength | Unit Under Calibration | Correction | Uncertainty |
|---------------------|------------------------|------------|-------------|
| 418.61 | 418.5 | 0.11 | 0.13 |
| 536.66 | 536.7 | -0.04 | 0.13 |
| 637.98 | 638.3 | -0.32 | 0.13 |
| 748.48 | 748.8 | -0.32 | 0.13 |
| 807.03 | 807.5 | -0.47 | 0.13 |

Photometric Accuracy (Absorbance)

| Wavelength | Standard absorbance | Unit Under Calibration | Correction | Uncertainty |
|------------|---------------------|------------------------|------------|-------------|
| 420 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2930 | 0.291 | 0.0020 | 0.0045 |
| | 0.5168 | 0.518 | -0.0012 | 0.0045 |
| | 1.0298 | 1.031 | -0.0012 | 0.0045 |
| 440 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2867 | 0.285 | 0.0017 | 0.0045 |
| | 0.5073 | 0.508 | -0.0007 | 0.0045 |
| | 1.0083 | 1.009 | -0.0007 | 0.0045 |
| 465 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2516 | 0.250 | 0.0016 | 0.0045 |
| | 0.4595 | 0.461 | -0.0015 | 0.0045 |
| | 0.9334 | 0.935 | -0.0016 | 0.0045 |
| 546.1 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2461 | 0.246 | 0.0001 | 0.0045 |
| | 0.4652 | 0.466 | -0.0008 | 0.0045 |
| | 0.9468 | 0.948 | -0.0012 | 0.0045 |
| 590 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2594 | 0.259 | 0.0004 | 0.0045 |
| | 0.5040 | 0.505 | -0.0010 | 0.0045 |
| | 1.0032 | 1.004 | -0.0008 | 0.0045 |
| 635 nm | 0.0000 | 0.000 | 0.0000 | 0.0045 |
| | 0.2579 | 0.258 | -0.0001 | 0.0045 |
| | 0.4971 | 0.497 | 0.0001 | 0.0045 |
| | 0.9720 | 0.973 | -0.0010 | 0.0045 |

Calibration Results:
Without Adjustment
Photometric Accuracy (Absorbance)

| Wavelength | Standard absorbance | Unit Under Calibration | Correction | Uncertainty |
|------------|---------------------|------------------------|------------|-------------|
| 235 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.7355 | 0.738 | -0.0025 | 0.0080 |
| 257 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.8574 | 0.857 | 0.0004 | 0.0080 |
| 313 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.2864 | 0.290 | -0.0036 | 0.0080 |
| 350 nm | 0.0000 | 0.000 | 0.0000 | 0.0080 |
| | 0.6374 | 0.637 | 0.0004 | 0.0080 |

Stray light *

| Standard: cut-off | UUC: Wavelength (nm) | UUC: Transmission (%T) | Absorbance (A) |
|--------------------|----------------------|------------------------|----------------|
| 260.62 +/- 0.11 nm | 260.6 | 1.7 | 1.770 |
| 391.44 +/- 0.11 nm | 391.4 | 1.4 | 1.854 |

Spectral Resolution *

| Nominal Concentration 0.02 % v/v | Peak | Trough | Ratio | SBW |
|----------------------------------|--------|--------|-------|------|
| Standard Wavelength (nm) | 268.66 | 266.69 | 1.38 | 2.00 |
| UUC: Wavelength (nm) | 268.2 | 266.2 | | |
| Std Absorbance (A) | 0.4566 | 0.2780 | | |
| UUC: Absorbance (A) | 0.413 | 0.299 | | |

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064379

ชนิดเครื่องมือ: SPECTROPHOTOMETER

รุ่น: DR6000

หมายเลขเครื่อง: 1627845

| ตรวจสอบ (รับ) | | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) | | หมายเหตุ |
|-------------------------------------|--------------------------|---------------------------------------------------|-------------------------------------|--------------------------|-------------|
| 18 Mar 2025 | | | 18 Mar 2025 | | |
| ปกติ | ไม่ปกติ | | ปกติ | ไม่ปกติ | |
| | | General | | | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. ความสมบูรณ์เครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. ปุ่มกด (Keypad) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. หน้าจอ (Display, Screen Contrast) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | | Spectrophotometer | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. ความยาวคลื่น (Wavelength Check) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | * |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. แหล่งกำเนิดแสง (UV < 3,000 hour) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 13.5 Hours |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 10. แหล่งกำเนิดแสง (Visible < 5,000 hour) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | 893.0 Hours |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 11. ช่องวัดหลายตัวอย่าง (Carousel Module) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | | pH Meter and Conductivity Meter | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 12. อิเล็กโทรด (Electrode and Connection Cable) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 13. ระดับสารละลายใน Electrode (Level KCl) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 14. ฝาปิดกันปลาย Electrode (Dust Protection Hood) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 15. ขาจับอิเล็กโทรด (Stand) | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | Turbidimeter | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 16. ค่าความขุ่นที่ต่ำสุด (No Sample) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่เกิน 3.0) | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | Automatic titrator | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 18. สภาพ Piston Burettes | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 19. Function Rinsing and Dosing | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 20. ระบบท่อสายยางและอุปกรณ์ประกอบ | <input type="checkbox"/> | <input type="checkbox"/> | |

เพิ่มเติม/ข้อแนะนำ : * 656.1nm = 656.1nm

* 486.0nm = 485.7nm

Mr.Preecha Phooarsai

Service Engineer

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 25BKL0003

| | | |
|------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Object | Electronic non-automatic weighing instrument | This calibration certificate documents the traceability to national standards. |
| Manufacturer | Sartorius | Uncertainties of measurements are taken into account when only statements of compliance are made. |
| Type | MSU224S-100-DU | This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08. |
| Serial QM Ident. no. | 31709552 RYG_EN0003 | This certificate relate and apply this equipment only. |
| Customer | ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) | |
| | 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand. | |
| Order no. | 2230 | |
| Number of pages | 4 | |
| Date of calibration | 20 Feb 2025 | |

REVIEW BY

Thanitak.

APPROVED BY

D. Khunon.

NEXT CAL DATE.....

20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date 06 Mar 2025

Approval of the Calibration Certificate



Mr. Chonchai Inthana

Person in charge

Kachen Lalee

Calibration object

Single range instrument

| | |
|------------------------------|------------------|
| Model | MSU224S-100-DU |
| Serial Number | 31709552 |
| QM Ident. no Inventory no. | RYG_EN0003 --- |
| Maximum capacity (Max. load) | 220.0000 g |
| Measured range | 220.0000 g |
| Scale interval | 0.0001 g |

Place of calibration

| | |
|-------------------------------------------------------|------------------------------|
| Address | According to page 1 |
| Department Cost center | Laboratory Department. --- |
| Building Floor | --- 1st Floor. |
| Room | Balance Room. |
| Maximum temperature variation at place of calibration | 5 K |

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

| Test equipment type | Test equipment ID | Valid until |
|------------------------------|----------------------------------------------------------------|-------------|
| Thermometer | MHB-382SD s/nB011342 Traceable to SI unit through DKSH | 21 Aug 2025 |
| Test weight set OIML R111 E2 | Certificate No.M2308197S ,E2(Traceable to SI unit through TCS) | 23 Aug 2025 |

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

| | |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Date of calibration | 20 Feb 2025 |
| Temperature at place of calibration Temp. diff. <i>T</i> _{weights} - <i>T</i> _{place} | 24.7 °C 0.3 K |
| Measuring conditions | The installation site is suitable. The device was levelled. Balance was loaded up to Max before test. |
| Comments | Humidity 62.3 %RH. |

Measurement results | Measurement uncertainties

| | | | | |
|-----------------------------------|----------------------|----------------------|---------------------------------------------------|--|
| Repeatability | | | Eccentricity | |
| Test load (nominal): 10 g 200 g | | | Test load (nominal): 100 g | |
| | 10 g | 200 g | | |
| 1 | 10.0000 g | 200.0000 g | Center | |
| 2 | 10.0000 g | 200.0001 g | Front left | |
| 3 | 9.9999 g | 200.0000 g | Back left | |
| 4 | 10.0000 g | 200.0000 g | Back right | |
| 5 | 10.0000 g | 200.0001 g | Front right | |
| 6 | 9.9999 g | 200.0000 g | Maximum deviation from centric loading indication | |
| 7 | 10.0000 g | 200.0000 g | Δ _{ecc} max = 0.0001 g | |
| 8 | 10.0000 g | 200.0000 g | | |
| 9 | 10.0000 g | 200.0000 g | | |
| 10 | 10.0000 g | 200.0001 g | | |
| | <i>s</i> = 0.00004 g | <i>s</i> = 0.00005 g | | |

Error of indication

| Testload | Indication | Error | Expansion factor | Uncertainty | Uncertainty relative |
|-----------------------------|------------|--------------------------------------|------------------|-----------------------|--------------------------------------|
| <i>L</i> | <i>I</i> | <i>E</i> | <i>k</i> | <i>U</i> (<i>E</i>) | <i>U</i> _{rel} (<i>E</i>) |
| 0.0100 g | 0.0100 g | 0.0000 g | 2.00 | 0.00012 g | 1.2 % |
| 0.1000 g | 0.1000 g | 0.0000 g | 2.00 | 0.00013 g | 0.13 % |
| 0.5000 g | 0.5000 g | 0.0000 g | 2.00 | 0.00013 g | 0.026 % |
| 1.0000 g | 1.0000 g | 0.0000 g | 2.00 | 0.00013 g | 0.013 % |
| 5.0000 g | 5.0000 g | 0.0000 g | 2.00 | 0.00013 g | 0.0026 % |
| 10.0000 g | 10.0000 g | 0.0000 g | 2.00 | 0.00013 g | 0.0013 % |
| 20.0000 g | 20.0000 g | 0.0000 g | 2.00 | 0.00014 g | 0.00068 % |
| 50.0000 g | 50.0000 g | 0.0000 g | 2.00 | 0.00015 g | 0.00029 % |
| 100.0000 g | 100.0001 g | 0.0001 g | 2.00 | 0.00018 g | 0.00018 % |
| 200.0000 g | 200.0000 g | 0.0000 g | 2.00 | 0.00028 g | 0.00014 % |
| 220.0000 g | 220.0000 g | 0.0000 g | 2.00 | 0.00032 g | 0.00015 % |
| Maximum error of indication | | <i>E</i> _{max} = 0.0001 g | | | |

*U*_{rel}(*E*) is the quotient of *U*(*E*) and test load *L*. The uncertainty of measurement *U*(*E*) is valid only if error *E* is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

Device adjusted before measurement

Yes

Temperature deviation considered

1.5 K (isoCAL active)

Temperature coefficient considered

$1 \cdot 10^{-6}/\text{K}$

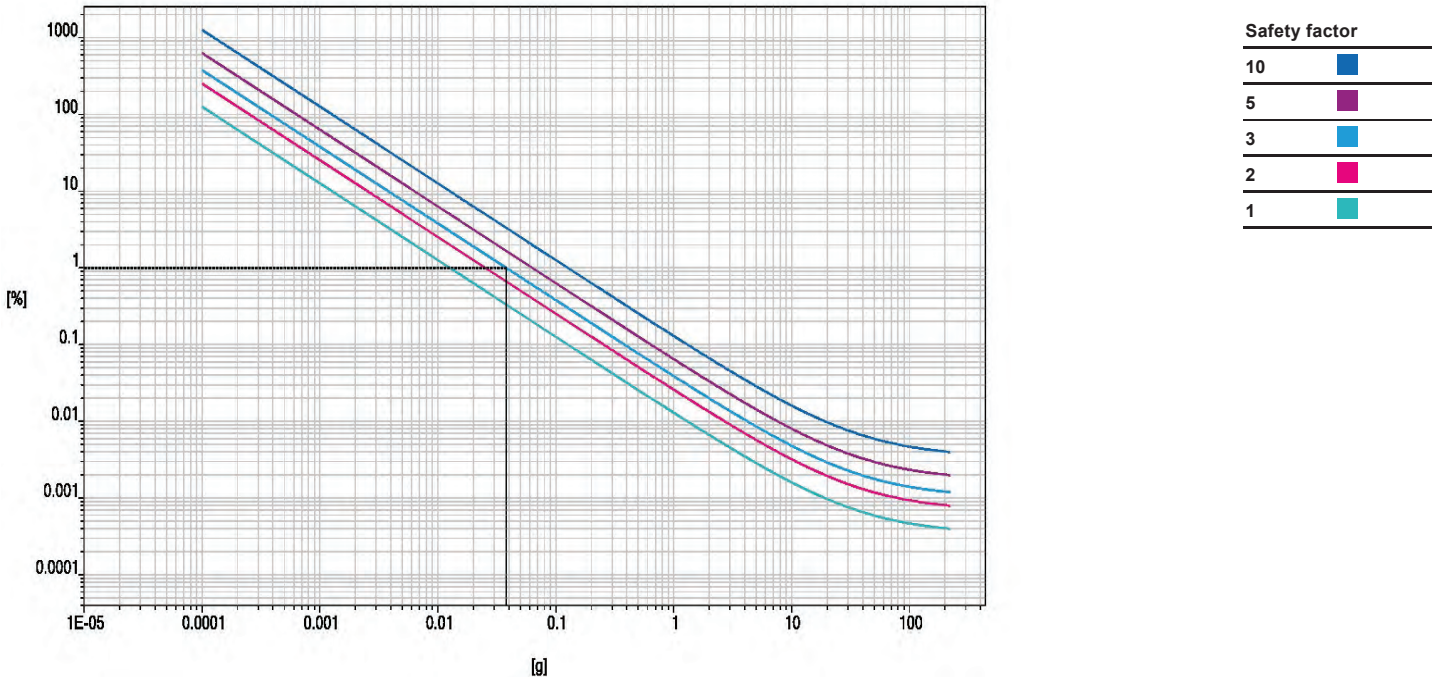
Uncertainty of the weighing result $U_{gl}(W)$

$U_{gl}(W) = 0.00013 \text{ g} + 3.42 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

| Indication in % from max load | Net indication R | Uncertainty $U_{gl}(W)$ | Uncertainty relative $U_{gl}(W)_{rel}$ |
|-------------------------------|-----------------------|----------------------------|-------------------------------------------|
| 1 % | 2.2000 g | 0.00014 g | 0.0063 % |
| 25 % | 55.0000 g | 0.00032 g | 0.00058 % |
| 50 % | 110.0000 g | 0.00051 g | 0.00046 % |
| 75 % | 165.0000 g | 0.00069 g | 0.00042 % |
| 100 % | 220.0000 g | 0.00088 g | 0.00040 % |

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy

1.00 %

Safety factor

3

Minimum sample weight

0.0380 g

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok
10250

Certificate No : 24-AFM-033

Request No : Req-2024-0241

Unit Under Calibration Details

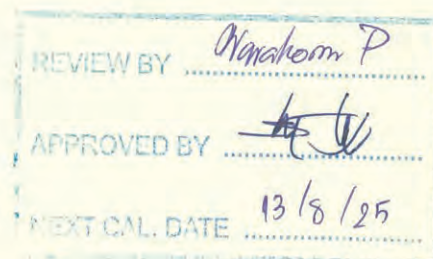
Measurement Item : Primary Flow Calibrator
Manufacturer : Bios
Model : Defender 510-L
Serial Number : 130027
ID : RYG_FS0208
Location of Calibration : LAB 4 AIR VELOCITY METER

Sensor Model : -

Sensor Serial Number : -

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 31 January 2024
Calibration Date : 13 February 2024



Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator


| Reference Standard | Model | Serial Number | Traceble | Due Calibration |
|--------------------|----------------------------|-----------------|-----------|------------------|
| Air Flow Meter | Gilibrator 3 Low flow | 18501010006 | Sensidyne | 12 July 2024 |
| Air Flow Meter | Gilibrator 3 Standard flow | 19031011003 | Sensidyne | 12 July 2024 |
| Temperature meter | GT 11 | 08000057 | Qreborn | 27 February 2024 |
| Pressure meter | CPG2400 | 41000KDU/651882 | TPA | 9 November 2024 |


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibration By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 13 February 2024

Certificate No : 24-AFM-033

Request No : Req-2024-0241

Result of Calibration : Without Adjustment

| Temperature (°C) | Pressure (kPa) | STD (cc/min) | UUC (cc/min) | Error (cc/min) | Uncertainty (cc/min) |
|---------------------|-------------------|-----------------|-----------------|-------------------|-------------------------|
| 24.50 | 101.26 | 20 | 19.965 | 0.0 | 1.3 |
| 24.20 | 101.25 | 101 | 100.50 | -0.5 | 2.8 |
| 24.00 | 101.31 | 200 | 199.13 | -0.9 | 5.6 |
| 23.90 | 101.42 | 301 | 303.56 | 2.6 | 8.4 |
| 24.10 | 101.41 | 401 | 404.57 | 4 | 11 |
| 24.10 | 101.49 | 480 | 483.81 | 3.8 | 7.0 |

Note

STD : Standard

UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate

P = Absolute Pressure

T = Absolute Temperature

Meas = Measurement Condition

ref = Standard Condition

* Indicates non accredited

End of Certificate

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang,
Bangkok 10250

Certificate No : 25-AFM-023

Request No : Req-2025-0169

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : Mesa Labs
Model : 200-510L
Serial Number : 130027
ID : RYG_FS0208

Accuracy : 1% of Reading

Sensor Model : -

Sensor Serial Number : -

Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 21 January 2025
Calibration Date : 27 January 2025

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

REVIEW BY 

APPROVED BY 

NEXT CAL DATE.....26/01/26.....

| Reference Standard | Model | Serial Number | Traceble | Due Calibration |
|--------------------|----------------------------|-----------------|-----------|-----------------|
| Air Flow Meter | Gilibrator 3 Low flow | 18501010006 | Sensidyne | 6 August 2025 |
| Air Flow Meter | Gilibrator 3 Standard flow | 19031011003 | Sensidyne | 2 August 2025 |
| Temperature meter | GT 11 | 08000057 | Qreborn | 1 March 2025 |
| Pressure meter | CPG2400 | 41000KDU/651882 | TPA | 21 October 2025 |

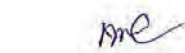
Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibration By :



Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :



Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date :

27 January 2025

Certificate No : 25-AFM-023

Request No : Req-2025-0169

Result of Calibration : Without Adjustment

| Temperature (° C) | Pressure (kPa) | STD (cc/min) | UUC (cc/min) | Error (cc/min) | Uncertainty (cc/min) | MPE (cc/min) | Result |
|------------------------|---------------------|-------------------|-------------------|---------------------|---------------------------|-------------------|--------|
| 22.50 | 100.90 | 20 | 19.854 | -0.1 | 1.3 | 0.2 | Pass1 |
| 22.50 | 100.90 | 50 | 49.732 | -0.3 | 3.3 | 0.5 | Pass1 |
| 22.60 | 100.90 | 101 | 100.77 | -0.2 | 2.8 | 1.0 | Pass1 |
| 22.70 | 100.90 | 151 | 150.23 | -0.8 | 4.2 | 1.5 | Pass1 |
| 22.70 | 100.90 | 201 | 200.39 | -0.6 | 5.6 | 2.0 | Pass1 |
| 22.70 | 100.90 | 301 | 300.69 | -0.3 | 8.4 | 3.0 | Pass1 |
| 22.80 | 100.90 | 400 | 402.96 | 3.0 | 11 | 4.0 | Pass1 |
| 23.10 | 100.90 | 500 | 504.62 | 4.6 | 7.2 | 5.0 | Pass1 |

Note STD : Standard UUC : Unit Under Calibration
 - UUC Reference Condition : At atmospheric pressure and room temperature condition
 - Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
 Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited
 MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)
 N/A = Not Aavailable, Customer does not require a statement of conformity.

Certificate No : 25-AFM-023

Request No : Req-2025-0169

Decision Rule for Statements of Conformity

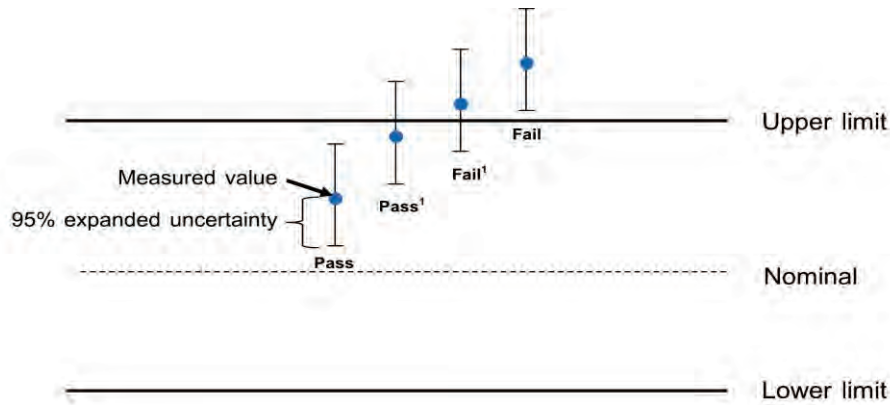
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate



Calibration Certificate

Certificate No. 610563
Product 200-510M Defender 510 Medium Flow
Serial No. 151114
Cal. Date 21-May-2024

Sold To:

All calibrations are performed in accordance with ISO 17025 at Mesa Laboratories, Inc., 12100 W. 6th Ave, Lakewood, CO 80228, an ISO 17025:2017 accredited laboratory through NVLAP. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

As Received Calibration Data

| | | | | | |
|--------------------|----------------------|---------------|--|---------------------|------------------|
| Technician | | Derek Dellape | | Lab. Pressure | 614.2 mmHg |
| | | | | Lab. Temperature | 24.3 °C |
| Instrument Reading | Lab Standard Reading | Deviation | | Allowable Deviation | As Received |
| 0 ccm | 4504.81 ccm | -100.0% | | 1.00% | Out of Tolerance |
| 0 ccm | 1000.98 ccm | -100.0% | | 1.00% | Out of Tolerance |
| 0 ccm | 249.55 ccm | -100.0% | | 1.00% | Out of Tolerance |

Mesa Laboratories Standards Used

| | | | |
|--------------------|-------------------------------|-------------------------|-----------------------------|
| Description | Standard Serial Number | Calibration Date | Calibration Due Date |
| ML-800-24 | 117991 | 13-Nov-2023 | 13-Nov-2024 |

| | |
|---------------|--------------------|
| REVIEW BY | <i>Naraku P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL DATE | 21/5/25 |

As Shipped Calibration Data

| | | | | |
|--------------------|----------------------|------------------|---------------------|--------------|
| Certificate No | 610563 | Lab. Pressure | 617 mmHg | |
| Technician | Derek Dellape | Lab. Temperature | 24.6 °C | |
| Instrument Reading | Lab Standard Reading | Deviation | Allowable Deviation | As Shipped |
| 4482.47 ccm | 4493.49 ccm | -0.25% | 1.00% | In Tolerance |
| 997.25 ccm | 996.83 ccm | 0.04% | 1.00% | In Tolerance |
| 248.51 ccm | 248.67 ccm | -0.06% | 1.00% | In Tolerance |

Mesa Laboratories Standards Used

| Description | Standard Serial Number | Calibration Date | Calibration Due Date |
|-------------|------------------------|------------------|----------------------|
| ML-800-24 | 211063 | 04-Oct-2023 | 04-Oct-2024 |

Calibration Notes

The expanded uncertainty of flow has a coverage factor of $k = 2$ for a confidence interval of approximately 95%.

Flow testing is in accordance with our test number MP-00672 with an expanded uncertainty of 0.27% using high-purity nitrogen or filtered laboratory air.

Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

Technician Notes:

By:

Approved By:



Derek Dellape
Production Assembler II



Troy Thacker
Quality Engineer

Mesa Laboratories, Inc. certifies that the above instrument meets or exceeds published specifications, and that the calibration results in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). Calibration results are in compliance with ISO/IEC 17025:2017. Calibrations process has a Test Uncertainty Ratio (TUR) of 4:1 or greater. Any Pass/Fail determination is made without taking measurement uncertainty into account and is based on UUT performance against required tolerance only.

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang,
Bangkok 10250

Certificate No : 24-AFM-179

Request No : Req-2024-1987

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : MesaLabs Accuracy : 1% of Reading
Model : Defender 510-M Sensor Model : -
Serial Number : 151114 Sensor Serial Number : -
ID : BKK_FS0614 Instrument Status : Used
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 30 August 2024
Calibration Date : 9 September 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator



| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------|----------------------------|-----------------|-----------|-----------------|
| Air Flow Meter | Gilibrator 3 Low flow | 18501010006 | Sensidyne | 6 August 2025 |
| Air Flow Meter | Gilibrator 3 Standard flow | 19031011003 | Sensidyne | 2 August 2025 |
| Temperature meter | GT 11 | 08000057 | Qreborn | 1 March 2025 |
| Pressure meter | CPG2400 | 41000KDU/651882 | TPA | 9 November 2024 |

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibration By : [Signature]
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : [Signature]
Mr. Pacit Mathavorn
Calibration Engineer Supervisor
Issue Date : 9 September 2024

Certificate No : 24-AFM-179

Request No : Req-2024-1987

Result of Calibration : Without Adjustment

| Temperature (°C) | Pressure (kPa) | STD (cc/min) | UUC (cc/min) | Error (cc/min) | Uncertainty (cc/min) | MPE (cc/min) | Result |
|---------------------|-------------------|-----------------|-----------------|-------------------|-------------------------|-----------------|--------|
| 24.70 | 100.95 | 100 | 100.41 | 0.4 | 2.8 | 1.0 | N/A |
| 24.90 | 100.90 | 502 | 500.47 | -1.5 | 7.1 | 5.0 | N/A |
| 24.90 | 100.97 | 1003 | 1001.3 | -2 | 14 | 10.0 | N/A |
| 25.00 | 100.92 | 2014 | 2009.9 | -4 | 29 | 20.1 | N/A |
| 25.20 | 101.03 | 3043 | 3058.3 | 15 | 44 | 30.4 | N/A |
| 25.30 | 101.10 | 4043 | 4005.1 | -38 | 57 | 40.4 | N/A |
| 25.50 | 101.15 | 5052 | 5003.9 | -48 | 74 | 50.5 | N/A |

Note

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

Certificate No : 24-AFM-179

Request No : Req-2024-1987

Decision Rule for Statements of Conformity

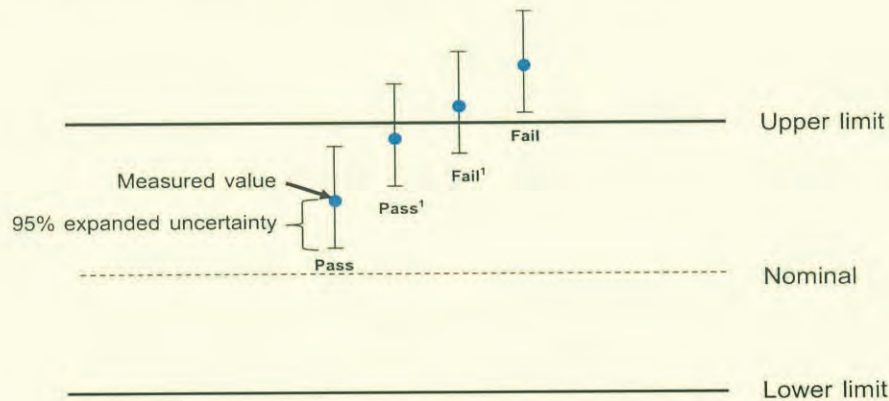
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Passⁱ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Failⁱ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang,
Bangkok 10250

Certificate No : 24-AFM-177

Request No : Req-2024-1862

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : Bios

Accuracy : 1% of Reading

Model : Defender 510-L

Sensor Model : -

Serial Number : 130026

Sensor Serial Number : -

ID : BKK_FS0619

Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

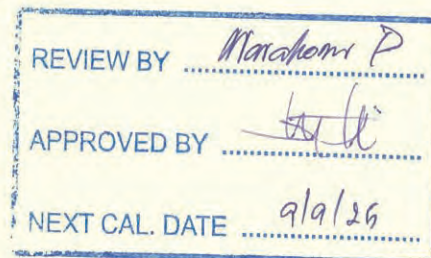
Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 22 August 2024

Calibration Date : 9 September 2024

Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator



| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------|----------------------------|-----------------|-----------|-----------------|
| Air Flow Meter | Gilibrator 3 Low flow | 18501010006 | Sensidyne | 6 August 2025 |
| Air Flow Meter | Gilibrator 3 Standard flow | 19031011003 | Sensidyne | 2 August 2025 |
| Temperature meter | GT 11 | 08000057 | Qreborn | 1 March 2025 |
| Pressure meter | CPG2400 | 41000KDU/651882 | TPA | 9 November 2024 |

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibration By : *[Signature]*
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : *[Signature]*
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 9 September 2024

Certificate No : 24-AFM-177

Request No : Req-2024-1862

Result of Calibration : Without Adjustment

| Temperature (°C) | Pressure (kPa) | STD (cc/min) | UUC (cc/min) | Error (cc/min) | Uncertainty (cc/min) | MPE (cc/min) | Result |
|---------------------|-------------------|-----------------|-----------------|-------------------|-------------------------|-----------------|--------|
| 24.70 | 100.92 | 20 | 20.192 | 0.2 | 1.3 | 0.2 | N/A |
| 24.70 | 100.90 | 100 | 99.923 | -0.1 | 2.8 | 1.0 | N/A |
| 24.70 | 100.94 | 201 | 200.7 | -0.3 | 5.6 | 2.0 | N/A |
| 24.70 | 100.97 | 298 | 300.1 | 2.1 | 8.4 | 3.0 | N/A |
| 24.70 | 100.99 | 403 | 399.1 | -4 | 11 | 4.0 | N/A |
| 24.80 | 101.05 | 482 | 477.6 | -4.4 | 6.9 | 4.8 | N/A |

Note

STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At atmospheric pressure and room temperature condition

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

Certificate No : 24-AFM-177

Request No : Req-2024-1862

Decision Rule for Statements of Conformity

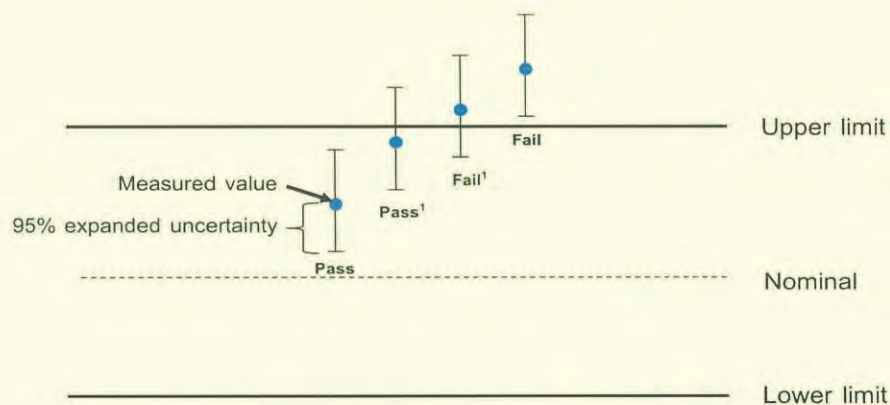
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 25BKL0006

| | | |
|------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Object | Electronic non-automatic weighing instrument | This calibration certificate documents the traceability to national standards. |
| Manufacturer | Sartorius | Uncertainties of measurements are taken into account when only statements of compliance are made. |
| Type | MSE125P-100-DU | This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08. |
| Serial QM Ident. no. | 33108993 RYG_EN0004 | This certificate relate and apply this equipment only. |
| Customer | ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) | |
| | 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand. | |
| Order no. | 2230 | |
| Number of pages | 4 | |
| Date of calibration | 20 Feb 2025 | |

REVIEW BY

Thanitak.

APPROVED BY

D. Khunon

NEXT CAL DATE.....

20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

Date 06 Mar 2025

Approval of the Calibration Certificate



Mr. Chonchai Inthana

Person in charge

Kachen Lalee

Calibration object

Multi interval instrument

| | | |
|------------------------------|------------------|------------|
| Model | MSE125P-100-DU | |
| Serial Number | 33108993 | |
| QM Ident. no Inventory no. | RYG_EN0004 --- | |
| Range | 1 | 2 |
| Maximum capacity (Max. load) | 60.00000 g | 120.0000 g |
| Measured range | 60.00000 g | 120.0000 g |
| Scale interval | 0.00001 g | 0.0001 g |

Place of calibration

| | |
|-------------------------------------------------------|------------------------------|
| Address | According to page 1 |
| Department Cost center | Laboratory Department. --- |
| Building Floor | --- 1st Floor. |
| Room | Balance Room. |
| Maximum temperature variation at place of calibration | 5 K |

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

| Test equipment type | Test equipment ID | Valid until |
|------------------------------|----------------------------------------------------------------|-------------|
| Thermometer | MHB-382SD s/nB011342 Traceable to SI unit through DKSH | 21 Aug 2025 |
| Test weight set OIML R111 E2 | Certificate No.M2308197S ,E2(Traceable to SI unit through TCS) | 23 Aug 2025 |

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

| | |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Date of calibration | 20 Feb 2025 |
| Temperature at place of calibration Temp. diff. <i>T</i> _{weights} - <i>T</i> _{place} | 24.2 °C 0.3 K |
| Measuring conditions | The installation site is suitable. The device was levelled. Balance was loaded up to Max before test. |
| Comments | Humidity 62.5 %RH. |

Measurement results | Measurement uncertainties

Repeatability

| Test load (nominal): 50 g 100 g | | |
|-----------------------------------|-----------------------|----------------------|
| | 50 g | 100 g |
| 1 | 50.00002 g | 100.0000 g |
| 2 | 50.00001 g | 100.0000 g |
| 3 | 50.00003 g | 100.0000 g |
| 4 | 50.00002 g | 100.0000 g |
| 5 | 50.00001 g | 100.0000 g |
| 6 | 50.00002 g | 99.9999 g |
| 7 | 50.00002 g | 100.0000 g |
| 8 | 50.00001 g | 100.0000 g |
| 9 | 50.00001 g | 100.0000 g |
| 10 | 50.00002 g | 100.0000 g |
| | <i>s</i> = 0.000007 g | <i>s</i> = 0.00003 g |

Eccentricity

| Test load (nominal): 50 g | |
|------------------------------------------------------------------------------------------------|------------|
| Center | 50.00002 g |
| Front left | 50.00000 g |
| Back left | 50.00000 g |
| Back right | 50.00001 g |
| Front right | 50.00003 g |
| Maximum deviation from centric loading indication $ \Delta_{ecc} _{max} = 0.00002\text{ g}$ | |

Error of indication

| Testload <i>L</i> | Indication <i>I</i> | Error <i>E</i> | Expansion factor <i>k</i> | Uncertainty <i>U</i> (<i>E</i>) | Uncertainty relative <i>U</i> _{rel} (<i>E</i>) |
|-----------------------------|------------------------|--------------------------------|------------------------------|--------------------------------------|--------------------------------------------------------------|
| 0.01000 g | 0.01000 g | 0.00000 g | 2.00 | 0.000024 g | 0.24 % |
| 0.10000 g | 0.10000 g | 0.00000 g | 2.00 | 0.000037 g | 0.037 % |
| 1.00000 g | 1.00000 g | 0.00000 g | 2.00 | 0.000037 g | 0.0037 % |
| 5.00002 g | 5.00002 g | 0.00000 g | 2.00 | 0.000050 g | 0.0010 % |
| 20.00002 g | 20.00002 g | 0.00000 g | 2.00 | 0.000069 g | 0.00034 % |
| 55.00004 g | 55.00003 g | -0.00001 g | 2.00 | 0.00017 g | 0.00031 % |
| 70.0000 g | 70.0000 g | 0.0000 g | 2.00 | 0.00017 g | 0.00024 % |
| 80.0001 g | 80.0001 g | 0.0000 g | 2.00 | 0.00018 g | 0.00023 % |
| 100.0000 g | 100.0000 g | 0.0000 g | 2.00 | 0.00017 g | 0.00017 % |
| 110.0000 g | 110.0000 g | 0.0000 g | 2.00 | 0.00028 g | 0.00025 % |
| 120.0000 g | 119.9999 g | -0.0001 g | 2.00 | 0.00028 g | 0.00023 % |
| Maximum error of indication | | $ E _{max} = 0.00010\text{ g}$ | | | |

*U*_{rel}(*E*) is the quotient of *U*(*E*) and test load *L*. The uncertainty of measurement *U*(*E*) is valid only if error *E* is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

| | |
|------------------------------------|----------------------------|
| Device adjusted before measurement | Yes |
| Temperature deviation considered | 1.5 K (isoCAL active) |
| Temperature coefficient considered | $1 \cdot 10^{-6}/\text{K}$ |

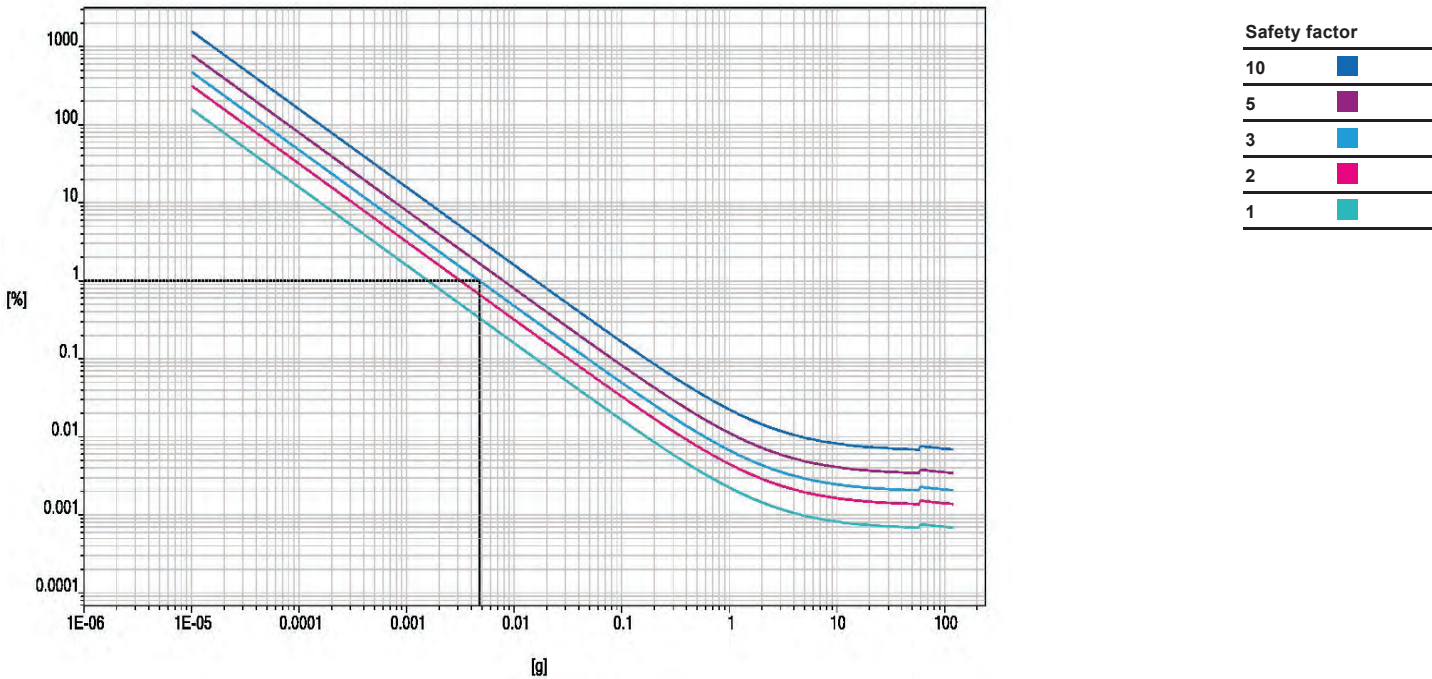
Uncertainty of the weighing result $U_{gl}(W)$

| | |
|----------------------------------------------------|---------------------------------------------------------------|
| Partial weighing range 1 0.00000 g...60.00000 g | $U_{gl}(W) = 0.000016 \text{ g} + 6.61 \cdot 10^{-6} \cdot R$ |
| Partial weighing range 2 60.00000 g...120.0000 g | $U_{gl}(W) = 0.000086 \text{ g} + 6.19 \cdot 10^{-6} \cdot R$ |

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

| Indication in % from Max1 | Net indication R | Uncertainty $U_{gl}(W)$ | Uncertainty relative $U_{gl}(W)_{rel}$ |
|---------------------------|-----------------------|----------------------------|-------------------------------------------|
| 1 % | 0.60000 g | 0.000020 g | 0.0033 % |
| 25 % | 15.00000 g | 0.00012 g | 0.00077 % |
| 50 % | 30.00000 g | 0.00021 g | 0.00071 % |
| 75 % | 45.00000 g | 0.00031 g | 0.00070 % |
| 100 % | 60.00000 g | 0.00041 g | 0.00069 % |

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

| | |
|-----------------------|-----------|
| Process accuracy | 1.00 % |
| Safety factor | 3 |
| Minimum sample weight | 0.00474 g |

Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GM-3
Organization Name: ALS Laboratory Group
Organization Location: 104 Phattanakan40, Suan Luang Bangkok 10250
Date: October 25, 2024 12:05:35 PM
EQP Name: AgilentRecommended , AgilentRecommended
EQP Revision: GC.02.52, GCMS.02.53
Overall Qualification Status: Pass

| | |
|----------------|--------------------|
| REVIEW BY | <i>C. V. S.</i> |
| APPROVED BY | <i>Tamraton M.</i> |
| NEXT CAL. DATE | 25/4/2026 |

CDS Logon Verification - GC

Logon: asbkk.env03

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front SSL

Setpoint Status: Pass

| | Setpoint | Actual |
|----------------------|----------|----------|
| Inlet Pressure: | 25.0 psi | 24.9 psi |
| Accuracy: | | 0.1 psi |
| Agilent Recommended: | | <= 1.2 |

Date: October 25, 2024 12:05:35 PM
System ID: GM-3

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 230.9 °C

Accuracy: 0.9 °C

Agilent Recommended: >= -1.0 % setpoint in K (-5.0 °C)
<= 1.0 % setpoint in K (5.0 °C)

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.4 °C

Accuracy: 0.4 °C

Agilent Recommended: >= -1.0 % setpoint in K (-3.7 °C)
<= 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.3333 °C

Stability: 0.1 °C

Agilent Recommended: <= 0.5

Overall GC Oven Temperature Stability Test Status

Pass

Log Amp

Tested Combination1

Front

SSL

/ External

SQ

Name:

5975C inert XL with TAD

Setpoint Status:

Pass

Overall Log Amp Test Status

Pass

RFPA

Tested Combination1

Front

SSL

/ External

SQ

Name:

5975C inert XL with TAD

Setpoint Status:

Pass

Amu:

1050

m/z

Drift After Five Minutes:

11

mV

RFPA Voltage:

524

mV

Agilent Recommended:

>=

-100

and

<=

100

<=

1100

Overall RFPA Test Status

Pass

Tune EI

Tested Combination1

Front

SSL

/ External

SQ

Name:

5975C inert XL with TAD

Setpoint Status:

Pass

Filament:

1

Setpoint Status:

Pass

Filament:

2

Overall Tune EI Test Status

Pass

Scouting Run

Date:

October 25, 2024 12:05:35 PM

System ID:

GM-3

Tested Combination1

Front

SSL

/ External

SQ

Injection Tower

Name:

7693A

Source:

EI - Inert

Setpoint Status:

Completed

Injection Volume on Column:

1.0

uL

Overall Scouting Run Status

Completed

Signal to Noise EI

Tested Combination1

Front

SSL

/ External

SQ

Name:

5975C inert XL with TAD

Source:

EI - Inert

Filament:

1

Setpoint Status:

Pass

Signal to Noise:

1572

Agilent Recommended:

>=

320

Source:

EI - Inert

Filament:

2

Setpoint Status:

Pass

Signal to Noise:

1541

Agilent Recommended:

>=

320

Overall Signal to Noise EI Test Status

Pass

Injection Precision

Tested Combination1

Front

SSL

/ External

SQ

Name:

7693A

Source:

EI - Inert

Date:

October 25, 2024 12:05:35 PM

System ID:

GM-3

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area RSD: 0.61 %

Retention Time RSD: 0.01 %

Agilent Recommended: <= 5.00

<= 1.00

Overall Injection Precision Test Status

Pass

Mass Ratio Precision

Tested Combination1 Front SSL / External SQ

Injection Tower

Name: 7693A

Source: EI - Inert

Setpoint Status: Pass

Injection Volume on Column: 1.0 uL

Area Mass 1

Mass Ratio

Abundance*s

RSD: 0.61 %

0.33 %

Agilent Recommended: <= 5.00

<= 5.00

Pass

Pass

Overall Mass Ratio Precision Test Status

Pass

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

| | |
|------------------------|-----------------------------------|
| System ID | GM-3 |
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Flow Data Input | Manual Data |
| Temperature Data Input | Manual Data or Other Data Logging |

Tested Combination1

| | |
|---------------------|-----------------|
| Injection Technique | Injection Tower |
| Inlet | Front |
| Detector | External |
| LTM Included? | No |

Sampler 1

| | |
|---------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Type | Injection Tower |
| Name | 7693A |
| Model Number | G4513A |
| Serial Number | CN12520102 |
| Firmware Revision | A.10.07 |
| Usage | Sample Injection |
| Location | Front |
| Syringe Volume (µL) | 10 |

Mainframe 1

| | |
|-------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Model Number | G3440A |
| Serial Number | CN12521119 |
| Firmware Revision | A.01.14 |
| Oven Type | Standard |

Inlet 1

| | |
|--------------|-----------------------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Type | SSL |
| Location | Front |
| Carrier Gas | Helium |
| Control Type | Electronic Pressure Control (EPC) |
| Purged Inlet | Yes |

Detector 1

| | |
|--------------|----------------------|
| Manufacturer | Agilent Technologies |
| Name | Mass Spectrometer |
| Type | Mass Spectrometer |
| Location | External |

Mass Spectrometer 1

| | |
|-----------------------|-------------------------|
| Manufacturer | Agilent Technologies |
| Type | SQ |
| Name | 5975C inert XL with TAD |
| Model Number | G3172A |
| Serial Number | US13013A11 |
| Firmware Revision | 7.02.29 |
| High Vacuum System | Turbo Pump |
| Scouting Run Standard | MRP Std |

MS EI Source 1

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

Electronic Signature

Purpose

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

Details

| | |
|--------------------------|-------------------------------------------------------------------|
| Full Name of Signer: | Adirek Rattanawijit |
| Logged On User Name: | adirek.rattanawijit@non.agilent.com |
| Signature Creation Date: | October 25, 2024 |
| Reason for Signature: | Executed protocol and published this original version of document |

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User Name: adirek.rattanawijit

System Id: GM-3

Report Generated by Hostname: ASBKKWX314

Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| October 25, 2024 10:33:46 AM | Audit | SessionCreated | Session | None |
| October 25, 2024 10:33:46 AM | Start | Configuration | Session | None |
| October 25, 2024 10:33:46 AM | Audit | Entitlement | Licensing | User is Nonpaying and does not require an unlock code |
| October 25, 2024 10:41:54 AM | Audit | EqpLoaded | Session | EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurations/02.52/Gc.02.52.eqp], EQP File Name: [Gc.02.52.eqp], EQP Name: [AgilentRecommended], Protocol Revision :[Gc.02.52] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Configurations/02.53/GcMs.02.53.eqp], EQP File Name: [GcMs.02.53.eqp], EQP Name: [AgilentRecommended] |
| October 25, 2024 10:42:30 AM | End | Configuration | Session | None |
| October 25, 2024 10:42:32 AM | Start | Qualification | Session | OQ |
| October 25, 2024 10:42:32 AM | Start | Execution | CDS Logon Verification - GC : - Qualitative test | None |
| October 25, 2024 10:45:20 AM | End | Execution | CDS Logon Verification - GC : - Qualitative test | Run Count : 1 |

User Name: adirek.rattanawijit
Report Generated by Hostname: ASBKKWX314

System Id: GM-3
Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|----------------------------------------------------------------------------------------------------------------|----------------------|
| October 25, 2024 10:45:22 AM | Start | Execution | System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated | None |
| October 25, 2024 10:45:32 AM | End | Execution | System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated | Run Count : 1 |
| October 25, 2024 10:45:34 AM | Start | Execution | Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi | None |
| October 25, 2024 10:45:38 AM | End | Execution | Inlet Pressure Accuracy - Front SSL: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi | Run Count : 1 |
| October 25, 2024 10:45:40 AM | Start | Execution | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | None |
| October 25, 2024 10:46:50 AM | Audit | Data | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Manual Data Entry |
| October 25, 2024 10:46:52 AM | End | Execution | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Run Count : 1 |
| October 25, 2024 10:46:54 AM | Start | Execution | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | None |
| October 25, 2024 10:47:21 AM | Audit | Data | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Manual Data Entry |

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User Name: adirek.rattanawijit

System Id: GM-3

Report Generated by Hostname: ASBKWX314

Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|----------------------------------------------------------------------------------------------------------------|----------------------|
| October 25, 2024 10:47:22 AM | End | Execution | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Run Count : 1 |
| October 25, 2024 10:47:23 AM | Start | Execution | GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C | None |
| October 25, 2024 10:48:14 AM | Audit | Data | GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C | Manual Data Entry |
| October 25, 2024 10:48:15 AM | End | Execution | GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C | Run Count : 1 |
| October 25, 2024 10:48:20 AM | Start | Execution | Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Inert | None |
| October 25, 2024 10:52:15 AM | End | Execution | Log Amp - 5975C inert XL with TAD SQ: - Source: EI - Inert | Run Count : 1 |
| October 25, 2024 10:52:18 AM | Start | Execution | RFPA - 5975C inert XL with TAD SQ: - Source: EI - Inert | None |
| October 25, 2024 10:55:41 AM | Start | Execution | Tune EI - 5975C inert XL with TAD SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated) | None |
| October 25, 2024 10:56:55 AM | End | Execution | Tune EI - 5975C inert XL with TAD SQ: - Source: EI - Inert Filament 1 (Qualitative - No setpoints associated) | Run Count : 1 |
| October 25, 2024 10:56:58 AM | Start | Execution | Tune EI - 5975C inert XL with TAD SQ: - Source: EI - Inert Filament 2 (Qualitative - No setpoints associated) | None |

User Name: adirek.rattanawijit

System Id: GM-3

Report Generated by Hostname: ASBKKWX314

Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| October 25, 2024 10:57:25 AM | End | Execution | Tune EI - 5975C Inert XL with TAD SQ: - Source: - EI - Inert Filament 2 (Qualitative - No setpoints associated) | Run Count : 1 |
| October 25, 2024 10:57:32 AM | Start | Execution | Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Inert- Part of GCMS System Preparation | None |
| October 25, 2024 10:59:48 AM | Audit | Data | Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Inert- Part of GCMS System Preparation | Data files Path : D:\MassHunter\GCMS\1\data\OQPV2024\Scout_001.D |
| October 25, 2024 11:00:27 AM | Audit | Reporting | Reintegration | Reintegration Count: 1 -- [Integration Type: injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 50000; Integration: Off at 0; Integration: On at 5.2;] |
| October 25, 2024 11:00:31 AM | End | Execution | Scouting Run - Injection Tower, Front SSL, SQ: - Source: - EI - Inert- Part of GCMS System Preparation | Run Count : 1 |
| October 25, 2024 11:00:39 AM | Start | Execution | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320 | None |
| October 25, 2024 11:01:11 AM | Start | Execution | RFPA - 5975C inert XL with TAD SQ: - Source: EI - Inert | None |
| October 25, 2024 11:01:37 AM | End | Execution | RFPA - 5975C Inert XL with TAD SQ: - Source: EI - Inert | Run Count : 1 |

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User Name: adirek.rattanawijit

System Id: GM-3

Report Generated by Hostname: ASBKKWX314

Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| October 25, 2024 11:01:51 AM | Start | Execution | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320 | None |
| October 25, 2024 11:02:02 AM | Audit | Data | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320 | Data files Path : D:\MassHunter\GCMS1\data VQPV2024\SN_F1_001.D |
| October 25, 2024 11:04:30 AM | Audit | Reporting | Reintegration | Reintegration Count: 1 -- [Integration Type: injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 1000; Integration: Off at 0; Integration: On at 4; Integration: Off at 5.6;] |
| October 25, 2024 11:04:41 AM | Audit | Reporting | Reintegration | Reintegration Count: 2 -- [Integration Type: injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 2000; Integration: Off at 0; Integration: On at 4; Integration: Off at 5.6;] |

User Name: adirek.rattanawijit

System Id: GM-3

Report Generated by Hostname: ASBKKWX314

Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| October 25, 2024 11:04:50 AM | Audit | Reporting | Reintegration | Reintegration Count: 3 -- [Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 2200; Integration: Off at 0; Integration: On at 4; Integration: Off at 5.6;] |
| October 25, 2024 11:05:02 AM | Audit | Reporting | Reintegration | Reintegration Count: 4 -- [Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 3000; Integration: Off at 0; Integration: On at 4; Integration: Off at 5.6;] |
| October 25, 2024 11:05:09 AM | Audit | Reporting | Reintegration | Reintegration Count: 5 -- [Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 4000; Integration: Off at 0; Integration: On at 4; Integration: Off at 5.6;] |
| October 25, 2024 11:16:07 AM | Start | Execution | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320 | None |

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User Name: adftek.rattanawijit
Report Generated by Hostname: ASBKWX314

System Id: GM-3
Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| October 25, 2024 11:28:50 AM | Start | Execution | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320 | None |
| October 25, 2024 11:29:20 AM | End | Execution | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 1 - L: >= 320 | Run Count : 1 |
| October 25, 2024 11:29:23 AM | Start | Execution | Injection Precision - Injection Tower, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00% | None |
| October 25, 2024 11:29:36 AM | Audit | Data | Injection Precision - Injection Tower, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00% | Data files Path : D:\MassHunter\GCMS\1\data IQPV2024\MRP_002.D |
| October 25, 2024 11:29:36 AM | Audit | Data | Injection Precision - Injection Tower, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00% | Data files Path : D:\MassHunter\GCMS\1\data IQPV2024\MRP_003.D |
| October 25, 2024 11:29:36 AM | Audit | Data | Injection Precision - Injection Tower, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00% | Data files Path : D:\MassHunter\GCMS\1\data IQPV2024\MRP_004.D |
| October 25, 2024 11:29:36 AM | Audit | Data | Injection Precision - Injection Tower, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00% | Data files Path : D:\MassHunter\GCMS\1\data IQPV2024\MRP_005.D |
| October 25, 2024 11:29:37 AM | Audit | Data | Injection Precision - Injection Tower, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00% | Data files Path : D:\MassHunter\GCMS\1\data IQPV2024\MRP_006.D |

User Name: adirek.rattanawijit
Report Generated by Hostname: ASBKKWX314

System Id: GM-3
Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| October 25, 2024 11:29:37 AM | Audit | Data | Injection Precision - Injection Tower, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00% | Data files Path : D:\MassHunter\GCMS\1\data\OQPV2024\MRP_007.D |
| October 25, 2024 11:29:47 AM | Audit | Reporting | Reintegration | Reintegration Count: 1 -- [Integration Type: Injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 50000; Integration: Off at 0; Integration: On at 5.2;] |
| October 25, 2024 11:29:48 AM | End | Execution | Injection Precision - Injection Tower, Front SSL, SQ: - Source: - EI - Inert L (Area): <= 5.00% - L (Ret. Time): <= 1.00% | Run Count : 1 |
| October 25, 2024 11:29:51 AM | Start | Execution | Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00% | None |
| October 25, 2024 11:30:04 AM | Audit | Data | Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00% | Data files Path : D:\MassHunter\GCMS\1\data\OQPV2024\MRP_002.D |
| October 25, 2024 11:30:04 AM | Audit | Data | Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00% | Data files Path : D:\MassHunter\GCMS\1\data\OQPV2024\MRP_003.D |
| October 25, 2024 11:30:04 AM | Audit | Data | Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00% | Data files Path : D:\MassHunter\GCMS\1\data\OQPV2024\MRP_004.D |

User Name: adirek.rattanawijit

System Id: GM-3

Report Generated by Hostname: ASBKWX314

Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| October 25, 2024 11:30:04 AM | Audit | Data | Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00% | Data files Path : D:\MassHunter\GCMS\1\data \\OQPV2024\MRP_005.D |
| October 25, 2024 11:30:04 AM | Audit | Data | Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00% | Data files Path : D:\MassHunter\GCMS\1\data \\OQPV2024\MRP_006.D |
| October 25, 2024 11:30:04 AM | Audit | Data | Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00% | Data files Path : D:\MassHunter\GCMS\1\data \\OQPV2024\MRP_007.D |
| October 25, 2024 11:30:15 AM | Audit | Reporting | Reintegration | Reintegration Count: 1 -- [Integration Type: injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 50000; Integration: Off at 0; Integration: On at 5.2;] |
| October 25, 2024 11:30:17 AM | End | Execution | Mass Ratio Precision - Injection Tower, Front SSL, SQ: - Source: EI - Inert - L (RSD): <= 5.00% | Run Count : 1 |
| October 25, 2024 11:30:23 AM | End | Qualification | Session | OQ |
| October 25, 2024 11:30:23 AM | Start | Reporting | Session | None |
| October 25, 2024 11:34:59 AM | End | Reporting | Session | None |
| October 25, 2024 11:34:59 AM | Start | Qualification | Session | OQ |

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Date:
System ID:October 25, 2024 12:05:35 PM
GM-3

User Name: adirek.rattanawijit

System Id: GM-3

Report Generated by Hostname: ASBKKWX314

Print Date: October 25, 2024 12:05:37 PM

ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| October 25, 2024 11:44:32 AM | Start | Execution | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320 | None |
| October 25, 2024 11:44:39 AM | Audit | Data | DataManager | DataManager was in a data verification state but the user chose to start over |
| October 25, 2024 11:44:42 AM | Audit | Data | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320 | Data files Path : D:\MassHunter\GCMS\1\data \OQPV2024\SN_F2_001.D |
| October 25, 2024 11:44:53 AM | Audit | Reporting | Reintegration | Reintegration Count: 1 -- [Integration Type: injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 1000; Integration: Off at 0; Integration: On at 4;] |
| October 25, 2024 11:45:20 AM | Audit | Reporting | Reintegration | Reintegration Count: 2 -- [Integration Type: injections; BaselineCorrectionMode: Advanced; InitialSlopeSensitivity: 10; InitialPeakWidth: 0.01; InitialAreaReject: 0; InitialHeightReject: 1000; Integration: Off at 0; Integration: On at 5; Integration: Off at 7;] |
| October 25, 2024 11:45:34 AM | End | Execution | Signal to Noise EI - Injection Tower, Front SSL, SQ: - Source: EI - Inert using Filament 2 - L: >= 320 | Run Count : 1 |

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Date:
System ID:October 25, 2024 12:05:35 PM
GM-3

User Name: adirek.rattanawijit

System Id: GM-3

Report Generated by Hostname: ASBKKWX314

Print Date: October 25, 2024 12:05:37 PM

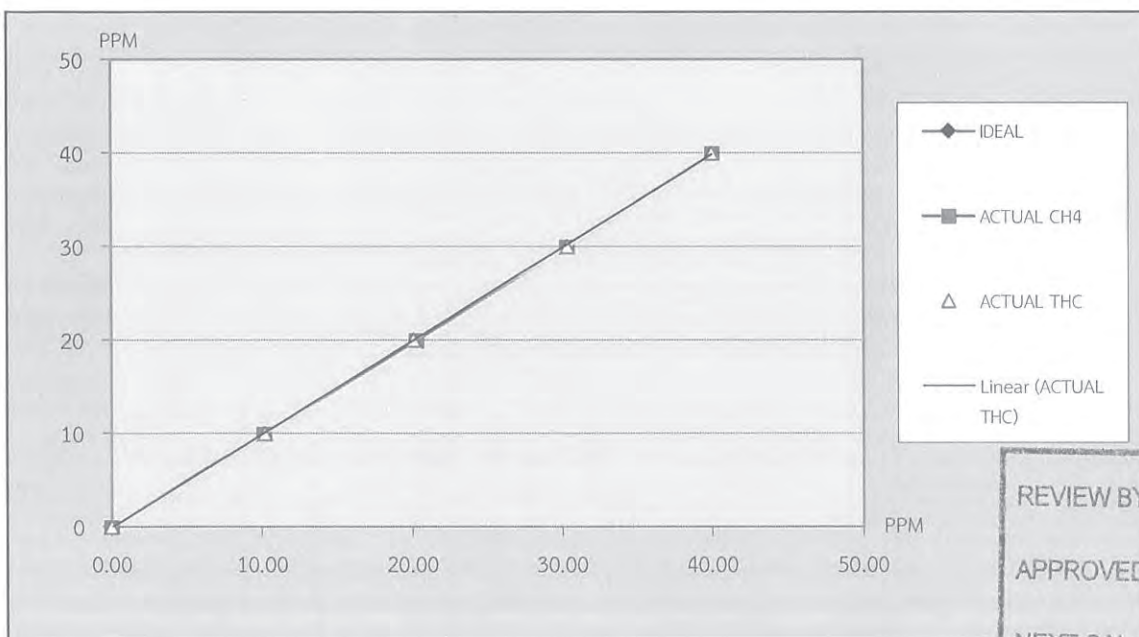
ALS_OQGCMS_GM-3_2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|------------------------------|-------------------|--------------------|---------------------|--------------------------------|
| October 25, 2024 11:45:59 AM | End | Qualification | Session | OQ |
| October 25, 2024 11:45:59 AM | Start | Reporting | Session | None |
| October 25, 2024 12:03:37 PM | Audit | Reporting | Session | Report Generated : Certificate |
| October 25, 2024 12:04:58 PM | Audit | Reporting | Session | Report Generated : Report |

| | | | | | | | |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------|-------|------------|----------------|--------------|--|--|
| CUSTOMER NAME | : ALS Laboratory Group (Thailand) Co., Ltd. [บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด] | | | | | | |
| EQUIPMENT NAME | : THC Analyzer | | | | | | |
| MANUFACTURER | : HORIBA | MODEL | : APHA-370 | SERIAL NO | : U430GTHB | | |
| STANDARD GAS CONCENTRATION (PPM) (CH ₄) | : 506.1 PPM | | | CYLINDER NO | : CC734373 | | |
| CYLINDER PRESSURE (psig) | : 1,600 PSI | | | CERTIFIED DATE | : 12/05/2020 | | |
| CERTIFIED BY | : AIRGAS | | | EXPIRED DATE | : 12/05/2028 | | |

TEST RESULTS

| POINT NO | TEST RESULTS | | | | | | |
|-------------|--------------|------------------------|-----------------------|------------------------|------------|-----------|------------|
| | IDEAL | ACTUAL CH ₄ | ERROR CH ₄ | %ERROR CH ₄ | ACTUAL THC | ERROR THC | %ERROR THC |
| ZERO | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | - |
| 1 | 10.00 | 10.15 | 0.15 | 1.50 | 10.21 | 0.21 | 2.10 |
| 2 | 20.00 | 20.30 | 0.30 | 1.50 | 20.10 | 0.10 | 0.50 |
| 3 | 30.00 | 30.29 | 0.29 | 0.97 | 30.33 | 0.33 | 1.10 |
| 4 | 40.00 | 40.00 | 0.00 | 0.00 | 40.00 | 0.00 | 0.00 |
| AVERAGE (%) | | | | 0.99 | 0.93 | | |



REVIEW BY Thaniat
 APPROVED BY D. [Signature]
 NEXT CAL. DATE 25/07/2025

CALIBRATED BY : นางพว DATE : 25/7/07
 CHECKED BY : ศิริ วัฒนา DATE : 25/7/07



ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15,16 , E-Mail : Engineer@jiranatee.com
 เลขที่ 63/14-15,67/35-36 ถนนเพชรเกษม 7,7/1 แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-8680812-13 โทรสาร 02-868-1889

| | | | |
|----------------|---------------------------------------------------------------------------------------------------|------------------|-----------------------|
| CUSTOMER NAME | : ALS Laboratory Group (Thailand) Co., Ltd. [บริษัท เอแอลเอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด] | | |
| EQUIPMENT NAME | : THC Analyzer | | |
| MANUFACTURER | : HORIBA | MODEL : APHA-370 | SERIAL NO. : U430GTHB |

| TEST VALUES | | | | |
|-------------|-----------------------------|------------------------------------------------------------|-------------|-------------|
| NO. | THC Analyzer (APHA - 370) | UNIT | BEFORE | AFTER |
| 1 | Signal (CH4) | mV | 35.60 | 35.80 |
| 2 | Signal (THC) | mV | 38.80 | 39.20 |
| 3 | Detector | Temp °C , Standard Value : Ambient temp+(5°Cto15°C) | 46.00 | 46.90 |
| | | Pressure kPa , Standard Value : (Ambient/1013x100-20)±4kPa | 69.30 | 69.30 |
| 4 | Ambient | kPa current atmospheric pressure | 100.30 | 100.30 |
| 5 | Purifire | °C , Standard Value : 390 °C to 430 °C | 420.00 | 420.50 |
| | | kPa , Normal value : 8 kPa to 25 kPa | 9.80 | 9.80 |
| 6 | NMHC | °C , Standard Value : 230 °C to 260 °C | 244.90 | 244.80 |
| 7 | DC 24 V | V , Standard Value : 24 V ± 0.5 V | 24.00 | 24.00 |
| 8 | DC 5 V | V , Standard Value : 5 V ± 0.5 V | 5.00 | 5.00 |
| 9 | Bypass (Optional) | L/min, Normal value : 0.9 L/min ± 0.3 L/min | - | - |
| 10 | Over Flow (Optional) | L/min, Standard Value : 0.8 L/min or More | - | - |
| 11 | CH4 Sampling Reading | PPM | 2.93 | 2.03 |
| 12 | NMHC Sampling Reading | PPM | 0.25 | 0.11 |
| 13 | THC Sampling Reading | PPM | 3.18 | 2.13 |
| 14 | Zero Gas CH4/THC | PPM | 0.13/0.18 | 0.00/0.00 |
| 15 | Span Gas | PPM | 56.19/56.43 | 40.00/40.00 |
| G | Gas H2/..... | 20 PSI | 20 | 20 |

Remark : Reference EX-EN-017-56 , Ambient HC Monitor APHA-370 Operation Manual Page #81

Remark : (Ambient temperature = 5°C to 40°C)

อาการที่ตรวจพบ

- Air Filter สกปรกและเสื่อมสภาพ , Filter Sponge สกปรกและเสื่อมสภาพ

รายละเอียดการดำเนินการ

- ทำการ Service Maintenance ,เปลี่ยน Air Filter , 0.3 , เปลี่ยน Filter Sponge , ทำ Calibration Zero/Span , Multipoint

ผลการดำเนินการ

- เรียบร้อย เครื่องสามารถดำเนินการตรวจวัดได้ตามปกติ

CALIBRATED BY : วรพงษ์

CHECKED BY : สรวิทย์ ธีรพงศ์



DATE : 25/7/67

DATE : 25/7/67

ต้องการข้อมูลทางด้านเทคนิคเพิ่มเติม : เจ้าหน้าที่ฝ่ายบริการหลังการขาย , โทร 02-868-0812 # 15-16 , E-Mail : Engineer@jiranatee.com
เลขที่ 63/14-15,67/35-36 ซอยเพชรเกษม 7,7/1 ถนนเพชรเกษม แขวงวัดท่าพระ เขตบางกอกใหญ่ กรุงเทพฯ 10600 โทร 02-868-0812-13 โทรสาร 02-868-1889

Certificate of Calibration

Customer



Name : ALS Laboratory Group Thailand Co., Ltd. **Certificate No** : 25-ACT-010
Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, **Request No** : Req-2025-0091
Bangkok 10250

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : RION Range : 94 dB / 1000 Hz
Model : NC-74 Instrument Status : Used
Serial Number : 34178121
ID : RYG_FS0213

Calibration Environment and Details

Temperature : (23 \pm 2 $^{\circ}$ C)
Humidity : (50 \pm 20 %RH)
Barometric Pressure : (1013 \pm 10.0 hPa)
Received Date : 15 January 2025
Calibration Date : 16 January 2025
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators


REVIEW BY 
APPROVED BY 
NEXT CAL DATE 16/01/26

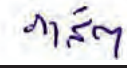
| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------|--------|---------------|-----------|-----------------|
| Sound Calibrator | SV 35A | 58079 | EEI | 12 June 2025 |
| THD Multimeter | 2015 | 1047765 | NIMT | 16 January 2025 |

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 16 January 2025

Certificate No : 25-ACT-010

Request No : Req-2025-0091

Sound pressure level

Calibration Results : Without Adjustment

| Calibration Range (dB) | Without Adjustment (dB) | | Adjustment (dB) | | Uncertainty (± dB) | Acceptance limit Class 1 (± dB) | Result |
|---------------------------|-------------------------|----------------|-----------------|----------------|-----------------------|------------------------------------|--------|
| | Measured | Deviated value | Measured | Deviated value | | | |
| 94 dB / 1000 Hz | 94.11 | 0.11 | - | - | 0.13 | 0.25 | Pass |

Frequency of Sound pressure level

| Calibration Range (Hz) | Without Adjustment | | Adjustment | | Uncertainty (± %) | Acceptance limit Class 1 (± %) | Result |
|---------------------------|--------------------|----------|---------------|----------|----------------------|-----------------------------------|--------|
| | Measured (Hz) | Deviated | Measured (Hz) | Deviated | | | |
| 94 dB / 1000 Hz | 1000.00 | 0.00 | - | - | 0.01 | 0.70 | Pass |

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

| Calibration Range (Hz) | Without Adjustment | Adjustment | Uncertainty (± %) | Acceptance limit Class 1 (± %) | Result |
|---------------------------|--------------------|--------------|----------------------|-----------------------------------|--------|
| | Measured (%) | Measured (%) | | | |
| 94 dB / 1000 Hz | 1.21 | - | 0.40 | 2.5 | Pass |

Note :

| Function | Maximum-permitted Uncertainty of measurement |
|------------------------|-------------------------------------------------|
| Sound pressure level | 0.15 dB |
| Frequency | 0.20% |
| Total distortion+noise | 0.50% |

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

Certificate No : 25-ACT-010

Request No : Req-2025-0091

Decision Rule for Statements of Conformity

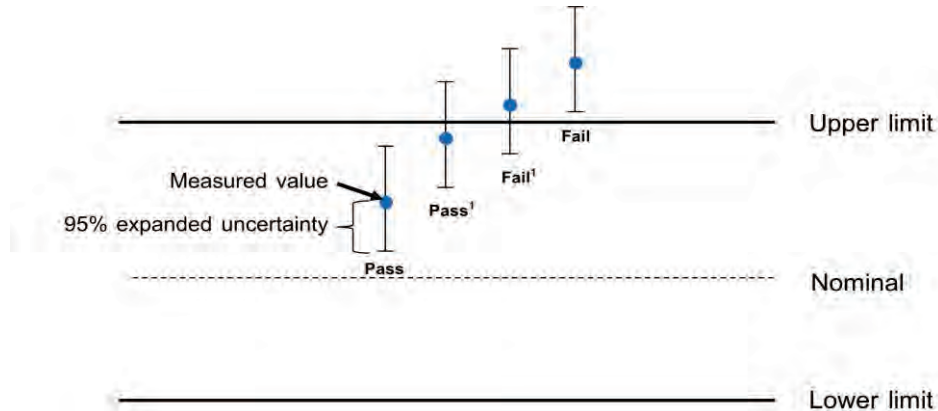
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass^1 = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail^1 = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Calibration

Cert. No. : ACL25110

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00900074 / 188467 / 01736
ID No.: RYG_FS0495

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

REVIEW BY *Supt S.*

APPROVED BY *[Signature]*

NEXT CAL DATE 26/ 01/ 2026

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

[Signature]
(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.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|---------------------|---------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

T. Petch.

Cert. No. : ACL25110
Job No. : VC68AC0064
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 14.6 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 12.0 |
| C - weight | 17.7 |
| Flat | 23.2 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.1 | 0.1 | 0.1 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | 0.3 | 0.3 | 0.3 | ±5.0 |

Signature

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | 0.0 | 0.0 | -0.1 | ±2.0 |
| 125 | 0.0 | 0.0 | 0.0 | ±1.5 |
| 250 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 500 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.0 | 0.0 | ±2.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±3.0 |
| 8000 | 0.0 | 0.0 | 0.0 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

T. Petch.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.0 | 0.0 | ± 1.1 |
| 135.0 | 135.1 | 0.1 | ± 1.1 |
| 134.0 | 134.1 | 0.1 | ± 1.1 |
| 133.0 | 133.0 | 0.0 | ± 1.1 |
| 132.0 | 132.0 | 0.0 | ± 1.1 |
| 131.0 | 131.0 | 0.0 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.1 | 0.1 | ± 1.1 |
| 114.0 | 114.1 | 0.1 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.1 | 0.1 | ± 1.1 |
| 99.0 | 99.1 | 0.1 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.0 | 0.0 | ± 1.1 |
| 29.0 | 29.1 | 0.1 | ± 1.1 |
| 28.0 | 28.1 | 0.1 | ± 1.1 |
| 27.0 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.2 | 0.2 | ± 1.1 |
| 25.0 | 25.2 | 0.2 | ± 1.1 |

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Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 7 of 8

8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 29.1 | 0.1 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 116.9 | -0.1 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.0 | 0.0 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.0 | 0.0 | ±1.0 |

T. Petch.

Cert. No. : ACL25110
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.4 | 0.0 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.5 | 89.5 | 0.0 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch.



Cert. No. : ACL24419
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623388 / 198635 / 26416
ID No.: RYG_FS0613

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

REVIEW BY Supt S.

APPROVED BY.....

NEXT CAL DATE..23/ 12/ 25.....

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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Cert. No. : ACL24419

Job No. : VC68AC0051

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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Cert. No. : ACL24419
Job No. : VC68AC0051
Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|---------------------|---------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

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Cert. No. : ACL24419

Job No. : VC68AC0051

Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 14.2 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 12.6 |
| C - weight | 19.1 |
| Flat | 24.6 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | Acceptance Limits |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.5 | 0.6 | 0.6 | ± 1.5 |
| 1000 | 0.1 | 0.1 | 0.2 | ± 1.0 |
| 8000 | 0.8 | 0.8 | 0.8 | ±5.0 |

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Cert. No. : ACL24419
Job No. : VC68AC0051
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | 0.0 | -0.1 | 0.0 | ±2.0 |
| 125 | 0.0 | 0.1 | 0.0 | ±1.5 |
| 250 | 0.0 | 0.0 | 0.0 | ±1.5 |
| 500 | 0.0 | 0.1 | 0.0 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.1 | 0.0 | ±2.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±3.0 |
| 8000 | 0.0 | 0.1 | 0.1 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

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Cert. No. : ACL24419

Job No. : VC68AC0051

Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.0 | 0.0 | ± 1.1 |
| 135.0 | 135.0 | 0.0 | ± 1.1 |
| 134.0 | 134.0 | 0.0 | ± 1.1 |
| 133.0 | 133.0 | 0.0 | ± 1.1 |
| 132.0 | 132.0 | 0.0 | ± 1.1 |
| 131.0 | 131.0 | 0.0 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.0 | 0.0 | ± 1.1 |
| 114.0 | 114.0 | 0.0 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.0 | 0.0 | ± 1.1 |
| 99.0 | 99.0 | 0.0 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.0 | 0.0 | ± 1.1 |
| 29.0 | 28.9 | -0.1 | ± 1.1 |
| 28.0 | 28.0 | 0.0 | ± 1.1 |
| 27.0 | 26.9 | -0.1 | ± 1.1 |
| 26.0 | 25.9 | -0.1 | ± 1.1 |
| 25.0 | 24.9 | -0.1 | ± 1.1 |

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Cert. No. : ACL24419
Job No. : VC68AC0051
Pages : 7 of 8

8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 28.9 | -0.1 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.1 | 0.1 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.1 | 0.1 | ±1.0 |

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Cert. No. : ACL24419

Job No. : VC68AC0051

Pages : 8 of 8

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.3 | -0.1 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.1 | 0.1 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.6 | 89.5 | -0.1 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch

Cert. No. : ACL25079

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623394 / 198641 / 26422
ID No.: RYG_FS0619

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 07 JANUARY 2025
Calibration Date : 21 - 23 JANUARY 2025
Date of Issue : 24 JANUARY 2025

REVIEW BY *Supt. S.*

APPROVED BY..... *[Signature]*

NEXT CAL DATE..... 21/ 01/ 2026

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(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.

Cert. No. : ACL25079

Job No. : VC68AC0059

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

Cert. No. : ACL25079

Job No. : VC68AC0059

Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|-----------------------------|------------------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

T. Ketchum

Cert. No. : ACL25079

Job No. : VC68AC0059

Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 14.6 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 12.6 |
| C - weight | 19.1 |
| Flat | 24.5 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | Acceptance Limits |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.4 | 0.4 | 0.4 | ± 1.5 |
| 1000 | 0.1 | 0.1 | 0.1 | ± 1.0 |
| 8000 | 0.1 | 0.1 | 0.1 | ±5.0 |

T. Petch

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Job No. : VC68AC0059
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | 0.0 | -0.1 | 0.0 | ±2.0 |
| 125 | 0.0 | 0.0 | 0.0 | ±1.5 |
| 250 | 0.0 | 0.0 | 0.0 | ±1.5 |
| 500 | 0.0 | 0.0 | 0.0 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.0 | 0.0 | ±2.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±3.0 |
| 8000 | 0.0 | 0.1 | 0.1 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

T. Petch.

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7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.0 | 0.0 | ± 1.1 |
| 135.0 | 135.0 | 0.0 | ± 1.1 |
| 134.0 | 134.0 | 0.0 | ± 1.1 |
| 133.0 | 133.0 | 0.0 | ± 1.1 |
| 132.0 | 132.0 | 0.0 | ± 1.1 |
| 131.0 | 131.0 | 0.0 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.0 | 0.0 | ± 1.1 |
| 114.0 | 114.0 | 0.0 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.0 | 0.0 | ± 1.1 |
| 99.0 | 99.0 | 0.0 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.1 | 0.1 | ± 1.1 |
| 30.0 | 30.1 | 0.1 | ± 1.1 |
| 29.0 | 29.1 | 0.1 | ± 1.1 |
| 28.0 | 28.1 | 0.1 | ± 1.1 |
| 27.0 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.1 | 0.1 | ± 1.1 |
| 25.0 | 25.1 | 0.1 | ± 1.1 |

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Cert. No. : ACL25079

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8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 28.9 | -0.1 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.0 | 0.0 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.0 | 0.0 | ±1.0 |

T. Ketch

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Job No. : VC68AC0059

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10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{cpeak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.3 | -0.1 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 132.9 | -0.1 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.5 | 89.6 | 0.1 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

S. Ketchum

Cert. No. : ACL24420

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623389 / 198636 / 26417
ID No.: RYG_FS0614

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAEANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

REVIEW BY *Supt S.*

APPROVED BY *Stan Vith*

NEXT CAL DATE..... 23/ 12/ 25

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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Cert. No. : ACL24420
Job No. : VC68AC0051
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

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Cert. No. : ACL24420
Job No. : VC68AC0051
Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|---------------------|---------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

T. ReJoh.

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Cert. No. : ACL24420

Job No. : VC68AC0051

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Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 13.8 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 9.9 |
| C - weight | 16.8 |
| Flat | 22.7 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | Acceptance Limits |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.3 | 0.4 | 0.4 | ± 1.5 |
| 1000 | 0.2 | 0.2 | 0.2 | ± 1.0 |
| 8000 | 0.4 | 0.5 | 0.5 | ±5.0 |

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Job No. : VC68AC0051
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | 0.0 | 0.0 | 0.0 | ±2.0 |
| 125 | 0.0 | 0.0 | 0.0 | ±1.5 |
| 250 | 0.0 | 0.0 | 0.0 | ±1.5 |
| 500 | 0.0 | 0.1 | 0.0 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.1 | 0.0 | ±2.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±3.0 |
| 8000 | 0.0 | 0.1 | 0.1 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

T. Petch

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Cert. No. : ACL24420

Job No. : VC68AC0051

Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.0 | 0.0 | ± 1.1 |
| 135.0 | 135.0 | 0.0 | ± 1.1 |
| 134.0 | 134.0 | 0.0 | ± 1.1 |
| 133.0 | 133.0 | 0.0 | ± 1.1 |
| 132.0 | 132.0 | 0.0 | ± 1.1 |
| 131.0 | 131.0 | 0.0 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.0 | 0.0 | ± 1.1 |
| 114.0 | 114.0 | 0.0 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.0 | 0.0 | ± 1.1 |
| 99.0 | 99.0 | 0.0 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.0 | 0.0 | ± 1.1 |
| 29.0 | 29.0 | 0.0 | ± 1.1 |
| 28.0 | 28.0 | 0.0 | ± 1.1 |
| 27.0 | 27.0 | 0.0 | ± 1.1 |
| 26.0 | 25.9 | -0.1 | ± 1.1 |
| 25.0 | 25.0 | 0.0 | ± 1.1 |

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Cert. No. : ACL24420
Job No. : VC68AC0051
Pages : 7 of 8

8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 28.8 | -0.2 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.1 | 0.1 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.0 | 0.0 | ±1.0 |

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Cert. No. : ACL24420
Job No. : VC68AC0051
Pages : 8 of 8

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.4 | 0.0 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.1 | 0.1 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.6 | - 89.5 | -0.1 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

G. Petcha

Cert. No. : ACL24421
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623390 / 198637 / 26418
ID No.: RYG_FS0615

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

REVIEW BY
APPROVED BY
NEXT CAL DATE.....23/ 12/ 25.....

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.

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Cert. No. : ACL24421
Job No. : VC68AC0051
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. ReTeH.

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Cert. No. : ACL24421
Job No. : VC68AC0051
Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|---------------------|---------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

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Cert. No. : ACL24421

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Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 14.6 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 13.1 |
| C - weight | 19.5 |
| Flat | 24.8 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | Acceptance Limits |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | |
| 125 | 0.5 | 0.5 | 0.5 | ± 1.5 |
| 1000 | 0.2 | 0.2 | 0.2 | ± 1.0 |
| 8000 | 0.0 | 0.0 | 0.0 | ±5.0 |

T. Reichen.

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | -0.1 | -0.1 | -0.1 | ±2.0 |
| 125 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 250 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 500 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.0 | 0.0 | ±2.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±3.0 |
| 8000 | 0.0 | 0.1 | 0.1 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

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Job No. : VC68AC0051

Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.0 | 0.0 | ± 1.1 |
| 135.0 | 135.0 | 0.0 | ± 1.1 |
| 134.0 | 134.0 | 0.0 | ± 1.1 |
| 133.0 | 132.9 | -0.1 | ± 1.1 |
| 132.0 | 131.9 | -0.1 | ± 1.1 |
| 131.0 | 130.9 | -0.1 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.0 | 0.0 | ± 1.1 |
| 114.0 | 114.0 | 0.0 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.0 | 0.0 | ± 1.1 |
| 99.0 | 99.0 | 0.0 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.0 | 0.0 | ± 1.1 |
| 29.0 | 29.0 | 0.0 | ± 1.1 |
| 28.0 | 27.9 | -0.1 | ± 1.1 |
| 27.0 | 27.0 | 0.0 | ± 1.1 |
| 26.0 | 25.9 | -0.1 | ± 1.1 |
| 25.0 | 24.9 | -0.1 | ± 1.1 |

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8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 29.0 | 0.0 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.0 | 0.0 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.0 | 0.0 | ±1.0 |

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10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{cpeak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.4 | 0.0 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.6 | 89.6 | 0.0 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

G. Ketchum

Cert. No. : ACL24422

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623391 / 198638 / 26419
ID No.: RYG_FS0616

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAEANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 12 DECEMBER 2024
Calibration Date : 23 - 24 DECEMBER 2024
Date of Issue : 26 DECEMBER 2024

REVIEW BY 

APPROVED BY 

NEXT CAL DATE.....23/ 12/ 25.....

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.

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Cert. No. : ACL24422
Job No. : VC68AC0051
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

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Job No. : VC68AC0051
Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|---------------------|---------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

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Job No. : VC68AC0051

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Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 15.7 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 14.8 |
| C - weight | 21.3 |
| Flat | 26.9 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.6 | 0.6 | 0.6 | ± 1.5 |
| 1000 | 0.2 | 0.2 | 0.2 | ± 1.0 |
| 8000 | -0.7 | -0.6 | -0.6 | ±5.0 |

T. Petchu.

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Job No. : VC68AC0051
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | 0.0 | -0.1 | 0.0 | ±2.0 |
| 125 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 250 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 500 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.0 | 0.0 | ±2.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±3.0 |
| 8000 | 0.0 | 0.1 | 0.1 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

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7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.0 | 0.0 | ± 1.1 |
| 135.0 | 135.0 | 0.0 | ± 1.1 |
| 134.0 | 134.0 | 0.0 | ± 1.1 |
| 133.0 | 133.0 | 0.0 | ± 1.1 |
| 132.0 | 132.0 | 0.0 | ± 1.1 |
| 131.0 | 131.0 | 0.0 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.0 | 0.0 | ± 1.1 |
| 114.0 | 114.0 | 0.0 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.0 | 0.0 | ± 1.1 |
| 99.0 | 99.0 | 0.0 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.0 | 0.0 | ± 1.1 |
| 29.0 | 29.0 | 0.0 | ± 1.1 |
| 28.0 | 28.0 | 0.0 | ± 1.1 |
| 27.0 | 27.0 | 0.0 | ± 1.1 |
| 26.0 | 26.0 | 0.0 | ± 1.1 |
| 25.0 | 24.9 | -0.1 | ± 1.1 |

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Pages : 7 of 8

8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 29.4 | 0.4 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.0 | 0.0 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.0 | 0.0 | ±1.0 |

[Signature]

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10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, Lcpeak (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.4 | 0.0 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±2.0 |
| Positive half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |
| Negative half cycle | 135.4 | 135.2 | -0.2 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.5 | 89.5 | 0.0 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petch

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Cert. No. : ACL25112

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42A / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00623396 / 198643 / 26424
ID No.: RYG_FS0621

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAEANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 14 JANUARY 2025
Calibration Date : 27-29 JANUARY 2025
Date of Issue : 30 JANUARY 2025

REVIEW BY *Supt S*

APPROVED BY *[Signature]*

NEXT CAL DATE..... 26/ 01/ 2026

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.

Cert. No. : ACL25112
Job No. : VC68AC0064
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).



Cert. No. : ACL25112
Job No. : VC68AC0064
Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|-----------------------------|------------------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

T. Retch.

Cert. No. : ACL25112
Job No. : VC68AC0064
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 14.8 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 11.3 |
| C - weight | 18.9 |
| Flat | 24.4 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.3 | 0.3 | 0.3 | ± 1.5 |
| 1000 | 0.1 | 0.1 | 0.1 | ± 1.0 |
| 8000 | 0.6 | 0.6 | 0.6 | ±5.0 |

T. Petch.

Cert. No. : ACL25112
Job No. : VC68AC0064
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | 0.0 | 0.1 | 0.1 | ±2.0 |
| 125 | 0.1 | 0.1 | 0.1 | ±1.5 |
| 250 | 0.1 | 0.1 | 0.0 | ±1.5 |
| 500 | 0.0 | 0.1 | 0.0 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.1 | 0.0 | ±2.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±3.0 |
| 8000 | 0.0 | 0.1 | 0.1 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.1 | 0.1 | ± 0.3 |

T. Ketchum

Cert. No. : ACL25112
Job No. : VC68AC0064
Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.0 | 0.0 | ± 1.1 |
| 135.0 | 135.0 | 0.0 | ± 1.1 |
| 134.0 | 134.0 | 0.0 | ± 1.1 |
| 133.0 | 133.0 | 0.0 | ± 1.1 |
| 132.0 | 132.0 | 0.0 | ± 1.1 |
| 131.0 | 131.0 | 0.0 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.0 | 0.0 | ± 1.1 |
| 114.0 | 114.0 | 0.0 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.0 | 0.0 | ± 1.1 |
| 99.0 | 99.0 | 0.0 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.1 | 0.1 | ± 1.1 |
| 29.0 | 29.0 | 0.0 | ± 1.1 |
| 28.0 | 28.1 | 0.1 | ± 1.1 |
| 27.0 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.2 | 0.2 | ± 1.1 |
| 25.0 | 25.1 | 0.1 | ± 1.1 |

T. Retoh.

Cert. No. : ACL25112
Job No. : VC68AC0064
Pages : 7 of 8

8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 29.1 | 0.1 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.1 | 0.1 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.1 | 0.1 | ±1.0 |

T. Petch.

Cert. No. : ACL25112
Job No. : VC68AC0064
Pages : 8 of 8

10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{cpeak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.4 | 0.0 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.6 | 89.6 | 0.0 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

S. Retoh .

Cert. No. : ACC24054
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178123
ID No.: RYG_FS0215

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

REVIEW BY
APPROVED BY
NEXT CAL DATE.....22-Oct-25.....

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 18 OCTOBER 2024
Calibration Date : 22 OCTOBER 2024
Date of Issue : 24 OCTOBER 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchurai
(Thanakul Petchurai)

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

SITHIPORN ASSOCIATES CO., LTD.

CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACC24054

Job No. : VC68AC0015

Pages : 2 of 3

Calibration Procedure : CP-AC-03

Calibration Method :

This equipment was calibrated by follow on IEC-60942-2003 Standard.

The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 33461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |
| Audio Analyzer | AVR-3360A | V744B6069 | EF-0009-24 | 09-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Z. Ketch.

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. : ACC24054
Job No. : VC68AC0015
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

| Specified sound pressure level (dB) | Measured value (dB) | Deviated value (dB) | Uncertainty (dB) | Acceptance limit (dB) |
|-------------------------------------------|---------------------------|---------------------------|---------------------|-----------------------------|
| 94 | 94.09 | 0.09 | 0.14 | 0.40 |

2. Frequency

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value (%) | Uncertainty (%) | Acceptance limit (%) |
|--------------------------------|---------------------------|--------------------------|--------------------|----------------------------|
| 1000 | 1001.5 | 0.1 | 0.1 | 1.0 |

3. Total distortion

| Measured value (%) | Uncertainty (%) | Acceptance limit (%) |
|--------------------|-----------------|----------------------|
| 1.55 | 0.10 | 3.0 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

Signature

Cert. No. : ACL25072

Pages : 1 of 8

Calibration Certificate


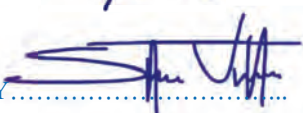
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01122607 / 145554 / 34373
ID No.: RYG_FS0019

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAEANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 07 JANUARY 2025
Calibration Date : 21 - 23 JANUARY 2025
Date of Issue : 24 JANUARY 2025

| | |
|---------------------|---------------------------------------------------------------------------------------|
| REVIEW BY |  |
| APPROVED BY |  |
| NEXT CAL DATE | 21/ 01/ 2026 |

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.

Cert. No. : ACL25072

Job No. : VC68AC0059

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

T. Petch.

Cert. No. : ACL25072

Job No. : VC68AC0059

Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|---------------------|---------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

T. Petch.

Cert. No. : ACL25072

Job No. : VC68AC0059

Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 16.0 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 12.6 |
| C - weight | 17.7 |
| Flat | 22.6 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | 0.5 | 0.5 | 0.5 | ± 1.5 |
| 1000 | 0.1 | 0.1 | 0.1 | ± 1.0 |
| 8000 | -1.2 | -1.2 | -1.2 | ±5.0 |

G. Petcha.

Cert. No. : ACL25072
Job No. : VC68AC0059
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | 0.0 | -0.1 | -0.1 | ±2.0 |
| 125 | -0.1 | 0.0 | -0.1 | ±1.5 |
| 250 | -0.1 | 0.0 | -0.1 | ±1.5 |
| 500 | 0.0 | 0.0 | -0.1 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ±1.0 |
| 2000 | 0.0 | 0.0 | 0.0 | ±2.0 |
| 4000 | 0.0 | 0.0 | 0.0 | ±3.0 |
| 8000 | 0.0 | 0.0 | 0.0 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.1 | 0.1 | ± 0.3 |

T. Petch

Cert. No. : ACL25072

Job No. : VC68AC0059

Pages : 6 of 8

7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 137.0 | 0.0 | ± 1.1 |
| 136.0 | 136.0 | 0.0 | ± 1.1 |
| 135.0 | 135.0 | 0.0 | ± 1.1 |
| 134.0 | 134.1 | 0.1 | ± 1.1 |
| 133.0 | 133.0 | 0.0 | ± 1.1 |
| 132.0 | 132.0 | 0.0 | ± 1.1 |
| 131.0 | 131.0 | 0.0 | ± 1.1 |
| 129.0 | 129.0 | 0.0 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.1 | 0.1 | ± 1.1 |
| 114.0 | 114.1 | 0.1 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.1 | 0.1 | ± 1.1 |
| 99.0 | 99.0 | 0.0 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.0 | 0.0 | ± 1.1 |
| 29.0 | 29.0 | 0.0 | ± 1.1 |
| 28.0 | 28.0 | 0.0 | ± 1.1 |
| 27.0 | 27.0 | 0.0 | ± 1.1 |
| 26.0 | 25.9 | -0.1 | ± 1.1 |
| 25.0 | 24.9 | -0.1 | ± 1.1 |

T. Petch.

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8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 29.0 | 0.0 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.1 | 0.1 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.1 | 0.1 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.7 | 0.1 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.1 | 0.1 | ±1.0 |

S. Petch.

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10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{cpeak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.4 | 0.0 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 133.0 | 0.0 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.5 | 89.5 | 0.0 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

E. Petcha-

Cert. No. : ACL25073

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Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 01222716 / 143832 / 22763
ID No.: RYG_FS0020

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location : -
Ambient Temperature : (23.0 \pm 3) °C
Pressure : (101.3 \pm 3) kPa
Relative Humidity : (50.0 \pm 20) %

Received Date : 07 JANUARY 2025
Calibration Date : 21 - 23 JANUARY 2025
Date of Issue : 24 JANUARY 2025

REVIEW BY 

APPROVED BY 

NEXT CAL DATE..... 21/ 01/ 2026

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.

Cert. No. : ACL25073

Job No. : VC68AC0059

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by follow on IEC-61672-3 (2013) Standard for sound level meter (SLM).

The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

| <u>Instrument</u> | <u>Model</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------|--------------|-------------------|------------------|-----------------|
| Waveform Generator | 33210A | MY48017076 | EF-0009-24 | 05-FEB-25 |
| Waveform Generator | 33511B | MY52302742 | EF-0007-24 | 05-FEB-25 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 21/0267 | 13-FEB-25 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 20/0267 | 15-FEB-25 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 22/0267 | 15-FEB-25 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0008-24 | 05-FEB-25 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-24 | 12-FEB-25 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3001-24 | 05-FEB-25 |

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

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

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

S. Petch

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Summary of Measurement Result :

| Parameter | Uncertainty (dB) | Maximum-permitted uncertainty of measurement (dB) |
|------------------------------------------------------|-----------------------------|------------------------------------------------------------------|
| 1. Absolute sensitivity | 0.2 | N/A |
| 2. Self-generated noise | 0.2 | N/A |
| 3. Acoustical signal tests of frequency weightings | | |
| 125 Hz | 0.3 | 0.6 |
| 1000 Hz | 0.3 | 0.6 |
| 8000 Hz | 0.3 | 0.7 |
| 4. Electrical signal tests of frequency weightings | | |
| For 10 Hz to 4 kHz | 0.3 | 0.6 |
| For > 4 kHz to 10 kHz | 0.3 | 0.7 |
| For > 10 kHz to 20 kHz | 0.3 | 1.0 |
| 5. Frequency and time weightings at 1 kHz | 0.2 | 0.2 |
| 6. Long - term stability | 0.1 | 0.1 |
| 7. Level linearity on the reference level range | 0.2 | 0.3 |
| 8. Level linearity including the level range control | 0.2 | 0.3 |
| 9. Tone burst response | 0.2 | 0.3 |
| 10. Peak C sound level | 0.2 | 0.35 |
| 11. Overload indication | 0.2 | 0.25 |
| 12. High level stability | 0.1 | 0.1 |

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Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|----------------------------------------|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.94) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 13.4 |

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

| Frequency Weighting | Weighting (dB) |
|------------------------|---------------------|
| A - weight | 10.8 |
| C - weight | 16.7 |
| Flat | 22.6 |

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 125 | -0.2 | -0.2 | -0.2 | ± 1.5 |
| 1000 | -0.6 | -0.6 | -0.6 | ± 1.0 |
| 8000 | -1.0 | -1.0 | -1.0 | ±5.0 |

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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

| Frequency (Hz) | Deviation from various frequency weighting response curve (dB) | | | |
|---------------------|----------------------------------------------------------------|----------|----------|----------------------|
| | Flat | C-weight | A-weight | Acceptance Limits |
| 63 | 0.2 | 0.2 | 0.3 | ±2.0 |
| 125 | 0.2 | 0.2 | 0.2 | ±1.5 |
| 250 | 0.1 | 0.1 | 0.1 | ±1.5 |
| 500 | 0.1 | 0.1 | 0.1 | ±1.5 |
| 1000 | 0.0 | 0.0 | 0.1 | ±1.0 |
| 2000 | 0.0 | 0.0 | 0.0 | ±2.0 |
| 4000 | -0.1 | -0.1 | 0.0 | ±3.0 |
| 8000 | -0.1 | 0.0 | 0.0 | ±5.0 |

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| C - weight | 94.0 | 94.0 | 0.0 | ± 0.2 |
| Flat | 94.0 | 94.0 | 0.0 | ± 0.2 |

5.2 Time weighting at 1 kHz

| Frequency Weighting | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Slow | 94.0 | 94.0 | 0.0 | ± 0.1 |
| Leq | 94.0 | 94.0 | 0.0 | ± 0.1 |

6. Long - term stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 94.0 | 94.0 | 0.0 | ± 0.3 |

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7. Level linearity on the reference level range

| Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 137.0 | 140.0 | 3.0 | ± 1.1 |
| 136.0 | 140.0 | 4.0 | ± 1.1 |
| 135.0 | 140.0 | 5.0 | ± 1.1 |
| 134.0 | 140.0 | 6.0 | ± 1.1 |
| 133.0 | 133.1 | 0.1 | ± 1.1 |
| 132.0 | 132.1 | 0.1 | ± 1.1 |
| 131.0 | 131.1 | 0.1 | ± 1.1 |
| 129.0 | 129.1 | 0.1 | ± 1.1 |
| 124.0 | 124.0 | 0.0 | ± 1.1 |
| 119.0 | 119.1 | 0.1 | ± 1.1 |
| 114.0 | 114.1 | 0.1 | ± 1.1 |
| 109.0 | 109.0 | 0.0 | ± 1.1 |
| 104.0 | 104.1 | 0.1 | ± 1.1 |
| 99.0 | 99.1 | 0.1 | ± 1.1 |
| 94.0 | 94.0 | 0.0 | ± 1.1 |
| 89.0 | 89.0 | 0.0 | ± 1.1 |
| 84.0 | 84.0 | 0.0 | ± 1.1 |
| 79.0 | 79.0 | 0.0 | ± 1.1 |
| 74.0 | 74.0 | 0.0 | ± 1.1 |
| 69.0 | 69.0 | 0.0 | ± 1.1 |
| 64.0 | 64.0 | 0.0 | ± 1.1 |
| 59.0 | 59.0 | 0.0 | ± 1.1 |
| 54.0 | 54.0 | 0.0 | ± 1.1 |
| 49.0 | 49.0 | 0.0 | ± 1.1 |
| 44.0 | 44.0 | 0.0 | ± 1.1 |
| 39.0 | 39.0 | 0.0 | ± 1.1 |
| 34.0 | 34.0 | 0.0 | ± 1.1 |
| 30.0 | 30.1 | 0.1 | ± 1.1 |
| 29.0 | 29.1 | 0.1 | ± 1.1 |
| 28.0 | 28.2 | 0.2 | ± 1.1 |
| 27.0 | 27.1 | 0.1 | ± 1.1 |
| 26.0 | 26.2 | 0.2 | ± 1.1 |
| 25.0 | 25.3 | 0.3 | ± 1.1 |

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Job No. : VC68AC0059
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8. Level linearity including the level range control

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 94.0 | 94.0 | 0.0 | ±1.1 |

| Range | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| 130 | 29.0 | 29.2 | 0.2 | ±1.1 |

9. Tone burst response

| Time Weighting | Tone burst duration, Tb (ms) | Cycle | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|-------------------|--------------------------------------|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Fast | 0.25 | 1 | 108.0 | 107.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 117.0 | 117.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 134.0 | 134.1 | 0.1 | ±1.0 |
| Slow | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.5 ; -5.0 |
| | 200 | 800 | 127.6 | 127.6 | 0.0 | ±1.0 |
| SEL | 0.25 | 1 | 99.0 | 98.9 | -0.1 | 1.5 ; -5.0 |
| | 2 | 8 | 108.0 | 108.0 | 0.0 | 1.0 ; -2.5 |
| | 200 | 800 | 128.0 | 128.0 | 0.0 | ±1.0 |

G. Petch

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10. Peak C sound level

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value, L _{cpeak} (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-------------------------------------------------|-----------------------------|--------------------------------|
| Continuous | 130.0 | 130.0 | 0.0 | ±3.0 |
| One | 133.4 | 133.4 | 0.0 | ±3.0 |

| Number of cycle in test signal | Anticipated Value (dB) | Measured Value (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|--------------------------------------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Continuous | 133.0 | 132.9 | -0.1 | ±2.0 |
| Positive half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |
| Negative half cycle | 135.4 | 135.1 | -0.3 | ±2.0 |

11. Overload indication

| Measured value (dB) | | Deviated Value (dB) | Acceptance Limits (dB) |
|----------------------------|----------------------------|-----------------------------|--------------------------------|
| Positive one-half cycle | Negative one-half cycle | | |
| 89.6 | 89.5 | -0.1 | ±1.5 |

12. High level stability

| Frequency Weighting | SLM Display at initial (dB) | SLM Display at final (dB) | Deviated Value (dB) | Acceptance Limits (dB) |
|------------------------|-------------------------------------|-----------------------------------|-----------------------------|--------------------------------|
| A - weight | 137.0 | 137.0 | 0.0 | ±0.3 |

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

T. Petcha

Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.

Certificate No : 25-SLM-114

Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250

Request No : Req-2025-0603

Unit Under Calibration Details

Measurement item : Sound Level Meter

Microphone Class : 2

Manufacturer : RION

Microphone Model : UC-52

Model : NL-42

Microphone S/N : 143841

Serial Number : 01222723

Preamplifier Model : NH-24

ID : RYG_FS0022

Preamplifier S/N : 22770

Resolution : 0.1 dB

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 6 March 2025

Calibrated Date : 19 March 2025

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3; Periodic tests

Location of Calibration : Lab Acoustic

REVIEW BY 

APPROVED BY 


NEXT CAL DATE 19/03/26


Reference Standard

| Instrument | Brand | Model | SN. | Due calibration | Traceability |
|---------------------|--------------|---------|---------|-----------------|--------------|
| Standard Microphone | Brüel & Kjær | 4192 | 2294985 | 25 June 2025 | NIMT |
| Audio Generator | Svantek | Svan401 | 131 | 15 October 2025 | WK Electric |

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By : 
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : 
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 19 March 2025

Certificate No : 25-SLM-114

Request No : Req-2025-0603

1. Indication at the calibration check frequency

| UUC Setting | Nominal | Before Adjust | | After Adjust | | UNCERTAINTY | Acceptance | Result |
|--------------------|---------|---------------|-------|--------------|-------|-------------|------------|--------|
| FAST / A / 30-130 | Level | UUC | ERR | UUC | ERR | (± dB) | Limit | |
| Calibrator Setting | (dB) | (dB) | (dB) | (dB) | (dB) | | (± dB) | |
| 1000 Hz 94 dB | 94.06 | 94.0 | -0.06 | 94.1 | +0.04 | 0.20 | 0.30 | Pass |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand RION, Model NC-75, SN.35002736

2. Self-generated noise, Microphone installed

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 30-130 | | |
| UUC Weighting | (dB) | (± dB) |
| A | 15.4 | 0.10 |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 30-130 | | |
| UUC Weighting | (dB) | (± dB) |
| A | 12.2 | 0.10 |
| C | 16.6 | 0.10 |
| Z | 20.4 | 0.10 |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting | Deviation from various Frequency Weighting Responce curve | | | UNCERTAINTY | Acceptance | Result |
|---------------|-----------------------------------------------------------|------|------|-------------|------------|--------|
| FAST / 30-130 | A | C | Z | (± dB) | Limit | |
| STD Setting | (dB) | (dB) | (dB) | | (± dB) | |
| 125 Hz | 0.3 | 0.5 | 0.5 | 0.60 | 1.5 | Pass |
| 1000 Hz | 0.0 | 0.0 | 0.0 | 0.60 | 1.0 | Pass |
| 4000 Hz | 0.4 | 0.4 | 0.4 | 0.60 | 3.0 | Pass |
| 8000 Hz | -1.3 | -1.3 | -1.3 | 0.70 | 5.0 | Pass |

Certificate No : 25-SLM-114

Request No : Req-2025-0603

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting | Deviation from various Frequency | | | UNCERTAINTY | Acceptance | Result |
|---------------|----------------------------------|--------|--------|-------------|------------|--------|
| FAST / 30-130 | Weighting Response curve | | | | Limit | |
| STD Setting | A (dB) | C (dB) | Z (dB) | (± dB) | (± dB) | |
| 63 Hz | -0.1 | 0.0 | 0.0 | 0.20 | 2.0 | Pass |
| 125 Hz | -0.1 | 0.0 | 0.0 | | 1.5 | Pass |
| 250 Hz | 0.0 | 0.0 | 0.0 | | 1.5 | Pass |
| 500 Hz | 0.0 | 0.1 | 0.0 | | 1.5 | Pass |
| 1000 Hz | 0.0 | 0.0 | 0.0 | | 1.0 | Pass |
| 2000 Hz | 0.0 | 0.1 | 0.0 | | 2.0 | Pass |
| 4000 Hz | 0.0 | 0.0 | 0.0 | | 3.0 | Pass |
| 8000 Hz | 0.1 | 0.1 | 0.0 | | 5.0 | Pass |
| 16000 Hz | -1.3 | -1.3 | 0.0 | | +5, -INF. | Pass |

6. Frequency and time weightings at 1kHz

| UUC Setting | STD | Measured | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) | Result |
|---------------|--------|----------|------|------------------------|--------------------------------|--------|
| FAST / 30-130 | REF | UUC | ERR | | | |
| UUC Weighting | (dB) | (dB) | (dB) | 0.20 | | |
| A | 114.00 | 114.0 | 0.0 | | | |
| C | 114.00 | 114.0 | 0.0 | | | |
| Z | 114.00 | 114.0 | 0.0 | | | |

| UUC Setting | STD | Measured | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) | Result |
|-------------------|--------|----------|------|------------------------|--------------------------------|--------|
| 30-130 / A | REF | UUC | ERR | | | |
| UUC Time Response | (dB) | (dB) | (dB) | 0.20 | | |
| Fast | 114.00 | 114.0 | 0.0 | | | |
| Slow | 114.00 | 114.0 | 0.0 | | | |
| Leq | 114.00 | 114.0 | 0.0 | | | |

Certificate No : 25-SLM-114

Request No : Req-2025-0603

7. Long Term Stability

| UUC Setting | Measured | UNCERTAINTY (± dB) | Acceptance Limit (± dB) | Result |
|-------------------|----------|------------------------|--------------------------------|--------|
| FAST / A / 30-130 | UUC | | | |
| STD Setting | (dB) | | | |
| Initial | 114.0 | | | |
| Final | 114.0 | | | |
| Deviated | 0.0 | 0.10 | 0.30 | Pass |

8. Level linearity on the reference level range

| UUC Setting | Anticipated | Deviation | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) | Result |
|-------------------|-------------|-----------|------|------------------------|--------------------------------|--------|
| FAST / A / 30-130 | REF | UUC | ERR | | | |
| STD dB | (dB) | (dB) | (dB) | | | |
| 138.00 | 138 | 137.9 | -0.1 | 0.30 | 1.1 | Pass |
| 134.00 | 134 | 134.0 | 0.0 | | 1.1 | Pass |
| 129.00 | 129 | 129.0 | 0.0 | | 1.1 | Pass |
| 124.00 | 124 | 124.0 | 0.0 | | 1.1 | Pass |
| 119.00 | 119 | 119.0 | 0.0 | | 1.1 | Pass |
| 114.00 | 114 | 114.0 | 0.0 | | 1.1 | Pass |
| 109.00 | 109 | 109.0 | 0.0 | | 1.1 | Pass |
| 104.00 | 104 | 104.0 | 0.0 | | 1.1 | Pass |
| 99.00 | 99 | 99.0 | 0.0 | | 1.1 | Pass |
| 94.00 | 94 | 94.0 | 0.0 | | 1.1 | Pass |
| 89.00 | 89 | 89.0 | 0.0 | | 1.1 | Pass |
| 84.00 | 84 | 84.0 | 0.0 | | 1.1 | Pass |
| 79.00 | 79 | 79.0 | 0.0 | | 1.1 | Pass |
| 74.00 | 74 | 74.0 | 0.0 | | 1.1 | Pass |
| 69.00 | 69 | 69.0 | 0.0 | | 1.1 | Pass |
| 64.00 | 64 | 64.0 | 0.0 | | 1.1 | Pass |
| 59.00 | 59 | 59.0 | 0.0 | | 1.1 | Pass |
| 54.00 | 54 | 54.0 | 0.0 | | 1.1 | Pass |
| 49.00 | 49 | 49.0 | 0.0 | | 1.1 | Pass |
| 44.00 | 44 | 44.0 | 0.0 | | 1.1 | Pass |
| 39.00 | 39 | 39.0 | 0.0 | | 1.1 | Pass |
| 34.00 | 34 | 34.0 | 0.0 | | 1.1 | Pass |
| 29.00 | 29 | 29.1 | 0.1 | | 1.1 | Pass |
| 24.00 | 24 | 24.0 | 0.0 | | 1.1 | Pass |

Certificate No : 25-SLM-114

Request No : Req-2025-0603

9. Level linearity including the level range control

| UUC Setting | STD | Measured | | UNCERTAINTY (± dB) | Acceptance | Result |
|-------------|-------|----------|------|------------------------|------------|--------|
| FAST / A | REF | UUC | ERR | | Limit | |
| UUC Range | (dB) | (dB) | (dB) | | (± dB) | |
| 30-130 | 29.50 | 29.7 | 0.2 | 0.30 | 1.1 | Pass |
| | 114 | 114.0 | 0.0 | | 1.1 | Pass |

10. Tone burst response

| UUC Setting | STD | Anticipated | Measured | | UNCERTAINTY (± dB) | Acceptance | Result |
|-------------------|-----------|-------------|----------|------|------------------------|------------|--------|
| A / 30-130 | Toneburst | Ref | UUC | ERR | | Limit | |
| UUC Time Response | (ms) | (dB) | (dB) | (dB) | | (± dB) | |
| Fast | 200 | 126.0 | 126.1 | +0.1 | 0.20 | 1.0 | Pass |
| | 2 | 109.0 | 109.0 | 0.0 | | +1.0, -2.5 | Pass |
| | 0.25 | 100.0 | 99.9 | -0.1 | | +1.5, -5.0 | Pass |
| Slow | 200 | 119.6 | 119.6 | 0.0 | | 1.0 | Pass |
| | 2 | 100.0 | 100.0 | 0.0 | | +1.0, -5.0 | Pass |
| SEL | 200 | 120.0 | 120.0 | 0.0 | | 1.0 | Pass |
| | 2 | 100.0 | 100.0 | 0.0 | | +1.0, -2.5 | Pass |
| | 0.25 | 91.0 | 90.9 | -0.1 | | +1.5, -5.0 | Pass |

11. Peak C Sound level

| UUC Setting | Anticipated | Measured | | UNCERTAINTY (± dB) | Acceptance | Result |
|---------------------|-------------|----------|-------|------------------------|------------|--------|
| FAST / C / 55-141 | REF | UUC | ERR | | Limit | |
| STD Setting | (dB) | (dB) | (dB) | | (± dB) | |
| Complete cycle | 136.4 | 135.8 | -0.60 | 0.20 | 3.0 | Pass |
| Positive half cycle | 135.4 | 135.2 | -0.20 | | 2.0 | Pass |
| Negative half cycle | 135.4 | 135.2 | -0.20 | | 2.0 | Pass |

Certificate No : 25-SLM-114

Request No : Req-2025-0603

12. Overload indication

| UUC Setting | Measured | UNCERTAINTY | Acceptance | Result |
|-------------------------|----------|-------------|------------|--------|
| FAST / A / 30-130 | UUC | (± dB) | Limit | |
| STD Setting | (dB) | | (± dB) | |
| Positive one-half cycle | 139.5 | | | |
| Negative one-half cycle | 139.4 | | | |
| Deviated | 0.1 | 0.20 | 1.5 | Pass |

13. High Level Stability

| UUC Setting | Measured | UNCERTAINTY | Acceptance | Result |
|-------------------|----------|-------------|------------|--------|
| FAST / A / 30-130 | UUC | (± dB) | Limit | |
| STD Setting | (dB) | | (± dB) | |
| Initial | 129.0 | | | |
| Final | 129.0 | | | |
| Deviated | 0.0 | 0.10 | 0.30 | Pass |

Note :

| Function | Maximum-permitted Uncertainty of measurement |
|------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| 1. Indication at the calibration check frequency | Not applicable |
| 2. Self-generated noise, Microphone installed | Not applicable |
| 3. Self-generated noise, Microphone replaced by the electrical input signal device | Not applicable |
| 4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz | 0.60 dB |
| 4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz | 0.70 dB |
| 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz | 0.20 dB |
| 6. Frequency and time weightings at 1kHz | 0.20 dB |
| 7. Long Term Stability | 0.10 dB |
| 8. Level linearity on the reference level range | 0.30 dB |
| 9. Level linearity including the level range control | 0.30 dB |
| 10. Tone burst response | 0.30 dB |
| 11. Peak C Sound level | 0.35 dB |
| 12. Overload indication | 0.25 dB |
| 13. High Level Stability | 0.10 dB |

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

Certificate No : 25-SLM-114

Request No : Req-2025-0603

Decision Rule for Statements of Conformity

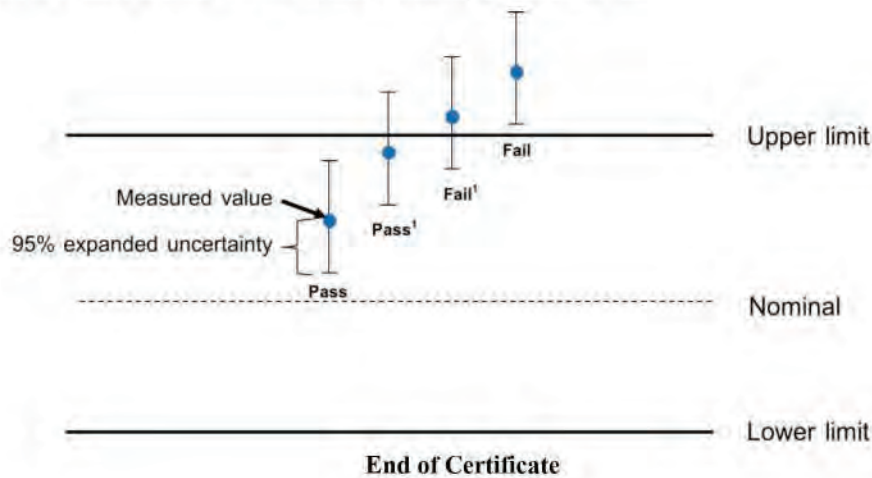
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.





Certificate of Calibration

Customer

Name : ALS Laboratory Group Thailand Co., Ltd.

Certificate No : 25-SLM-116

Address : 104 Soi Phatthanakan 40, Phatthanakan Road, Suan Luang, Bangkok 10250

Request No : Req-2025-0603

Unit Under Calibration Details

Measurement item : Sound Level Meter

Microphone Class : 2

Manufacturer : RION

Microphone Model : UC-52

Model : NL-42

Microphone S/N : 143486

Serial Number : 01222724

Preamplifier Model : NH-24

ID : RYG_FS0023

Preamplifier S/N : 22620

Resolution : 0.1 dB

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C

Humidity : 50 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 6 March 2025

Calibrated Date : 19 March 2025

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3; Periodic tests

Location of Calibration : Lab Acoustic

REVIEW BY

APPROVED BY

NEXT CAL DATE.....19/03/26

Reference Standard

| Instrument | Brand | Model | SN. | Due calibration | Traceability |
|---------------------|--------------|---------|---------|-----------------|--------------|
| Standard Microphone | Brüel & Kjær | 4192 | 2294985 | 25 June 2025 | NIMT |
| Audio Generator | Svantek | Svan401 | 131 | 15 October 2025 | WK Electric |

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.

Calibrated By :

Mr. Noppadon Luangart

Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn

Calibration Engineer Supervisor

Issue Date :

19 March 2025

Certificate No : 25-SLM-116

Request No : Req-2025-0603

1. Indication at the calibration check frequency

| UUC Setting | Nominal | Before Adjust | | After Adjust | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) | Result |
|--------------------|---------|---------------|-------|--------------|-------|------------------------|--------------------------------|--------|
| FAST / A / 30-130 | Level | UUC | ERR | UUC | ERR | | | |
| Calibrator Setting | (dB) | (dB) | (dB) | (dB) | (dB) | | | |
| 1000 Hz 94 dB | 94.06 | 94.0 | -0.06 | 94.1 | +0.04 | 0.20 | 0.30 | Pass |

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand RION, Model NC-75, SN.35002736

2. Self-generated noise, Microphone installed

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 30-130 | | |
| UUC Weighting | (dB) | (± dB) |
| A | 19.7 | 0.10 |

3. Self-generated noise, Microphone replaced by the electrical input signal device

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 30-130 | | |
| UUC Weighting | (dB) | (± dB) |
| A | 14.7 | 0.10 |
| C | 19.0 | 0.10 |
| Z | 23.4 | 0.10 |

4. Acoustic signal test of frequency weightings (Without Windscreen)

| UUC Setting | Deviation from various Frequency Weighting Responce curve | | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) | Result |
|---------------|--------------------------------------------------------------|------|------|------------------------|--------------------------------|--------|
| FAST / 30-130 | A | C | Z | | | |
| STD Setting | (dB) | (dB) | (dB) | (± dB) | (± dB) | |
| 125 Hz | 0.0 | 0.1 | 0.1 | 0.60 | 1.5 | Pass |
| 1000 Hz | 0.0 | 0.0 | 0.0 | 0.60 | 1.0 | Pass |
| 4000 Hz | 1.0 | 1.0 | 1.0 | 0.60 | 3.0 | Pass |
| 8000 Hz | -0.4 | -0.4 | -0.5 | 0.70 | 5.0 | Pass |

Certificate No : 25-SLM-116

Request No : Req-2025-0603

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

| UUC Setting | Deviation from various Frequency | | | UNCERTAINTY | Acceptance | Result |
|---------------|----------------------------------|--------|--------|-------------|------------|--------|
| FAST / 30-130 | Weighting Responce curve | | | | Limit | |
| STD Setting | A (dB) | C (dB) | Z (dB) | (± dB) | (± dB) | |
| 63 Hz | -0.2 | -0.1 | 0.0 | 0.20 | 2.0 | Pass |
| 125 Hz | -0.1 | 0.1 | 0.0 | | 1.5 | Pass |
| 250 Hz | 0.0 | 0.0 | 0.0 | | 1.5 | Pass |
| 500 Hz | 0.0 | 0.1 | 0.0 | | 1.5 | Pass |
| 1000 Hz | 0.0 | 0.0 | 0.0 | | 1.0 | Pass |
| 2000 Hz | 0.0 | 0.1 | 0.0 | | 2.0 | Pass |
| 4000 Hz | 0.0 | 0.0 | 0.0 | | 3.0 | Pass |
| 8000 Hz | 0.1 | 0.1 | 0.0 | | 5.0 | Pass |
| 16000 Hz | -1.3 | -1.4 | 0.0 | | +5, -INF. | Pass |

6. Frequency and time weightings at 1kHz

| UUC Setting | STD | Measured | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) | Result |
|---------------|--------|----------|------|------------------------|--------------------------------|--------|
| FAST / 30-130 | REF | UUC | ERR | | | |
| UUC Weighting | (dB) | (dB) | (dB) | | | |
| A | 114.00 | 114.0 | 0.0 | 0.20 | 0.20 | Pass |
| C | 114.00 | 114.0 | 0.0 | | 0.20 | Pass |
| Z | 114.00 | 114.0 | 0.0 | | 0.20 | Pass |

| UUC Setting | STD | Measured | | UNCERTAINTY (± dB) | Acceptance Limit (± dB) | Result |
|-------------------|--------|----------|------|------------------------|--------------------------------|--------|
| 30-130 / A | REF | UUC | ERR | | | |
| UUC Time Response | (dB) | (dB) | (dB) | | | |
| Fast | 114.00 | 114.0 | 0.0 | 0.20 | 0.10 | Pass1 |
| Slow | 114.00 | 114.0 | 0.0 | | 0.10 | Pass1 |
| Leq | 114.00 | 114.0 | 0.0 | | 0.10 | Pass1 |

Certificate No : 25-SLM-116

Request No : Req-2025-0603

7. Long Term Stability

| UUC Setting | Measured | UNCERTAINTY | Acceptance | Result |
|-------------------|----------|-------------|------------|--------|
| FAST / A / 30-130 | UUC | | Limit | |
| STD Setting | (dB) | (± dB) | (± dB) | |
| Initial | 114.0 | | | |
| Final | 114.0 | | | |
| Deviated | 0.0 | 0.10 | 0.30 | Pass |

8. Level linearity on the reference level range

| UUC Setting | Anticipated | Deviation | | UNCERTAINTY | Acceptance | Result |
|-------------------|-------------|-----------|------|-------------|------------|--------|
| FAST / A / 30-130 | REF | UUC | ERR | | Limit | |
| STD dB | (dB) | (dB) | (dB) | (± dB) | (± dB) | |
| 138.00 | 138 | 138.0 | 0.0 | 0.30 | 1.1 | Pass |
| 134.00 | 134 | 134.0 | 0.0 | | 1.1 | Pass |
| 129.00 | 129 | 129.0 | 0.0 | | 1.1 | Pass |
| 124.00 | 124 | 124.0 | 0.0 | | 1.1 | Pass |
| 119.00 | 119 | 119.0 | 0.0 | | 1.1 | Pass |
| 114.00 | 114 | 114.0 | 0.0 | | 1.1 | Pass |
| 109.00 | 109 | 109.0 | 0.0 | | 1.1 | Pass |
| 104.00 | 104 | 104.0 | 0.0 | | 1.1 | Pass |
| 99.00 | 99 | 99.0 | 0.0 | | 1.1 | Pass |
| 94.00 | 94 | 94.0 | 0.0 | | 1.1 | Pass |
| 89.00 | 89 | 89.0 | 0.0 | | 1.1 | Pass |
| 84.00 | 84 | 84.0 | 0.0 | | 1.1 | Pass |
| 79.00 | 79 | 79.0 | 0.0 | | 1.1 | Pass |
| 74.00 | 74 | 74.0 | 0.0 | | 1.1 | Pass |
| 69.00 | 69 | 69.0 | 0.0 | | 1.1 | Pass |
| 64.00 | 64 | 64.0 | 0.0 | | 1.1 | Pass |
| 59.00 | 59 | 59.0 | 0.0 | | 1.1 | Pass |
| 54.00 | 54 | 54.0 | 0.0 | | 1.1 | Pass |
| 49.00 | 49 | 49.0 | 0.0 | | 1.1 | Pass |
| 44.00 | 44 | 44.0 | 0.0 | | 1.1 | Pass |
| 39.00 | 39 | 39.0 | 0.0 | | 1.1 | Pass |
| 34.00 | 34 | 34.0 | 0.0 | | 1.1 | Pass |
| 29.00 | 29 | 29.1 | 0.1 | 1.1 | Pass | |
| 24.00 | 24 | 24.3 | 0.3 | 1.1 | Pass | |

Certificate No : 25-SLM-116

Request No : Req-2025-0603

9. Level linearity including the level range control

| UUC Setting | STD | Measured | | UNCERTAINTY | Acceptance | Result |
|-------------|-------|----------|------|-------------|------------|--------|
| FAST / A | REF | UUC | ERR | (± dB) | Limit | |
| UUC Range | (dB) | (dB) | (dB) | | (± dB) | |
| 30-130 | 29.40 | 29.7 | 0.3 | 0.30 | 1.1 | Pass |
| | 114 | 114.0 | 0.0 | | 1.1 | Pass |

10. Tone burst response

| UUC Setting | STD | Anticipated | Measured | | UNCERTAINTY | Acceptance | Result |
|-------------------|-----------|-------------|----------|------|-------------|------------|--------|
| A / 30-130 | Toneburst | Ref | UUC | ERR | (± dB) | Limit | |
| UUC Time Response | (ms) | (dB) | (dB) | (dB) | | (± dB) | |
| Fast | 200 | 126.0 | 126.1 | +0.1 | 0.20 | 1.0 | Pass |
| | 2 | 109.0 | 109.0 | 0.0 | | +1.0, -2.5 | Pass |
| | 0.25 | 100.0 | 99.9 | -0.1 | | +1.5, -5.0 | Pass |
| Slow | 200 | 119.6 | 119.6 | 0.0 | | 1.0 | Pass |
| | 2 | 100.0 | 100.0 | 0.0 | | +1.0, -5.0 | Pass |
| SEL | 200 | 120.0 | 120.0 | 0.0 | | 1.0 | Pass |
| | 2 | 100.0 | 100.0 | 0.0 | | +1.0, -2.5 | Pass |
| | 0.25 | 91.0 | 90.9 | -0.1 | | +1.5, -5.0 | Pass |

11. Peak C Sound level

| UUC Setting | Anticipated | Measured | | UNCERTAINTY | Acceptance | Result |
|---------------------|-------------|----------|-------|-------------|------------|--------|
| FAST / C / 55-141 | REF | UUC | ERR | (± dB) | Limit | |
| STD Setting | (dB) | (dB) | (dB) | | (± dB) | |
| Complete cycle | 136.4 | 136.4 | 0.00 | 0.20 | 3.0 | Pass |
| Positive half cycle | 135.4 | 135.2 | -0.20 | | 2.0 | Pass |
| Negative half cycle | 135.4 | 135.2 | -0.20 | | 2.0 | Pass |

Certificate No : 25-SLM-116

Request No : Req-2025-0603

12. Overload indication

| UUC Setting | Measured | UNCERTAINTY | Acceptance | Result |
|-------------------------|----------|-------------|------------|--------|
| FAST / A / 30-130 | UUC | (± dB) | Limit | |
| STD Setting | (dB) | | (± dB) | |
| Positive one-half cycle | 139.4 | | | |
| Negative one-half cycle | 139.3 | | | |
| Deviated | 0.1 | 0.20 | 1.5 | Pass |

13. High Level Stability

| UUC Setting | Measured | UNCERTAINTY | Acceptance | Result |
|-------------------|----------|-------------|------------|--------|
| FAST / A / 30-130 | UUC | (± dB) | Limit | |
| STD Setting | (dB) | | (± dB) | |
| Initial | 129.0 | | | |
| Final | 129.0 | | | |
| Deviated | 0.0 | 0.10 | 0.30 | Pass |

Note :

| Function | Maximum-permitted Uncertainty of measurement |
|------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| 1. Indication at the calibration check frequency | Not applicable |
| 2. Self-generated noise, Microphone installed | Not applicable |
| 3. Self-generated noise, Microphone replaced by the electrical input signal device | Not applicable |
| 4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz | 0.60 dB |
| 4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz | 0.70 dB |
| 5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz | 0.20 dB |
| 6. Frequency and time weightings at 1kHz | 0.20 dB |
| 7. Long Term Stability | 0.10 dB |
| 8. Level linearity on the reference level range | 0.30 dB |
| 9. Level linearity including the level range control | 0.30 dB |
| 10. Tone burst response | 0.30 dB |
| 11. Peak C Sound level | 0.35 dB |
| 12. Overload indication | 0.25 dB |
| 13. High Level Stability | 0.10 dB |

- Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

Certificate No : 25-SLM-116

Request No : Req-2025-0603

Decision Rule for Statements of Conformity

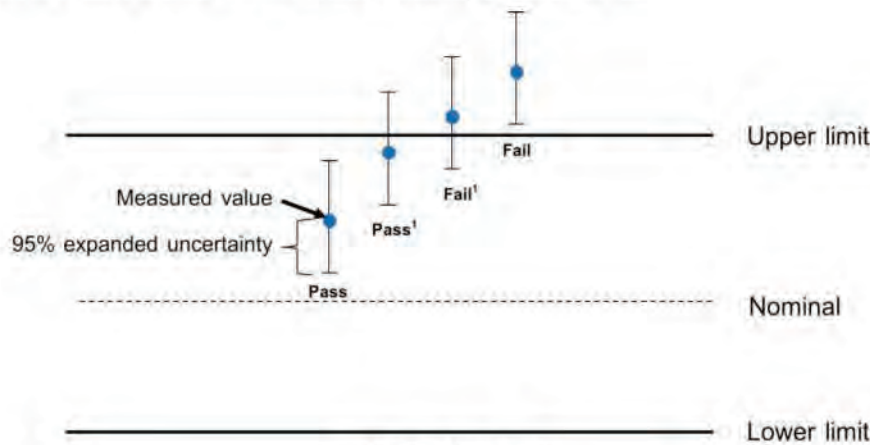
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate



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.: 25LM10

Page.: 1 of 2

Equipment : DO Meter with Sensor

Manufacturer : YSI

Model : 5000-115V

Serial No. : 15E102796

ID No. : RYG_EN0032

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5 T. Maenam Khu, A. Pluakdaeng,
Rayong 21140 Thailand

Location : TPA On Site Calibration Laboratory

Received Order : 17 January 2025

Calibrated Date : 20 January 2025

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

() Chakrit Waewwanjua

(✓) Suwit Imjai

() Kunchit Promprat

Issue Date : 23 January 2025

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 Corporate Services 3 : Equipment Calibration and Testing Services.

Photchana S.
REVIEW BY
D. Imjai
APPROVED BY
20/07/26
NEXT CAL DATE.....



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2501-0600DSC-2

Cert. No.: 25LM10
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|--------------------------------------------------------------------------------------------|-------------------|------------------|------------------|-----------------|
| 1) Digital Thermometer | 2188080 | 2411022 | TPA | 17 Sep 2025 |
| 2. This certificate is valid only to the item calibrated on date and place of calibration. | | | | |
| 3. This certification is traceable to the International System of Unit. | | | | |

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 15E100464

| <u>Calibration Point</u> (°C) | <u>Immersion Depth</u> (mm) | <u>Standard Temperature</u> (°C) | <u>UUC* Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (± °C) | <u>Coverage Factor</u> <i>k</i> |
|------------------------------------|----------------------------------|---------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------------------|
| 20.00 | 60 | 20.002 | 19.81 | -0.192 | 0.15 | 2.00 |

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 of approximately 95 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250

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

Certificate of Testing

Cert.No.: 25TW15

Page.: 1 of 2

Equipment : DO Meter

Manufacturer : YSI

Model : 5000-115V

Serial No. : 15E102796

ID No. : RYG_EN0032

Received Date : 17 January 2025

Test Date : 20 January 2025


Reference : 2501-0600DSC-1

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
(Rayong Branch)
616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng,
Rayong 21140, Thailand

Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %

Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method

Tested by : Walalak Sirithean

Approved by : 
Approved Signatory

() Pornthippa Tameyakul
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 21 January 2025



Cert.No.: 25TW15

Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

This certification is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, 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. Burette | - | 130BU10 | 23CG1172 | 22 Mar 2025 |
| 2. Balance | 14233821 | 110RC001 | 24MM131 | 04 July 2025 |

2. Standard Material :-

| <u>Material</u> | <u>Manufacturer</u> | <u>Lot.No.</u> | <u>Assay</u> |
|---------------------------------|---------------------|----------------|--------------|
| Sodium Thiosulfate 5-Hydrate AR | KEMAUS | 2203162447 | 99.6% |

Result : Dissolved Oxygen Meter Adjustment With Air 100 %

Dissolved Oxygen Probe No.: 15E100464

| Titration Method (Azide Modification Method) (mg/L) | DO Meter Reading (mg/L) | Standard Deviation (mg/L) |
|--------------------------------------------------------------------|----------------------------------------|--------------------------------------|
| 8.20 | 8.20 | 0.0084 |

This report was certified only for the instrument we tested. It is allowable to use for study
Intend to use for advertising and referral purpose is prohibited. This report may not be reproduced
other in full, without written approval of the laboratory

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



Certificate of Calibration

Cert. No.: 24TM1663

Page : 1 of 3

Equipment : Low Temp. Incubator

Manufacturer : Memmert

Model : IPP750

Serial No. : V818.0084

ID No. : RYG_EN0154

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng,
Rayong 21140, Thailand

Location : BOD Room

Received Order : 01 November 2024

Calibration Date : 01 November 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

AC Line Voltage : (220 ± 22) V

Calibrated by : Krisda Malee

Approved by :

Kunchit

Approved Signatory

() Ponpan Paipim

() Suwit Imjai

(✓) Kunchit Promprat

Issue Date : 07 November 2024

REVIEW BY *Thanitak*

APPROVED BY *D. Khunon*

NEXT CAL DATE..... 01/05/26

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1

Cert. No.: 24TM1663

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1) Data Acquisition | MY44073381 | 24LM73 | TPA | 18 May 2025 |

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

3. This certification is traceable to the International System of Unit.

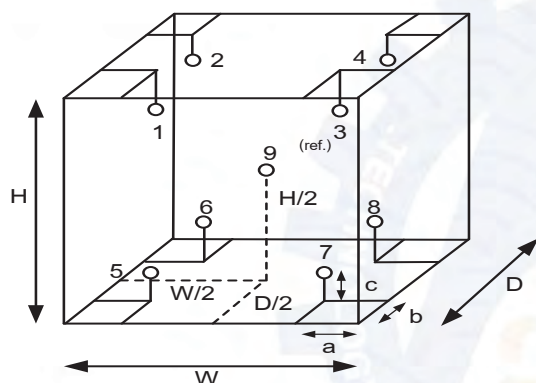
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 24 | 25 |
| REL.Humid. (%) | 55 | 53 |
| AC Supply (Volt) | 220 | 221 |



| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 1RTD-2/1 |
| 2 | 1RTD-2/2 |
| 3 | 22-01RTD-03 |
| 4 | 1RTD-2/4 |
| 5 | 1RTD-2/5 |
| 6 | 1RTD-2/6 |
| 7 | 23-01RTD-07 |
| 8 | 1RTD-2/8 |
| 9 (ref.) | 23-01RTD-09 |

Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.60 m
W = 1.0 m
H = 1.2 m
Capacity = 0.72 m³



Equipment : Low Temp. Incubator
Condition As-Received : Used Item
Reference : 2411-0002OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM1663

Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Coverage Factor <i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-----------------------------|
| 20.0 | 20.0 | 20.0 | 0.026 | 0.26 | 0.53 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (±°C) |
|--------------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|----------------------------|
| | Position | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 20.0 | 20.071 | 19.915 | 20.273 | 20.179 | 19.977 | 19.782 | 20.056 | 20.026 | 20.033 | 0.30 |

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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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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.: 24CG3711

Page.: 1 of 2

| | |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Equipment : | Burette |
| Capacity : | 50 mL |
| Serial No. : | - |
| ID. No. : | RYG_EN0216 |
| Manufacturer : | Witeg |
| Made in : | Germany |
| Submitted by : | ALS Laboratory Group (Thailand) Co.,Ltd. Rayong Branch 616/10 Moo 5, T.Maenam Khu, A.Pluakdaeng Rayong 21140, Thailand |
| Ambient Temperature : | (20 ± 2.5) °C |
| Relative Humidity : | (50 ± 10) % |
| Barometric Pressure : | 756 mmHg |
| Calibration Procedure : | ASTM E 542 - 01 |
| Calibrated by : | Sa-ngeunkam Wongsai |

REVIEW BY *Thanitak*

APPROVED BY *D. Johnson*

NEXT CAL DATE *24/09/25*

Approved by :

Approved Signatory

(✓) Srisuda Khamtha
() Ponpan Paipim
() Unnopphol Harachai

Issue Date :

24 September 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 Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Burette
Received Date : 19 September 2024
Condition As-Received : Used Item
Calibration Date : 24 September 2024
Reference : 2409-0756DSC-3

Cert.No.: 24CG3711
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :

| <u>Instruments</u> | <u>Model</u> | <u>Serial No.</u> | <u>ID. No.</u> | <u>Certificate No.</u> | <u>Traceability</u> | <u>Due date</u> |
|--------------------|--------------|-------------------|----------------|------------------------|---------------------|-----------------|
| 1) Balance | XP205 | B134206712 | 140RC007 | 24MM316 | TPA | 15 July 2025 |
| 2) Data Logger | HL-20D | 20683159 | 140EC012 | 23H2174 | TPA | 10 Oct 2024 |
| 3) Thermometer | - | 1594592 | 140EC010 | 24I175 | TPA | 20 Feb 2025 |

This certification is traceable to SI Unit

2. The certificate is valid only to the item calibrated on date and place of calibration.
3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result :

| Nominal capacity (mL) | Reading (mL) | Uncertainty (± mL) | k Factor |
|------------------------------------|---------------------------|---------------------------------|---------------------|
| 10 | 10.0259 | 0.0082 | 2.00 |
| 20 | 20.0214 | 0.0085 | 2.00 |
| 30 | 30.0006 | 0.0089 | 2.00 |
| 40 | 40.0003 | 0.0094 | 2.00 |
| 50 | 49.9988 | 0.011 | 2.00 |

Remark mL = cm³

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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Accredited by

NSC-TISI-TIS 17025

Calibration 0426



Calibration certificate

Calibration Certificate No. 25BKL0004

| | | |
|------------------------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Object | Electronic non-automatic weighing instrument | This calibration certificate documents the traceability to national standards. |
| Manufacturer | Sartorius | Uncertainties of measurements are taken into account when only statements of compliance are made. |
| Type | MSE224S-100-DU | This certificate was prepared by Sartorius Corporation in accordance to the current ISO/IEC 17025:2017 standard and Sartorius Work Instruction (Method) SOP WI 08. |
| Serial QM Ident. no. | 26207038 RYG_EN0002 | This certificate relate and apply this equipment only. |
| Customer | ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch) | |
| | 616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand. | |
| Order no. | 2230 | |
| Number of pages | 4 | |
| Date of calibration | 20 Feb 2025 | |

REVIEW BY *Thanitak*APPROVED BY *D. Khunon*

NEXT CAL DATE.....20/02/26

This calibration certificate may not be reproduced other than in full except with the permission of NSC-TISI-TIS-17025 and the issuing laboratory. Calibration certificates without signature are not valid.

The user is obliged to have the object recalibrated at appropriate intervals.

| | | | |
|------|-------------|-----------------------------------------|------------------|
| Date | 06 Mar 2025 | Approval of the Calibration Certificate | Person in charge |
| | | | |
| | | Mr. Chonchai Inthana | Kachen Lalee |

Calibration object

Single range instrument

| | |
|------------------------------|------------------|
| Model | MSE224S-100-DU |
| Serial Number | 26207038 |
| QM Ident. no Inventory no. | RYG_EN0002 --- |

| | |
|------------------------------|------------|
| Maximum capacity (Max. load) | 220.0000 g |
| Measured range | 220.0000 g |
| Scale interval | 0.0001 g |

Place of calibration

| | |
|-------------------------------------------------------|------------------------------|
| Address | According to page 1 |
| Department Cost center | Laboratory Department. --- |
| Building Floor | --- 1st Floor. |
| Room | Balance Room. |
| Maximum temperature variation at place of calibration | 5 K |

Calibration procedure

EURAMET cg-18, V4.0 - Guidelines on the Calibration of Non-Automatic Weighing Instruments

Test equipment

| Test equipment type | Test equipment ID | Valid until |
|------------------------------|----------------------------------------------------------------|-------------|
| Thermometer | MHB-382SD s/nB011342 Traceable to SI unit through DKSH | 21 Aug 2025 |
| Test weight set OIML R111 E2 | Certificate No.M2308197S ,E2(Traceable to SI unit through TCS) | 23 Aug 2025 |

Adjustment Status

The measuring device was internally adjusted before the calibration.

Environmental and measuring conditions

| | |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Date of calibration | 20 Feb 2025 |
| Temperature at place of calibration Temp. diff. <i>T</i> _{weights} - <i>T</i> _{place} | 24.4 °C 0.6 K |
| Measuring conditions | The installation site is suitable. The device was levelled. Balance was loaded up to Max before test. |
| Comments | Humidity 50.2 %RH. |

Measurement results | Measurement uncertainties

Repeatability

| Test load (nominal): 10 g 200 g | | |
|-----------------------------------|----------------------|----------------------|
| | 10 g | 200 g |
| 1 | 10.0000 g | 200.0000 g |
| 2 | 10.0000 g | 200.0001 g |
| 3 | 10.0001 g | 200.0001 g |
| 4 | 10.0000 g | 200.0000 g |
| 5 | 10.0001 g | 200.0000 g |
| 6 | 10.0001 g | 200.0001 g |
| 7 | 10.0000 g | 200.0000 g |
| 8 | 10.0000 g | 200.0001 g |
| 9 | 10.0001 g | 200.0000 g |
| 10 | 10.0000 g | 200.0000 g |
| | <i>s</i> = 0.00005 g | <i>s</i> = 0.00005 g |

Eccentricity

| Test load (nominal): 100 g | |
|-----------------------------------------------------------------------------------------------|------------|
| Center | 100.0000 g |
| Front left | 99.9998 g |
| Back left | 100.0000 g |
| Back right | 100.0000 g |
| Front right | 100.0000 g |
| Maximum deviation from centric loading indication $ \Delta_{ecc} _{max} = 0.0002\text{ g}$ | |

Error of indication

| Testload | Indication | Error | Expansion factor | Uncertainty | Uncertainty relative |
|-----------------------------|------------|-------------------------------|------------------|-----------------------|--------------------------------------|
| <i>L</i> | <i>I</i> | <i>E</i> | <i>k</i> | <i>U</i> (<i>E</i>) | <i>U</i> _{rel} (<i>E</i>) |
| 0.0100 g | 0.0100 g | 0.0000 g | 2.00 | 0.00013 g | 1.3 % |
| 0.1000 g | 0.1000 g | 0.0000 g | 2.00 | 0.00013 g | 0.13 % |
| 0.5000 g | 0.5000 g | 0.0000 g | 2.00 | 0.00013 g | 0.027 % |
| 1.0000 g | 1.0000 g | 0.0000 g | 2.00 | 0.00013 g | 0.013 % |
| 5.0000 g | 5.0000 g | 0.0000 g | 2.00 | 0.00014 g | 0.0027 % |
| 10.0000 g | 10.0000 g | 0.0000 g | 2.00 | 0.00014 g | 0.0014 % |
| 20.0000 g | 20.0000 g | 0.0000 g | 2.00 | 0.00014 g | 0.00072 % |
| 50.0000 g | 50.0000 g | 0.0000 g | 2.00 | 0.00016 g | 0.00032 % |
| 100.0000 g | 100.0001 g | 0.0001 g | 2.00 | 0.00021 g | 0.00021 % |
| 200.0000 g | 200.0000 g | 0.0000 g | 2.00 | 0.00034 g | 0.00017 % |
| 220.0000 g | 220.0000 g | 0.0000 g | 2.00 | 0.00039 g | 0.00018 % |
| Maximum error of indication | | $ E _{max} = 0.0001\text{ g}$ | | | |

*U*_{rel}(*E*) is the quotient of *U*(*E*) and test load *L*. The uncertainty of measurement *U*(*E*) is valid only if error *E* is considered. You will find reference notes on the uncertainty of measurement in use under: Appendix to the calibration certificate | Interpretation of measurement results.
Reference note: The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the documented Expansion factor, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

End of calibration certificate

Uncertainty of measurement in use

Device adjusted before measurement

Yes

Temperature deviation considered

1.5 K (isoCAL active)

Temperature coefficient considered

$1 \cdot 10^{-6}/\text{K}$

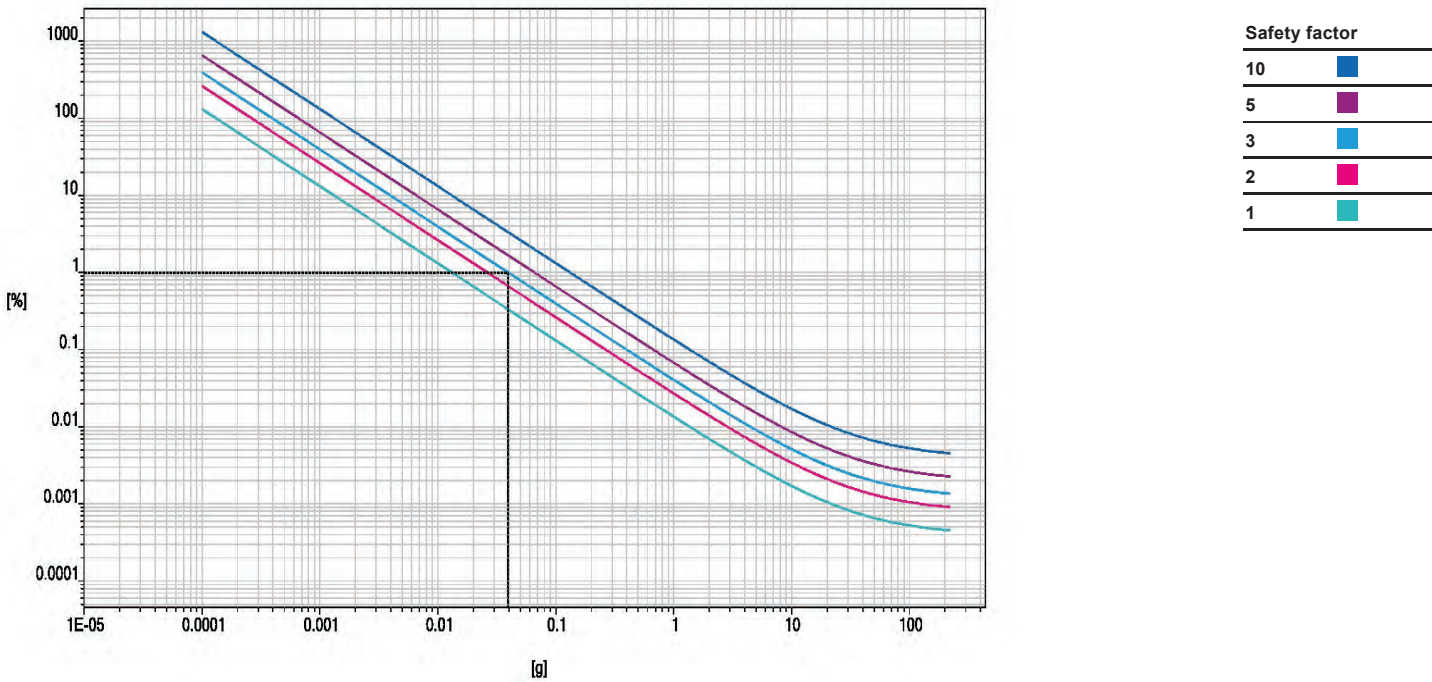
Uncertainty of the weighing result $U_{gl}(W)$

$U_{gl}(W) = 0.00013 \text{ g} + 3.95 \cdot 10^{-6} \cdot R$

Reference note: The current uncertainty of measurement is calculated by entering of the reading R into this formula. In relation to this, there is no need for a correction of the indication error. The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied with an Expansion factor of 2, determined in accordance with the European Calibration Guideline EURAMET cg-18, V4.0. There is a 95 % probability that the value of the measurand will be in the assigned value range.

| Indication in % from max load | Net indication R | Uncertainty $U_{gl}(W)$ | Uncertainty relative $U_{gl}(W)_{rel}$ |
|-------------------------------|-----------------------|----------------------------|-------------------------------------------|
| 1 % | 2.2000 g | 0.00014 g | 0.0063 % |
| 25 % | 55.0000 g | 0.00035 g | 0.00063 % |
| 50 % | 110.0000 g | 0.00056 g | 0.00051 % |
| 75 % | 165.0000 g | 0.00078 g | 0.00047 % |
| 100 % | 220.0000 g | 0.00100 g | 0.00045 % |

Graphic realization of the relative uncertainty of measurement | process accuracy



Displayed example

Process accuracy

1.00 %

Safety factor

3

Minimum sample weight

0.0395 g



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.: 24TM632

Page : 1 of 3

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UFE 500
Serial No. : G511.1572
ID No. : RYG_EN0010

REVIEW BY *Thanitak.*
APPROVED BY *D. Imjai.*
NEXT CAL DATE 21/09/25

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140 Thailand

Location : Oven Room

Received Order : 21 March 2024
Calibration Date : 21 March 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :

Approved Signatory

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Suwit Imjai

Issue Date : 22 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 Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1
Procedure Used :-

Cert. No.: 24TM632

Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1) Data Acquisition | MY57013711 | 23LM115 | TPA | 11 Jul 2024 |

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

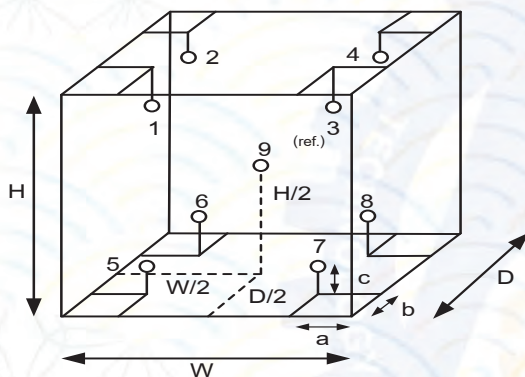
3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 27 | 27 |
| REL.Humid. (%) | 57 | 59 |
| AC Supply (Volt) | 222 | 224 |

**Ref. Std. ID No.: @
Calibration Point**

| Position : | (180) °C | (104) °C |
|------------|------------|-------------|
| 1 | 18-18TC-01 | 18-18RTD-01 |
| 2 | 18-18TC-02 | 18-18RTD-02 |
| 3 | 18-18TC-03 | 18-18RTD-03 |
| 4 | 18-18TC-04 | 18-18RTD-04 |
| 5 | 18-18TC-05 | 18-18RTD-05 |
| 6 | 18-18TC-06 | 23-18RTD-06 |
| 7 | 18-18TC-07 | 18-18RTD-07 |
| 8 | 18-18TC-08 | 22-18RTD-08 |
| 9 (ref.) | 18-18TC-09 | 18-18RTD-09 |

Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.40 m
W = 0.56 m
H = 0.48 m
Capacity = 0.11 m³



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2403-0563OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM632

Page : 3 of 3

| Calibration Point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Temperature stability (± °C) | Temperature uniformity (°C) | Overall Variation (°C) | Coverage Factor <i>k</i> |
|-----------------------------|------------------------|------------------------|-----------------------------------|----------------------------------|-----------------------------|-----------------------------|
| 104.0 | 104.0 | 104.0 | 0.051 | 0.59 | 0.62 | 2 |
| 180.0 | 180.0 | 180.0 | 0.15 | 1.3 | 1.7 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (±°C) |
|--------------------------------|-----------------------------|---------|---------|---------|---------|---------|---------|---------|----------|----------------------------|
| | Position | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 104.0 | 103.921 | 103.786 | 103.757 | 103.759 | 103.950 | 103.817 | 104.213 | 103.672 | 103.673 | 0.42 |
| 180.0 | 179.614 | 179.270 | 179.145 | 179.599 | 180.001 | 180.423 | 180.293 | 180.629 | 179.429 | 1.1 |

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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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Certificate of Calibration

Represent to Certificate of Calibration No. C29240007

| | | | |
|----------------------|-----------------------|------------------|---------------|
| Equipment: | Block Digestion Unit | Certificate No.: | C29240011 |
| Model: | KT-20s | Issued Date: | 22 March 2024 |
| Serial No. (or ID.): | 5720210009/5770200073 | Job No.: | WO-00020429 |
| Manufacturer: | Gerhardt | Page: | 1 of 4 |
| Condition: | In Condition | Digestion Block: | 20 holes. |

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition: Temperature: 25 °C ± 0.7 °C
Humidity: 54 %RH ± 4.1 %RH
Voltage: 225 VAC ± 1.7 VAC

| | |
|----------------|--------------------|
| REVIEW BY | <i>N. Banmit</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 11/07/25 |

1316124 ปล่อยตามนัด Cal

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemistry Lab)
616/10 Moo 5 T.Maenam Khu, A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Thanathorn Phunook

Calibration Date: 11 March 2024

The Method used: In house method, base on by comparison with standard

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)
Certificate No.: TC22/0080



(Mr. Thanathorn Phunook)

Person in charge



(Mr. Udon Srichana)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

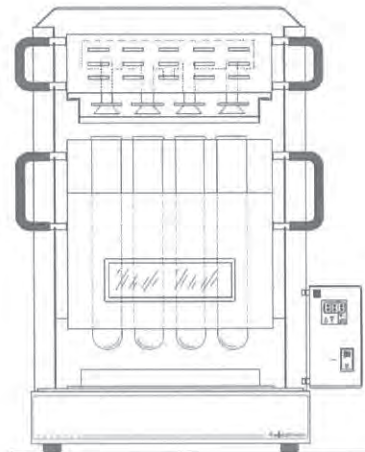
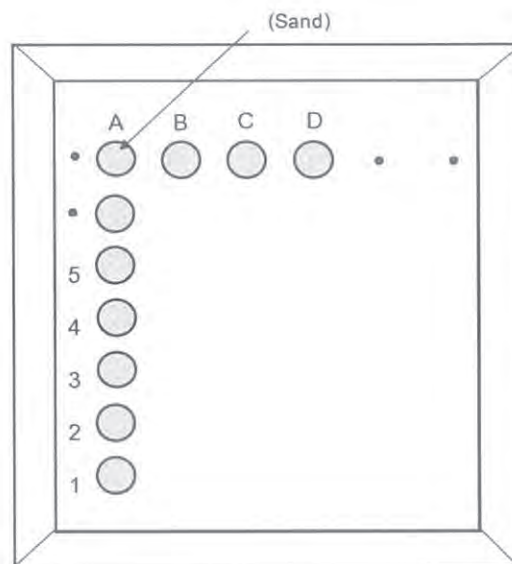


Fig. 1.: Front view



Location of standard

Fig. 2.: Digestion block

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature: The average reading of working standard at any positions or location.

Calibration Results:
Pre Calibration

| Locations | Desired (°C) | Setting (°C) | Indicating (°C) | Measured Temperature (°C) | Correction of UUC, (°C) | Uncertainty (± °C) |
|-----------|-----------------|-----------------|--------------------|---------------------------------|-------------------------------|-----------------------|
| A1 | 380 | 380 | 380 | 401.5 | 21.5 | 1.5 |
| A2 | | | | 401.2 | 21.2 | 1.5 |
| A3 | | | | 399.1 | 19.1 | 1.5 |
| A4 | | | | 397.8 | 17.8 | 1.5 |
| A5 | | | | 395.1 | 15.1 | 1.5 |
| B1 | | | | 396.6 | 16.6 | 1.5 |
| B2 | | | | 396.1 | 16.1 | 1.5 |
| B3 | | | | 392.9 | 12.9 | 1.5 |
| B4 | | | | 391.6 | 11.6 | 1.5 |
| B5 | | | | 390.7 | 10.7 | 1.5 |
| C1 | | | | 395.3 | 15.3 | 1.5 |
| C2 | | | | 395.6 | 15.6 | 1.5 |
| C3 | | | | 392.8 | 12.8 | 1.5 |
| C4 | | | | 391.7 | 11.7 | 1.5 |
| C5 | | | | 390.3 | 10.3 | 1.5 |
| D1 | | | | 397.6 | 17.6 | 1.5 |
| D2 | | | | 396.6 | 16.6 | 1.5 |
| D3 | | | | 395.0 | 15.0 | 1.5 |
| D4 | | | | 394.2 | 14.2 | 1.5 |
| D5 | | | | 393.6 | 13.6 | 1.5 |

Calibration Results:
Without adjustment

| Locations | Desired (°C) | Setting (°C) | Indicating (°C) | Measured Temperature (°C) | Correction of UUC. (°C) | Uncertainty (± °C) |
|-----------|-----------------|-----------------|--------------------|---------------------------------|-------------------------------|-----------------------|
| A1 | 380 | 365 | 365 | 382.5 | 17.5 | 1.5 |
| A2 | | | | 382.4 | 17.4 | 1.5 |
| A3 | | | | 382.1 | 17.1 | 1.5 |
| A4 | | | | 379.7 | 14.7 | 1.5 |
| A5 | | | | 378.3 | 13.3 | 1.5 |
| B1 | | | | 380.1 | 15.1 | 1.5 |
| B2 | | | | 380.1 | 15.1 | 1.5 |
| B3 | | | | 378.5 | 13.5 | 1.5 |
| B4 | | | | 378.3 | 13.3 | 1.5 |
| B5 | | | | 379.1 | 14.1 | 1.5 |
| C1 | | | | 380.1 | 15.1 | 1.5 |
| C2 | | | | 380.1 | 15.1 | 1.5 |
| C3 | | | | 378.9 | 13.9 | 1.5 |
| C4 | | | | 378.2 | 13.2 | 1.5 |
| C5 | | | | 377.3 | 12.3 | 1.5 |
| D1 | | | | 380.5 | 15.5 | 1.5 |
| D2 | | | | 380.6 | 15.6 | 1.5 |
| D3 | | | | 378.1 | 13.1 | 1.5 |
| D4 | | | | 378.7 | 13.7 | 1.5 |
| D5 | | | | 377.7 | 12.7 | 1.5 |

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00020429

ชนิดเครื่องมือ: Block Digestion Unit

รุ่น: KT-20s

หมายเลขเครื่อง: 5720210009/5770200073

| ตรวจสอบ (รับ) | | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) | | หมายเหตุ |
|-------------------------------------|--------------------------|--------------------------------------|-------------------------------------|--------------------------|----------|
| 11 Mar 2024 | | | 11 Mar 2024 | | |
| ปกติ | ไม่ปกติ | | ปกติ | ไม่ปกติ | |
| | | General | | | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. สายไฟ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. การทำงาน Main Switch | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. การทำงาน Selector Key | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. การแสดงผล Display | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. สภาพ Hole | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. สภาพฝาปิด | <input type="checkbox"/> | <input type="checkbox"/> | ไม่มี |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. สภาพตัวเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |

ข้อแนะนำ :

Mr. Thanathorn Phunook

Service Engineer



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T250454

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Oven)

Manufacturer : MEMMERT

Model : UF 110

Serial No. : B423.0853

Customer Code : RYG_EN0213

ID No. : T5884A5

Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)

616/10 Moo 5 T.Maenam Khu,

A.Plukdaeng, Rayong 21140

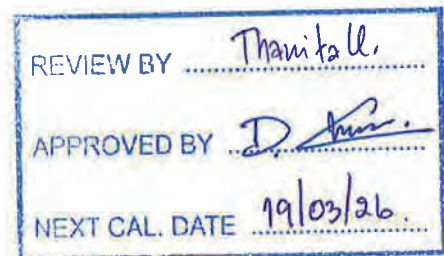
Customer Location : ENVIRONMENT LABORATORY

Date of Receipt : 12 March 2025

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 21 MAR 2025



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Certificate No. T250454

Page 2 of 3

Calibration Report

Equipment : Chamber (Oven)
Date of Calibration : 19 March 2025
Environment : Temperature : 26.5-26.9 °C
Line Voltage : 223.9-231.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2019) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|---------|----------------|-----------------|---------------|
| RTD | 100 ohm | 27-(CH1-10) | T240709 | 19 April 2025 |
| DATA LOGGER | 34970A | T149 | T240709 | 19 April 2025 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 44 Minute At 104 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☒ Close
☐ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

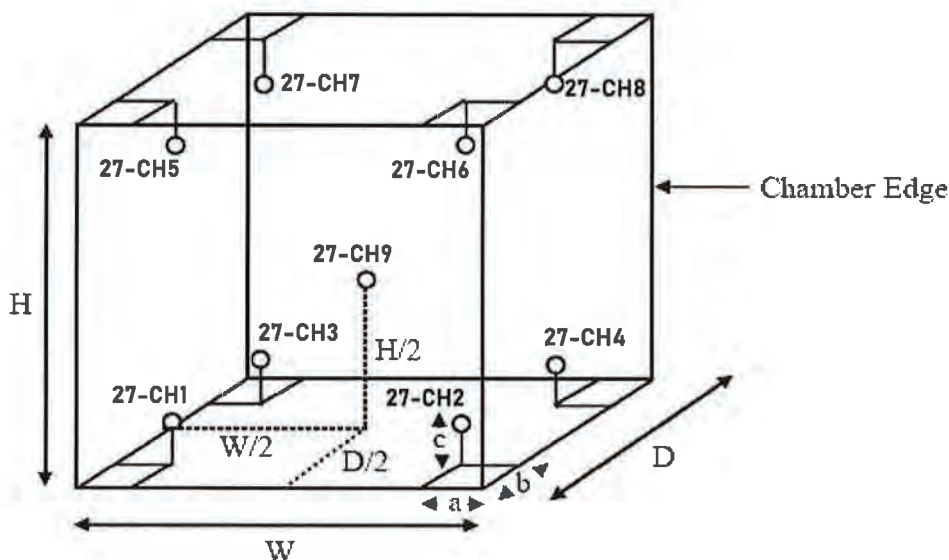
Approved By _____



Certificate No. T250454

Page 3 of 3

Calibration Report



Remark : Internal Dimensions of Chamber : W (Width) = 56 cm. , H (Height) = 48 cm. and D (Depth) = 40 cm.
Size of Installed Standard sensor number 27-CH1 to number 27-CH8 : a = 5 cm. ,b = 5 cm. and c = 5 cm.
Size of Installed Standard sensor number 27-CH9 : W/2 = 56 cm./2 , H/2 = 48 cm./2 and D/2 = 40cm./2

Measurement Results

| Average Standard Reading at each position (°C) | | | | | | | | | |
|------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Calibration Point | 27-CH1 | 27-CH2 | 27-CH3 | 27-CH4 | 27-CH5 | 27-CH6 | 27-CH7 | 27-CH8 | 27-CH9 |
| 104 | 103.84 | 104.10 | 104.10 | 104.48 | 103.73 | 104.14 | 103.95 | 103.57 | 104.22 |
| 180 | 179.41 | 179.92 | 180.80 | 181.37 | 179.54 | 179.52 | 179.82 | 179.41 | 180.31 |

| Chamber (Oven) | | | Temperature Distribution | | | | |
|------------------|---------------|---------|--------------------------|-------------------|-------------------|---------------------|-------------------|
| Setting °C | Reading (°C) | | Average (°C) | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage Factor k |
| | Min , Max | Average | | | | | |
| 104.0 | 103.9 , 104.1 | 104.0 | 104.01 | 0.08 | 0.65 | 0.42 | 2.00 |
| 180.0 | - | 180.0 | 180.01 | 0.17 | 1.26 | 0.49 | 2.00 |

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

End of Certificate.

Approved By. _____





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.: 24TM635

Page : 1 of 3

Equipment : Water Bath
Manufacturer : Memmert
Model : WNB22
Serial No. : L513.0648
ID No. : RYG_EN0061

REVIEW BY *Thanitak.*

APPROVED BY *D. J. J. J.*

NEXT CAL DATE 21/09/25

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5, T. Maenam Khu,
A. Pluakdaeng,
Rayong 21140, Thailand

Location : Wet Chemistry Lab

Received Order : 21 March 2024

Calibration Date : 21 March 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Man Pattanapongpaiboon

Approved by :

Approved Signatory

() Pornthippa Tameyakul

() Unnopphol Harachai

(✓) Suwit Imjai

Issue Date : 23 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 Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Procedure Used :-

Cert. No.: 24TM635

Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|----------------------|-------------------|------------------|------------------|-----------------|
| 1) Data Acquisition | MY57013711 | 23LM115 | TPA | 11 Jul 2024 |

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

3. This certification is traceable to the International System of Unit.

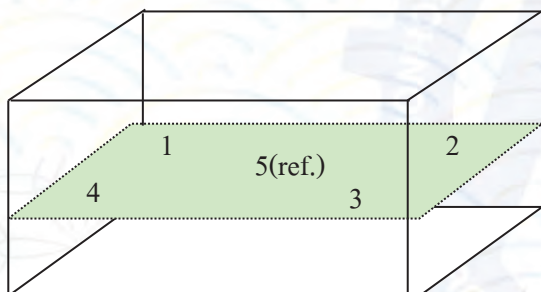
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

| | <u>Environmental</u> | | <u>AC Voltage Supply</u> |
|---------------------------------|----------------------|-----------|--------------------------|
| | (°C) | (%R.H.) | (Volt) |
| Beginning of Calibration | 25 | 55 | 222 |
| Finished of Calibration | 25 | 57 | 223 |



Front

| <u>Position :</u> | <u>Ref. Std. ID No.:</u> |
|-------------------|--------------------------|
| 1 | 4803988-001 |
| 2 | 4803988-002 |
| 3 | 4803988-003 |
| 4 | 4803988-004 |
| 5(ref.) | 4803988-005 |



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2403-0563OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM635

Page : 3 of 3

| Calibration point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Average* Standard Reading (°C) | | | | | Uncertainty (± °C) |
|--------------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|-----------------------------|
| | | | Position | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 (ref.) | |
| 85.0 | 85.0 | 85.0 | 84.428 | 84.424 | 84.489 | 84.507 | 84.477 | 0.18 |

| Calibration point (°C) | Uniformity (°C) | Stability (± °C) | Coverage Factor k |
|--------------------------------|----------------------|-----------------------|--------------------------------|
| 85.0 | 0.19 | 0.11 | 2 |

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

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



Certificate of Calibration

Cert.No.: 24CH1082

Page.: 1 of 2

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven2Go S2
Serial No. : C423217388
ID No. : RYG_FS0714
Condition As-Received: Used Item
Received Date : 29 August 2024
Calibration Date : 30 August 2024
Reference : 2408-0988DSC-7
Submitted by :

ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)

Calibrated by : Warakorn Lernagatrakul

Approved by :

Saithip

Approved Signatory

() Unnopphol Harachai
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 2 September 2024

REVIEW BY *Pitthaya T.*
APPROVED BY *Saithip S.*
NEXT CAL DATE *30/08/25*

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 Corporate Services 3 : Equipment Calibration and Testing Services.



Cert.No.: 24CH1082

Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument

| <u>Instrument</u> | <u>Serial No.</u> | <u>ID No.</u> | <u>Cert. No.</u> | <u>Due Date</u> |
|-------------------------------|-------------------|---------------|------------------|-----------------|
| 1)Document Process Calibrator | 58440003 | 130RC120 | 23E3607 | 13 Nov 2024 |

- This Certification is traceable to SI Throught Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| <u>Buffer Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------|---------------------|----------------|------------------|
| pH 4.006 | Hach Lenge GmbH | C03146 | 23 Feb 2026 |
| pH 7.000 | Hach Lenge GmbH | C03020 | 13 Dec 2024 |
| pH 9.997 | CPA chem | 970853 | 25 Apr 2025 |

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7,10)

| Unit Under Calibration | Nominal Value | Standard Voltage Input | Actual Reading | | Uncertainty of Measurement (±mV) | Coverage factor <i>k</i> |
|------------------------------|---------------|------------------------|----------------|-------|---------------------------------------|-----------------------------|
| | pH | mV | mV | pH | | |
| pH Meter S/N.: C423217388 | 4.00 | 177.48 | 178 | 4.00 | 0.58 | 2.00 |
| | 7.00 | 0.00 | 0 | 7.00 | 0.58 | 2.00 |
| | 10.00 | -177.48 | -177 | 10.00 | 0.58 | 2.00 |

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

| Unit Under Calibration | Standard pH Buffer Solution | Actual pH Reading | Actual mV Reading (mV) | Uncertainty of pH Measurement (±) | Coverage factor <i>k</i> |
|-------------------------------|-----------------------------|-------------------|---------------------------|--------------------------------------|-----------------------------|
| pH Electrode S/N.: 4260858 | 4.006 | 4.01 | 169 | 0.0084 | 2.00 |
| | 7.000 | 7.00 | 9 | 0.0085 | 2.00 |
| | 9.997 | 10.00 | -167 | 0.0092 | 2.00 |

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



Certificate of Calibration

Cert. No.: 24LM142

Page.: 1 of 2

Equipment : pH Meter with Sensor

Manufacturer : Mettler Toledo

Model : Seven2Go S2

Serial No. : C423217388

ID No. : RYG_FS0714

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5, T.Maenam Khu,
A.Pluakdaeng,
Rayong 21140, Thailand

Location : TPA On Site Calibration Laboratory

Received Order : 29 August 2024
Calibrated Date : 30 August 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Approved Signatory

- () Ponpan Paipim
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 02 September 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 Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2408-0988DSC-8

Cert. No.: 24LM142

Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| <u>Instrument</u> | <u>Serial No.</u> | <u>Cert. No.</u> | <u>Traceable</u> | <u>Due Date</u> |
|------------------------|-------------------|------------------|------------------|-----------------|
| 1) Digital Thermometer | 20410013 | 241851 | TPA | 08 Aug 2025 |

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

3. This certification is traceable to the International System of Unit.

Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 4260858

| <u>Calibration Point</u> (°C) | <u>Immersion Depth</u> (mm) | <u>Standard Temperature</u> (°C) | <u>UUC* Reading</u> (°C) | <u>Error</u> (°C) | <u>Uncertainty</u> (± °C) | <u>Coverage Factor</u> <i>k</i> |
|------------------------------------|----------------------------------|---------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------------------|
| 25.0 | 100 | 25.004 | 25.0 | -0.004 | 0.16 | 2.00 |
| 30.0 | 100 | 30.005 | 30.0 | -0.005 | 0.16 | 2.00 |
| 40.0 | 100 | 40.003 | 40.0 | -0.003 | 0.16 | 2.00 |
| 50.0 | 100 | 50.002 | 50.0 | -0.002 | 0.16 | 2.00 |

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 of approximately 95 %.

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Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360
Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T241120

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cold Room)

Manufacturer : MODULAR

Model : IREVCOHCOO

Serial No. : C00351459

Customer Code : RYG_EN0184


ID No. : T1939A5

Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140

Customer Location : Laboratory

Date of Receipt : 5 June 2024

Calibrated By : Sujjar Naknakred (Site Calibration Manager)

Approved By :  Preecha Phisassutthikul (Temperature Calibration Manager)

Date of Issue : 12 JUN 2024

| | |
|----------------|-------------------------------------------------------------------------------------|
| REVIEW BY | Thanitall. |
| APPROVED BY |  |
| NEXT CAL. DATE | 11/12/25 |

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Certificate No. T241120

Page 2 of 4

Calibration Report

Equipment : Chamber (Cold Room)
Date of Calibration : 11 June 2024
Environment : Temperature : 23.1-24.1 °C
Line Voltage : 222.3-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|--------|----------------|-----------------|---------------|
| TC | TYPE T | TN161-TN170 | T240713 | 19 April 2025 |
| TC | TYPE T | TN171-TN180 | T240713 | 19 April 2025 |
| DATA LOGGER | 34970A | T149 | T240713 | 19 April 2025 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 3 Hour 30 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

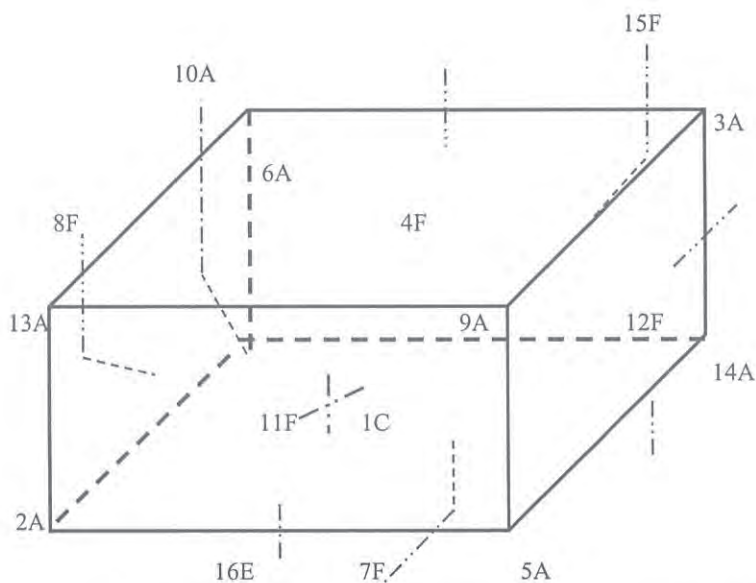
Approved By _____



Certificate No. T241120

Page 3 of 4

Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

| | | |
|-----|---|-------|
| 1C | = | TN161 |
| 2A | = | TN162 |
| 3A | = | TN163 |
| 4F | = | TN164 |
| 5A | = | TN165 |
| 6A | = | TN166 |
| 7F | = | TN167 |
| 8F | = | TN168 |
| 9A | = | TN169 |
| 10A | = | TN170 |

| | | |
|-----|---|-------|
| 11F | = | TN171 |
| 12F | = | TN172 |
| 13A | = | TN173 |
| 14A | = | TN174 |
| 15F | = | TN175 |
| 16E | = | TN176 |

Approved By. 

Certificate No. T241120

Page 4 of 4

Calibration Report

Measurement Results:

| Calibration Point | Average Standard Reading at each position (°C) | | | | | | | | | |
|-------------------|------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | TN161 | TN162 | TN163 | TN164 | TN165 | TN166 | TN167 | TN168 | TN169 | TN170 |
| 3 | 2.73 | 2.70 | 2.77 | 2.78 | 2.99 | 2.35 | 3.09 | 3.21 | 3.08 | 2.90 |
| | TN171 | TN172 | TN173 | TN174 | TN175 | TN176 | | | | |
| | 3.39 | 3.01 | 2.92 | 2.81 | 3.42 | 3.42 | | | | |

| Chamber (Cold Room) | | | Temperature Distribution | | | | |
|-----------------------|---------------|---------|--------------------------|------------------------|------------------|--------------------------|---------------------|
| Setting (°C) | Reading (°C) | | Average (°C) | Stability (\pm °C) | Uniformity (°C) | Uncertainty (\pm °C) | Coverage Factor k |
| | Min , Max | Average | | | | | |
| 3.0 | 2.9 , 4.4 | 3.7 | 2.97 | 1.32 | 1.13 | 2.02 | 2.00 |

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. 



Certificate of Calibration

| | | | |
|----------------------|---------------------|------------------|-------------------|
| Equipment: | CONDUCTIVITY METER | Certificate No.: | C24250077 |
| Model: | Orion STAR A215 | Issued Date: | 21 March 2025 |
| Serial No. (or ID.): | X58821 (RYG-EN0200) | Job No.: | WO-00064803 |
| Manufacturer: | Thermo Scientific | Page: | 1 of 2 |
| Electrode Serial No. | YQ1-11982 | Model : | ORION 013005MD |
| Condition: | In Condition | Brand : | Thermo Scientific |

Customer: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition:

| | | | | |
|-------------|------|-----|---|-----|
| Temperature | 23.5 | °C | ± | 0.8 |
| Humidity | 52.4 | %RH | ± | 1.3 |

| | |
|----------------|-----------------------|
| REVIEW BY | <i>Phatchann S.</i> |
| APPROVED BY | <i>D. [Signature]</i> |
| NEXT CAL. DATE | 21/3/26 |

Calibration Place: ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)
(Wet Chemisty Lab) 616/10 Moo 5 T.Maenam Khu,
A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By: Mr. Pongpisut Suebchantha

Calibration Date: 21 March 2025


The Method used: In house method, CAL-WI-49, base on ASTM D 1125-14 and D 5391-14

Traceability: This certificate is traceable to the SI Units maintained by CRM of NIST(SRM) through CPA chem Co., Ltd. (ISO/IEC 17034) Certificate No. 1066606, 1066607, 1066608, 1066609



(Mr. Pongpisut Suebchantha)

Person in charge



(Miss Kaewkan Suradech)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Calibration Results:
Before Adjustment

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction | Coverage Factor (k) | Uncertainty (±) |
|-----------------------------------|-----------------------------------|-------------------------|--------------------------|-----------------------|
| 25.000 $\mu\text{S/cm}$ | 27.43 $\mu\text{S/cm}$ | -2.430 $\mu\text{S/cm}$ | 2.00 | 0.28 $\mu\text{S/cm}$ |
| 84.003 $\mu\text{S/cm}$ | 90.76 $\mu\text{S/cm}$ | -6.757 $\mu\text{S/cm}$ | 2.00 | 0.68 $\mu\text{S/cm}$ |
| 1413.1 $\mu\text{S/cm}$ | 1464 $\mu\text{S/cm}$ | -50.9 $\mu\text{S/cm}$ | 2.00 | 11 $\mu\text{S/cm}$ |
| 12.881 mS/cm | 13.41 mS/cm | -0.529 mS/cm | 2.00 | 0.098 mS/cm |

After Adjustment ; at 25 $\mu\text{S/cm}$, 84 $\mu\text{S/cm}$, 1413 $\mu\text{S/cm}$, 12.88 mS/cm

| Standard Conductivity Solution | Unit Under Calibration Reading | Correction | Coverage Factor (k) | Uncertainty (±) |
|-----------------------------------|-----------------------------------|-------------------------|--------------------------|-----------------------|
| 25.000 $\mu\text{S/cm}$ | 25.63 $\mu\text{S/cm}$ | -0.630 $\mu\text{S/cm}$ | 2.00 | 0.28 $\mu\text{S/cm}$ |
| 84.003 $\mu\text{S/cm}$ | 84.53 $\mu\text{S/cm}$ | -0.527 $\mu\text{S/cm}$ | 2.00 | 0.68 $\mu\text{S/cm}$ |
| 1413.1 $\mu\text{S/cm}$ | 1415 $\mu\text{S/cm}$ | -1.9 $\mu\text{S/cm}$ | 2.00 | 11 $\mu\text{S/cm}$ |
| 12.881 mS/cm | 12.92 mS/cm | -0.039 mS/cm | 2.00 | 0.098 mS/cm |

The End of Certificate

ใบตรวจสอบสภาพเครื่องวัดสิ่งแวดล้อม

เลขที่ใบงาน: WO-00064803

ชนิดเครื่องมือ: CONDUCTIVITY METER

รุ่น: Orion STAR A215

หมายเลขเครื่อง: X58821

| ตรวจสอบ (รับ) | | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) | | หมายเหตุ |
|-------------------------------------|--------------------------|---------------------------------------------------|-------------------------------------|--------------------------|----------|
| 21 Mar 2025 | | | 21 Mar 2025 | | |
| ปกติ | ไม่ปกติ | | ปกติ | ไม่ปกติ | |
| | | General | | | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. ความสมบูรณ์เครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. ความสะอาด (ช่องใส่ตัวอย่าง, ภายใน-นอกเครื่อง) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. สวิทช์ ปิด – เปิด เครื่อง (On-Off Swicth) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. ปุ่มกด (Keypad) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. หน้าจอ (Display, Screen Contrast) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | | Spectrophotometer | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. แรงดันไฟฟ้า (Battery Backup) >= 2.5 VDC | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. ตัวหมุนเลือกความยาวคลื่น (Wavelength Control) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. ความยาวคลื่น (Wavelength Check) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. แหล่งกำเนิดแสง (UV < 3,000 hour) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. แหล่งกำเนิดแสง (Visible < 5,000 hour) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 11. ซองวัดหลายตัวอย่าง (Carousel Module) | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | pH Meter and Conductivity Meter | | | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 12. อิเล็กโทรด (Electrode and Connection Cable) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 13. ระดับสารละลายใน Electrode (Level KCl) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 14. ฝาปิดกันปลาย Electrode (Dust Protection Hood) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 15. ขาจับอิเล็กโทรด (Stand) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| | | Turbidimeter | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 16. ค่าความขุ่นที่ต่ำสุด (No Sample) | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 17. ระดับการส่องสว่างของแสง (>= 2.5 ไม่นเกิน 3.0) | <input type="checkbox"/> | <input type="checkbox"/> | |
| | | Automatic titrator | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | 18. สภาพ Piston Burettes | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 19. Function Rinsing and Dosing | <input type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 20. ระบบท่อสายยางและอุปกรณ์ประกอบ | <input type="checkbox"/> | <input type="checkbox"/> | |

ข้อแนะนำ :

Mr. Pongpisut Suebchantha

Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
 DKSH Technology Limited
 2533 ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร 10260
 2533 Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
 Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-R31-03: 20 Jul 2022



Certificate of Calibration

Equipment : Digital Thermometer with Probe

Model : Orion STAR A215

Serial No. : X58821

Manufacturer : Thermo Scientific

ID No. : RYG-EN0200

Certificate No. : C15250430

Issued Date : 21 March 2025

Job No. : WO-00064803

Page : 1 of 2

Condition : In Condition

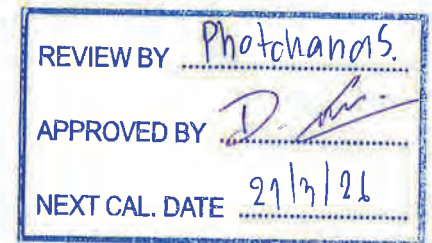
Customer : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)

616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140, Thailand.

Environment Condition :

| | | | |
|--------------|---------|---|--------|
| Temperature: | 30 °C | ± | 10 °C |
| Humidity: | 55 %RH | ± | 25 %RH |
| Voltage: | 220 VAC | ± | 10 % |



Calibration Place : ALS Laboratory Group (Thailand) Co.,Ltd. (Rayong Branch)

(Wet Chemistry Lab) 616/10 Moo 5 T.Maenam Khu,

A.Pluakdaeng, Rayong 21140, Thailand.

Calibration By : Mr. Piyapat Saidoung

Calibration Date : 21 March 2025

The Method used : In house method, CAL-WI-69, by comparison with standard thermometer

Traceability : This certificate is traceable to the International System of Unit maintained by:
Quality Reborn Co.,Ltd. (QR)



(Mr. Piyapat Saidoung)

Person in charge



(Mr. Tweewong Thaihiang)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM).

These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Reference standard equipment:

| Equipment | Certificate no | Cal. date | Next Cal. date |
|--------------------------------|----------------|----------------|----------------|
| Digital Thermometer with Probe | QR24-2043 | 21 August 2024 | 21 August 2025 |

Calibration Results:**Without Adjustment**

Sensor Type: RTD

Electrode Serial No. CS1-11923

Channel: -

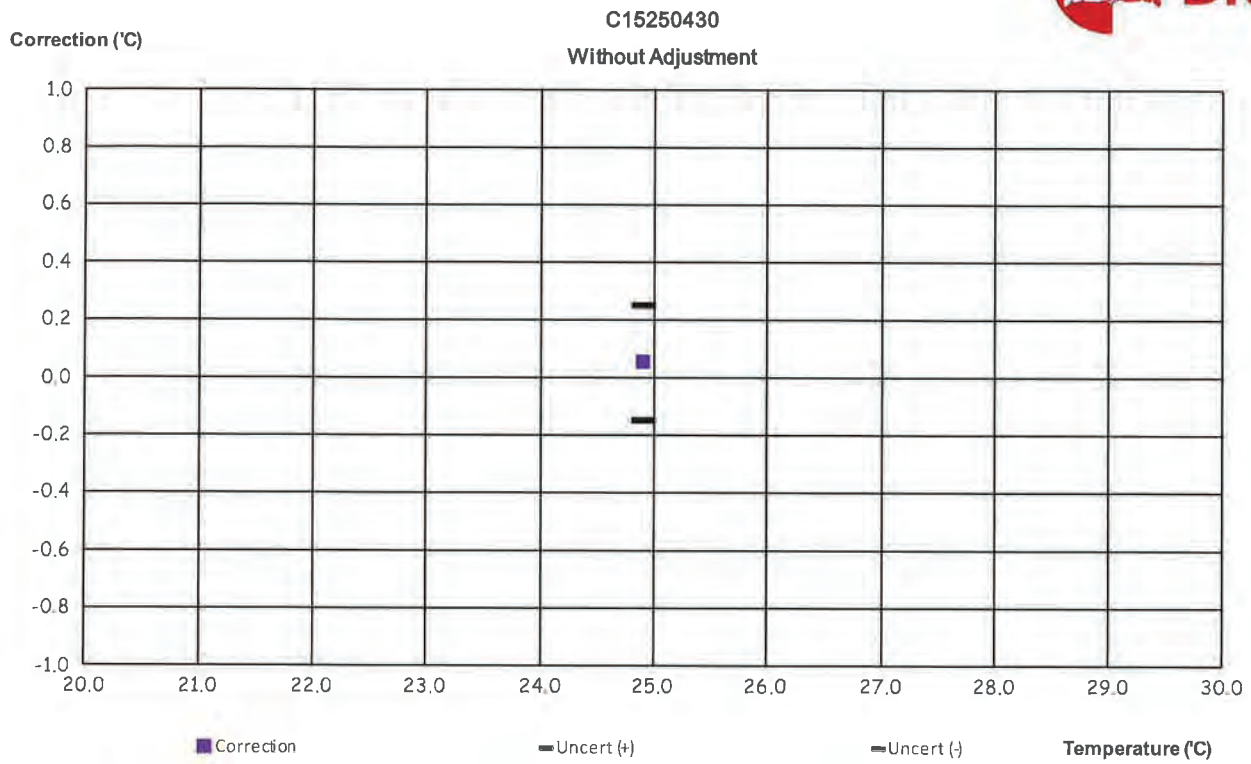
Diameter (mm): 15

Length (mm): 120

Immersion (mm): 110

| Calibrate Point.(°C) | STD. Reading (°C) | UUC. Reading (°C) | Correction of UUC (°C) | Uncertainty (\pm °C) |
|----------------------|-------------------|-------------------|------------------------|-------------------------|
| 25.0 | 24.954 | 24.9 | 0.054 | 0.20 |

The End of Certificate



ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ

Equipment : Digital Thermometer with Probe

Certificate No. : C15250430

Serial No. : X58821

Model : Orion STAR A215

| ตรวจสอบ (รับ) | | รายการตรวจเช็ค | ตรวจสอบ (ส่ง) | | หมายเหตุ |
|-------------------------------------|--------------------------|-----------------------------------------|-------------------------------------|--------------------------|----------|
| 21-Mar-2025 | | | 21-Mar-2025 | | |
| ปกติ | ไม่ปกติ | | ปกติ | ไม่ปกติ | |
| | | General | | | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. สายไฟ | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. Adapter / Power supply 220 / 110 VAC | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. การทำงาน Main Switch | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. การทำงาน Selector Key | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. การแสดงผล Display | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Battery | <input type="checkbox"/> | <input type="checkbox"/> | ไม่มี |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. สภาพตัวเครื่อง | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. สภาพ Sensor (In / Ex) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |

ข้อแนะนำ :

Mr. Piyapat Saidoung

Service Engineer

Certificate of Calibration

Number of Page(s) 1 of 3

Certificate No. BSCC-UV-374/24
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A11454908533 CD
ID No. BKK_EN0018
Date of receipt 13 September 2024
Date of calibration 13 September 2024
Date of issue 13 SEP 2024

| | |
|---------------|------------|
| REVIEW BY | Jinda K |
| APPROVED BY | Siriluk P |
| NEXT CAL DATE | 13/09/2025 |

Customer name ALS Laboratory Group (Thailand) Co., Ltd.

Address 104 Soi Phattanakan 40, Phattanakan Road, Phattanakan, Suan Luang, Bangkok 10250

Temperature (25.3 - 26.7) °C (On site)
Humidity (50.4 - 55.9) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Preparation Lab

Calibration Procedure In-house method WI-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 106372 and 106371
Photometric Accuracy is traceable to certificate No. 106364 and 111398
Stray Light is traceable to certificate No. 106377
The above certificate are traceable to SI unit through Sarna Scientific Ltd.
(UKAS accredited calibration laboratory NO. 0659)

Calibrated by Mr.Wanchana Janloey

Approved by



Mr.Sonthi Temboonsakdi
Service Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Certificate of Calibration

Certificate No.

BSCC-UV-374/24

Number of Page(s)

2 of 3

Calibration Results:

1.Wavelength Accuracy

| Certified Wavelength (nm) | UUC (nm) | Error (nm) | Uncertainty (\pm nm) |
|---------------------------|----------|------------|-------------------------|
| 241.70 | 241.55 | -0.15 | 0.18 |
| 334.02 | 333.85 | -0.17 | 0.18 |
| 418.53 | 418.57 | 0.04 | 0.18 |
| 572.99 | 572.97 | -0.02 | 0.18 |
| 879.41 | 879.17 | -0.24 | 0.18 |

2.Photometric Accuracy (UV)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty (\pm A) |
|-----------------|--------------------------|---------|-----------|------------------------|
| 235 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.7171 | 0.7169 | -0.0002 | 0.0075 |
| 257 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.8354 | 0.8345 | -0.0009 | 0.0075 |
| 313 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.2786 | 0.2781 | -0.0005 | 0.0075 |
| 350 | 0.0000 | 0.0000 | 0.0000 | 0.0075 |
| | 0.6199 | 0.6194 | -0.0005 | 0.0075 |

*CNR = Customer not request

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
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Certificate of Calibration

Certificate No. **BSCC-UV-374/24**

Number of Page(s)

3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

| Wavelength (nm) | Certified Absorbance (A) | UUC (A) | Error (A) | Uncertainty ($\pm A$) |
|-----------------|--------------------------|---------|-----------|-------------------------|
| 420.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5761 | 0.5765 | 0.0004 | 0.0042 |
| | 0.7119 | 0.7105 | -0.0014 | 0.0042 |
| | 1.0189 | 1.0174 | -0.0015 | 0.0042 |
| 440.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5610 | 0.5613 | 0.0003 | 0.0042 |
| | 0.7001 | 0.6984 | -0.0017 | 0.0042 |
| | 1.0026 | 1.0011 | -0.0015 | 0.0042 |
| 465.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5235 | 0.5232 | -0.0003 | 0.0042 |
| | 0.6614 | 0.6598 | -0.0016 | 0.0042 |
| | 0.9456 | 0.9444 | -0.0012 | 0.0042 |
| 546.1 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5249 | 0.5245 | -0.0004 | 0.0042 |
| | 0.6975 | 0.6956 | -0.0019 | 0.0042 |
| | 1.0009 | 0.9994 | -0.0015 | 0.0042 |
| 590.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5590 | 0.5586 | -0.0004 | 0.0042 |
| | 0.7725 | 0.7708 | -0.0017 | 0.0042 |
| | 1.1125 | 1.1114 | -0.0011 | 0.0042 |
| 635.0 | 0.0000 | 0.0000 | 0.0000 | 0.0042 |
| | 0.5666 | 0.5666 | 0.0000 | 0.0042 |
| | 0.7620 | 0.7604 | -0.0016 | 0.0042 |
| | 1.0982 | 1.0971 | -0.0011 | 0.0042 |

*CNR = Customer not request

4. Stray Light*

| Standard cut-off wavelength (nm) | Unit Under Calibration(UUC) | | |
|----------------------------------|-----------------------------|-------------------|----------------|
| | Wavelength (nm) | Transmission (%T) | Absorbance (A) |
| 200.85 \pm 0.11nm | 199.58 | 0.9520 | 2.0217 |

The Stray light transmission reference is less than 1.0%T and Stray light absorbance reference is greater than 2.00A

*Stray Light not NSC-ONSC Accredited.

The measurement uncertainty is base on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

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

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Agilent Technologies

Agilent Technologies (Thailand) Limited
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Tel. +662 637 6363
Fax: +662 632 4334
Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

TAX ID : 0105540004859

chanattagarn.imchom@alsglobal.com
227158760

Invoice To:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Delivery Site:

ALS Laboratory Group (Thailand) Co
Ltd Head Office

104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan

Location:

Room
Bldg
Lab
Dept

SERVICE REPORT

| | |
|--------------------------------------------|--------------------------------------------|
| Customer Purchase Order Number: | Customer Number: 70371013 |
| Service Request: | Service Request Date: |
| Service Order: 6006676060 | Service Confirmation: 6905905441 |

| |
|---------------------------------|
| REVIEW BY <u>Tattaporn C.</u> |
| APPROVED BY <u>Samtra N.</u> |
| NEXT CAL. DATE <u>31/4/2026</u> |

Direct Inquiries to:

Contact Name: Customer Contact Center
Contact E-mail: ccc-smt@agilent.com
Contact Telephone: +662 637 6363
Contact Fax: +662 632 4334

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Tax ID : 0105542068218

Citibank N.A. Bangkok Branch
399 Interchange 21 Building, Sukhumvit Road, Klongtoey Nau
Sub-district, Wattana District, Bangkok 10110 Thailand
Acc. No: 012-4452-007,
THB:Krung Thai Bank PCL
Siam Square Br.,416/1-2 Rama I Rd.,Pathumwan, BKK 10330
Thailand

ORIGINAL

Service Confirmation Number: 6905905441

Service Confirmation Date: 08.10.2024

Service Instrument:

| Model Number | Model Description | Serial Number | System Handle | Parent Asset |
|--------------|-----------------------------------|---------------|---------------|--------------|
| SYS-IM-7900 | ICPMS 7900 System | | | |
| G8410A | SPS 4 Autosampler | AU15430722 | ICP MS 7900 | SYS-IM-7900 |
| G8411A | ISIS 3 for Agilent 7850/7900/8900 | JP15510227 | ICP MS 7900 | SYS-IM-7900 |
| G3292A | PSC 6106T Chiller | 2U15A1948 | ICP MS 7900 | SYS-IM-7900 |
| G8403A | Agilent 7900 ICP-MS | JP15471169 | ICP MS 7900 | SYS-IM-7900 |

Service Items:

| Item | Service/Part # | Description | Qty | Entitlement | Service Start | Service End |
|------|----------------|--------------------------------------|------|---------------------------------------|---------------|-------------|
| 1000 | EOQ | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 04.10.2024 | 04.10.2024 |
| 1010 | 5185-5850 | ICP-MS Checkout Solutions | 1.00 | Agreement Entitlement - 100 % covered | | |

Additional Information:

Service Confirmation Number: 6905905441

Service Confirmation Date: 08.10.2024

Service Information:

Problem Description:

*WU-EQQ-IM-7900-5001253655

Service Provided:

Perform OQ Hardware. Test CDS logon, auto sampler, Auto tune, BG and 20 Min stability.
I calibrate the instrument No BKK_EL0043 test all pass.

Service Overview Code:

Reason Code: Scheduled Service

Diagnosis Code: Scheduled Service

Resolution Code: Scheduled Service

Reported Hours:

7.0

Travel Hours:

2.0

Customer Field Service

Representative Name:

Panthep Kurasathain

Customer Field Service

Representative Signature:



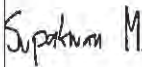
Date:

08 Oct 2024

Customer Name:

Supakwan Mak

Customer Signature:



Date:

08 Oct 2024

Additional Comments:

Certificate No. T250355

Page 1 of 6

Certificate of Calibration

Equipment : HEATING BLOCK

Manufacturer : Environmental Express

Model : SC 196

Serial No. : 6974CECW3285

Customer Code : BKK_EL0054

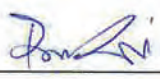
ID No. : T5306A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

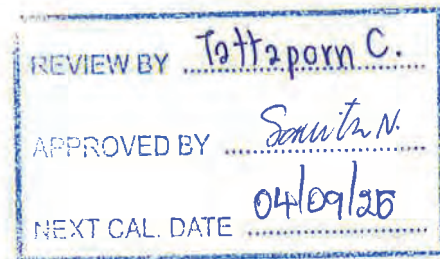
Customer Location : Acid Digestion Lab

Date of Receipt : 26 February 2025

Calibrated By : Atiphong Rongrat (Technician)

Approved By :  / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 17 MAR 2025



The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 4 March 2025
Environment : Temperature : 24.4-24.9 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20.

All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|--------|----------------|-----------------|---------------|
| TC | TYPE T | TN221-TN230 | T240712 | 19 April 2025 |
| TC | TYPE T | TN231-TN240 | T240712 | 19 April 2025 |
| TC | TYPE T | TN241-TN250 | T240401 | 16 March 2025 |
| TC | TYPE T | TN251-TN260 | T240401 | 16 March 2025 |
| DATA LOGGER | 34970A | T193 | T240401 | 16 March 2025 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 40 Minute At 95 °C

Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

Approved By. Pon Lri



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

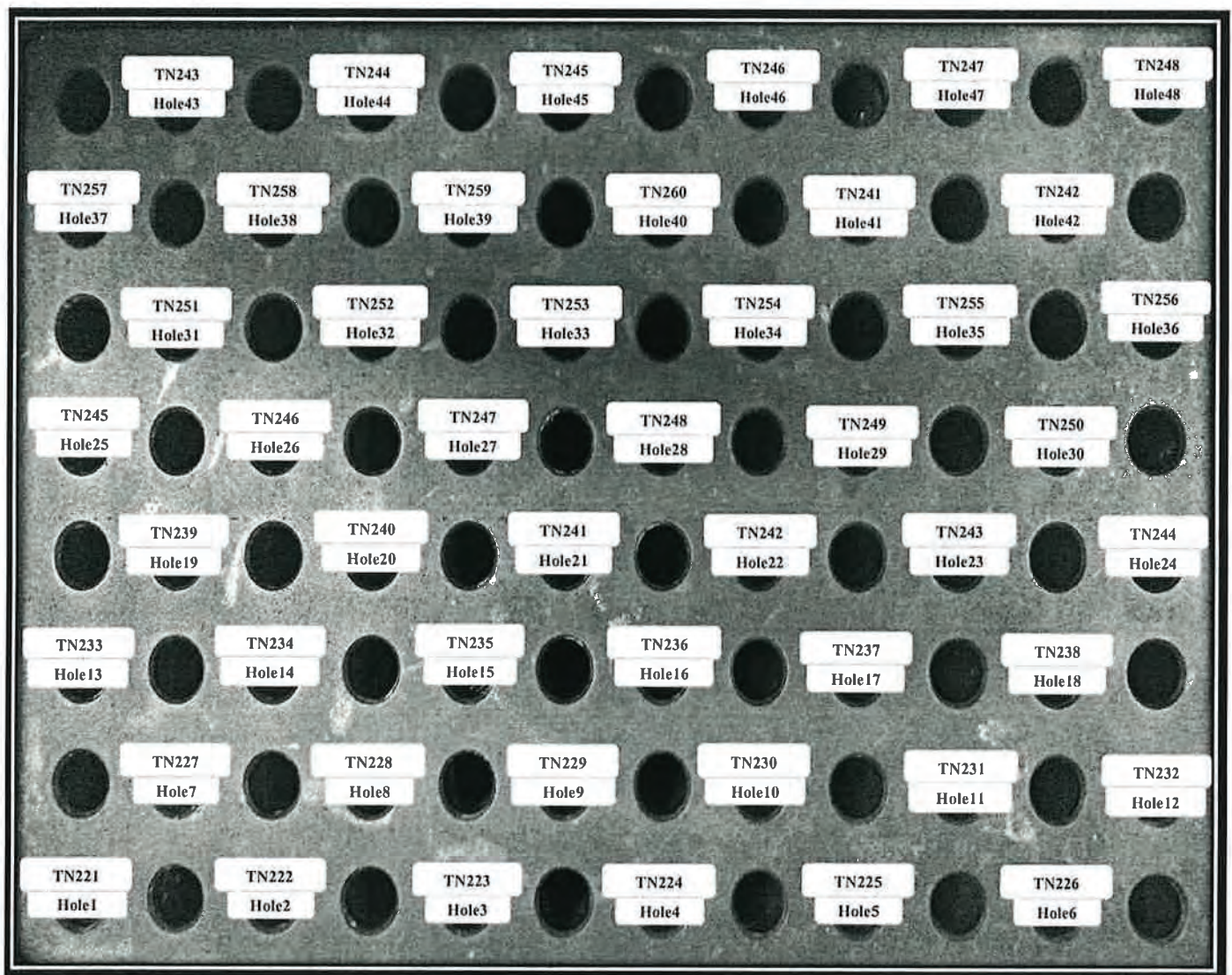
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. Don Lai

Certificate No. T250355

Page 4 of 6

Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (°C) | | | | | |
|-------------------|---------|------------------------------------------------|-------|-------|-------|-------|-------|
| R1 Hole1-Hole6 | | TN221 | TN222 | TN223 | TN224 | TN225 | TN226 |
| CAL POINT | Max | 94.85 | 95.37 | 95.03 | 95.25 | 95.52 | 94.75 |
| 95 | Min | 94.17 | 94.66 | 94.38 | 94.63 | 94.87 | 94.12 |
| | Average | 94.51 | 95.02 | 94.70 | 94.94 | 95.20 | 94.43 |
| R2 Hole7-Hole12 | | TN227 | TN228 | TN229 | TN230 | TN231 | TN232 |
| | Max | 94.71 | 94.56 | 94.79 | 95.32 | 95.44 | 95.06 |
| | Min | 94.05 | 93.88 | 94.10 | 94.65 | 94.90 | 94.65 |
| | Average | 94.38 | 94.22 | 94.44 | 94.99 | 95.17 | 94.85 |
| R3 Hole13-Hole18 | | TN233 | TN234 | TN235 | TN236 | TN237 | TN238 |
| | Max | 95.26 | 95.43 | 95.40 | 95.71 | 95.41 | 95.06 |
| | Min | 94.54 | 94.64 | 94.71 | 95.10 | 94.86 | 94.42 |
| | Average | 94.90 | 95.03 | 95.06 | 95.41 | 95.13 | 94.74 |
| R4 Hole19-Hole24 | | TN239 | TN240 | TN241 | TN242 | TN243 | TN244 |
| | Max | 95.13 | 95.06 | 95.68 | 96.16 | 95.35 | 95.80 |
| | Min | 94.39 | 94.43 | 94.86 | 95.51 | 94.88 | 95.12 |
| | Average | 94.76 | 94.75 | 95.27 | 95.83 | 95.12 | 95.46 |
| R5 Hole25-Hole30 | | TN245 | TN246 | TN247 | TN248 | TN249 | TN250 |
| | Max | 94.95 | 95.81 | 95.39 | 95.82 | 95.66 | 95.66 |
| | Min | 94.47 | 95.03 | 94.67 | 94.99 | 94.84 | 94.87 |
| | Average | 94.71 | 95.42 | 95.03 | 95.41 | 95.25 | 95.27 |
| R6 Hole31-Hole36 | | TN251 | TN252 | TN253 | TN254 | TN255 | TN256 |
| | Max | 96.07 | 95.34 | 96.28 | 95.39 | 94.95 | 95.12 |
| | Min | 95.28 | 94.55 | 95.51 | 94.62 | 94.13 | 94.35 |
| | Average | 95.67 | 94.95 | 95.90 | 95.00 | 94.54 | 94.73 |
| R7 Hole37-Hole42 | | TN257 | TN258 | TN259 | TN260 | TN241 | TN242 |
| | Max | 95.15 | 95.63 | 96.11 | 95.09 | 95.34 | 95.51 |
| | Min | 94.38 | 94.88 | 95.32 | 94.28 | 94.54 | 94.72 |
| | Average | 94.76 | 95.25 | 95.71 | 94.69 | 94.94 | 95.11 |
| R8 Hole43-Hole48 | | TN243 | TN244 | TN245 | TN246 | TN247 | TN248 |
| | Max | 95.84 | 95.87 | 95.44 | 95.72 | 95.65 | 95.75 |
| | Min | 95.06 | 95.10 | 94.60 | 94.95 | 94.87 | 94.98 |
| | Average | 95.45 | 95.48 | 95.02 | 95.34 | 95.26 | 95.36 |

Approved By.



Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (°C) | | | | | |
|-------------------------|---------|------------------------------------------------|--------------|--------------|--------------|--------------|--------------|
| R1 Hole1-Hole6 | | TN221 | TN222 | TN223 | TN224 | TN225 | TN226 |
| CAL POINT | Max | 104.48 | 104.40 | 104.60 | 105.27 | 105.24 | 105.19 |
| 105 | Min | 104.15 | 104.02 | 104.25 | 104.94 | 104.91 | 104.93 |
| | Average | 104.32 | 104.21 | 104.42 | 105.10 | 105.08 | 105.06 |
| R2 Hole7-Hole12 | | TN227 | TN228 | TN229 | TN230 | TN231 | TN232 |
| | Max | 105.20 | 105.45 | 105.58 | 105.96 | 105.81 | 106.03 |
| | Min | 104.92 | 105.14 | 105.29 | 105.64 | 105.53 | 105.79 |
| | Average | 105.06 | 105.29 | 105.43 | 105.80 | 105.67 | 105.91 |
| R3 Hole13-Hole18 | | TN233 | TN234 | TN235 | TN236 | TN237 | TN238 |
| | Max | 106.09 | 106.14 | 105.83 | 106.25 | 105.97 | 105.88 |
| | Min | 105.80 | 105.89 | 105.57 | 106.00 | 105.69 | 105.65 |
| | Average | 105.94 | 106.01 | 105.70 | 106.13 | 105.83 | 105.77 |
| R4 Hole19-Hole24 | | TN239 | TN240 | TN241 | TN242 | TN243 | TN244 |
| | Max | 105.87 | 105.75 | 105.30 | 105.07 | 105.22 | 105.66 |
| | Min | 105.62 | 105.52 | 105.13 | 104.90 | 105.05 | 105.49 |
| | Average | 105.74 | 105.63 | 105.21 | 104.98 | 105.14 | 105.57 |
| R5 Hole25-Hole30 | | TN245 | TN246 | TN247 | TN248 | TN249 | TN250 |
| | Max | 105.62 | 105.54 | 105.52 | 105.75 | 105.97 | 105.69 |
| | Min | 105.45 | 105.35 | 105.31 | 105.57 | 105.81 | 105.49 |
| | Average | 105.53 | 105.44 | 105.41 | 105.66 | 105.89 | 105.59 |
| R6 Hole31-Hole36 | | TN251 | TN252 | TN253 | TN254 | TN255 | TN256 |
| | Max | 106.19 | 106.34 | 106.47 | 105.96 | 105.76 | 105.35 |
| | Min | 106.02 | 106.16 | 106.31 | 105.77 | 105.58 | 105.18 |
| | Average | 106.10 | 106.25 | 106.39 | 105.87 | 105.67 | 105.27 |
| R7 Hole37-Hole42 | | TN257 | TN258 | TN259 | TN260 | TN241 | TN242 |
| | Max | 106.21 | 105.59 | 105.45 | 105.36 | 106.08 | 106.09 |
| | Min | 106.04 | 105.42 | 105.28 | 105.20 | 105.90 | 105.92 |
| | Average | 106.12 | 105.51 | 105.37 | 105.28 | 105.99 | 106.00 |
| R8 Hole43-Hole48 | | TN243 | TN244 | TN245 | TN246 | TN247 | TN248 |
| | Max | 106.54 | 106.33 | 105.78 | 105.38 | 105.42 | 105.69 |
| | Min | 106.38 | 106.16 | 105.60 | 105.20 | 105.25 | 105.52 |
| | Average | 106.46 | 106.25 | 105.69 | 105.29 | 105.33 | 105.61 |

Approved By.





Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110

Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109

Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T250355

Page 6 of 6

Calibration Report

Measurement Results:

| HEATING BLOCK | | | Temperature Distribution | |
|---------------|--------------|---------|--------------------------|-------------------------|
| Setting (°C) | Reading (°C) | | Stability (\pm °C) | Uncertainty (\pm °C) |
| | Min , Max | Average | | |
| 102.0 | - | 102.0 | 0.43 | 0.83 |
| 107.0 | - | 107.0 | 0.20 | 0.70 |

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. Don Lini



Metrology

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoi, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.com



Certificate No. T232160

Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)

Manufacturer : KOLDTECH

Model : KM 320

Serial No. : TBN-1012061/05

Customer Code : BKK_EN0167

ID No. : T2463A3

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory

Date of Receipt : 29 November 2023

Calibrated By : Atiphong Rongrat (Technician)

Approved By : Boonchai Suriyawong / Boonchai Suriyawong (Site Calibration Manager)

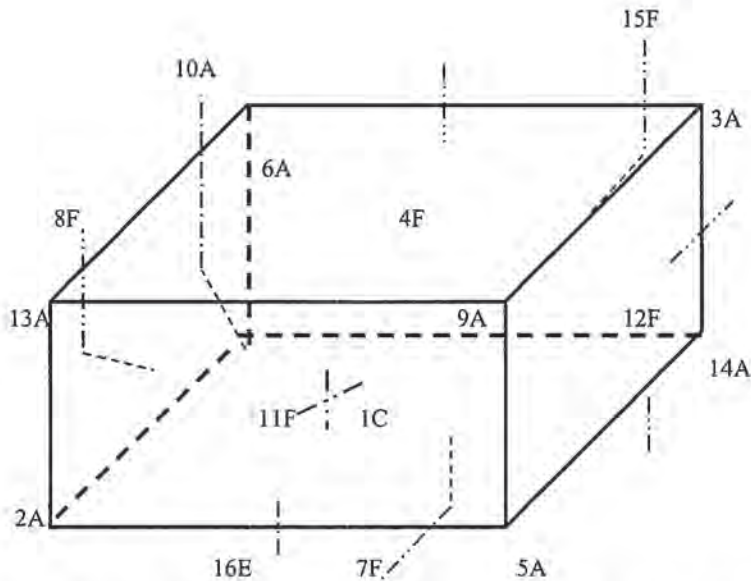
Date of Issue : 09 JAN 2024

| | |
|----------------|-------------------|
| REVIEW BY | <u>Kank Auk</u> |
| APPROVED BY | <u>Siriluk P.</u> |
| NEXT CAL. DATE | <u>06/06/25</u> |

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrology.

Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

| | | |
|-----|---|-------|
| 1C | = | TN161 |
| 2A | = | TN162 |
| 3A | = | TN163 |
| 4F | = | TN164 |
| 5A | = | TN165 |
| 6A | = | TN166 |
| 7F | = | TN167 |
| 8F | = | TN168 |
| 9A | = | TN169 |
| 10A | = | TN170 |
| 11F | = | TN171 |

| | | |
|-----|---|-------|
| 12F | = | TN172 |
| 13A | = | TN173 |
| 14A | = | TN174 |
| 15F | = | TN175 |
| 16E | = | TN176 |

Approved By. 

Certificate No. T232160

Page 4 of 4

Calibration Report

Measurement Results

| Calibration Point | Average Standard Reading at each position (°C) | | | | | | | | | | | |
|-------------------|------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | TN161 | TN162 | TN163 | TN164 | TN165 | TN166 | TN167 | TN168 | TN169 | TN170 | TN171 | TN172 |
| 3.0 | 2.83 | 3.34 | 2.95 | 3.46 | 3.45 | 3.76 | 3.25 | 3.46 | 3.39 | 3.50 | 3.58 | 3.42 |
| | TN173 | TN174 | TN175 | TN176 | | | | | | | | |
| | 3.33 | 3.39 | 3.15 | 3.43 | | | | | | | | |

| Chamber (Cooling Room) | | | Temperature Distribution | | | | |
|--------------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|--------------------------|
| Setting (°C) | Reading (°C) | | Average (°C) | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage Factor <i>k</i> |
| | Min , Max | Average | | | | | |
| 3.0 | 2.8 , 4.1 | 3.5 | 3.36 | 1.10 | 2.00 | 1.90 | 2.09 |

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a *t*-distribution, providing a level of confidence of approximately 95 % .

Approved By. 

Certificate No. T250873


Page 1 of 4

Certificate of Calibration

Equipment : Chamber (Cooling Room)**Manufacturer** : KOLDTECH**Model** : KM 320**Serial No.** : TBN-1012061/05**Customer Code** : BKK_EN0167**ID No.** : T2463A3**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory Room**Date of Receipt** : 28 May 2025**Calibrated By** : Atiphong Rongrat (Technician)**Approved By** :  / Boonchai Suriyawong (Site Calibration Manager)**Date of Issue** : 19 JUN 2025REVIEW BY APPROVED BY 

NEXT CAL DATE.....04/12/26

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standard laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the Metrological Center.

Certificate No. T250873

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 4 June 2025
Environment : Temperature : 23.4-24.9 °C
Line Voltage : 221.4-230.2 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 16 standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986).
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90 .

2. Reference Standard Instrument :

| Instrument | Model | Instrument No. | Certificate No. | Due Date |
|-------------|--------|----------------|-----------------|-----------------|
| TC | TYPE T | TN91-TN100 | T242036 | 3 December 2025 |
| TC | TYPE T | TN101-TN110 | T242036 | 3 December 2025 |
| DATA LOGGER | 34970A | T121 | T242036 | 3 December 2025 |

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)

4. Condition of calibrated item : good

Equipment Description :

Time Constant 2 Hour 20 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment

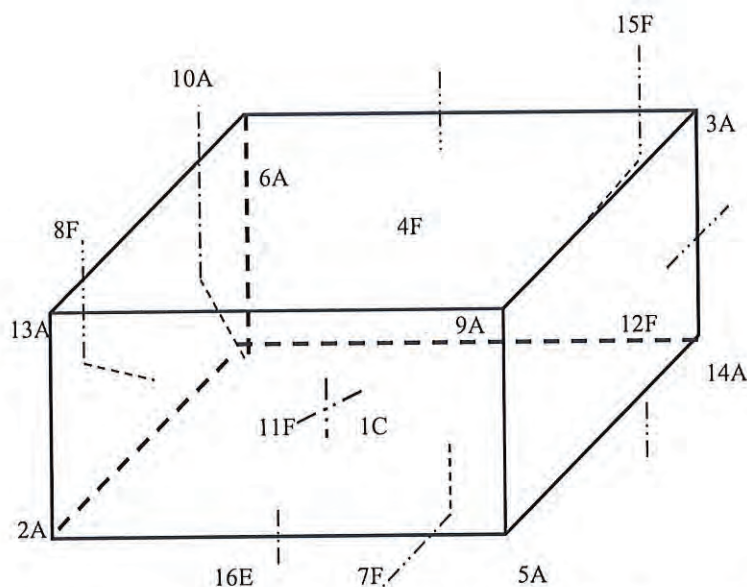
() after adjustment

Approved By. Bum Sri

Certificate No. T250873

Page 3 of 4

Calibration Report



C = Centre , F = Centre of Face , A = Corner , E = Centre of Edge

| | |
|-------------|-------------|
| 1C = TN91 | 12F = TN102 |
| 2A = TN92 | 13A = TN103 |
| 3A = TN93 | 14A = TN104 |
| 4F = TN94 | 15F = TN105 |
| 5A = TN95 | 16E = TN106 |
| 6A = TN96 | |
| 7F = TN97 | |
| 8F = TN98 | |
| 9A = TN99 | |
| 10A = TN100 | |
| 11F = TN101 | |

Approved By. _____



Certificate No. T250873

Page 4 of 4

Calibration Report

Measurement Results

| Calibration Point | Average Standard Reading at each position (°C) | | | | | | | | | | | |
|-------------------|------------------------------------------------|-------|-------|-------|------|------|------|------|------|-------|-------|-------|
| | TN91 | TN92 | TN93 | TN94 | TN95 | TN96 | TN97 | TN98 | TN99 | TN100 | TN101 | TN102 |
| 3.0 | 2.95 | 2.92 | 3.09 | 2.92 | 3.16 | 3.50 | 3.40 | 3.03 | 3.14 | 2.98 | 3.44 | 3.13 |
| | TN103 | TN104 | TN105 | TN106 | | | | | | | | |
| | 3.19 | 3.06 | 3.46 | 2.92 | | | | | | | | |

| Chamber (Cooling Room) | | | Temperature Distribution | | | | |
|--------------------------|--------------|---------|--------------------------|------------------|-----------------|--------------------|--------------------------|
| Setting (°C) | Reading (°C) | | Average (°C) | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage Factor <i>k</i> |
| | Min , Max | Average | | | | | |
| 3.0 | 2.8 , 3.9 | 3.4 | 3.14 | 1.20 | 1.30 | 1.90 | 2.04 |

The calibration result apply only the above calibrated item.

The result of test was found accurate as shown on date and place of test only.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* which for a t-distribution, providing a level of confidence of approximately 95 % .

Approved By. _____



**Scientist
Instrument**

| | |
|---------------|------------|
| REVIEW BY | Orawan T. |
| APPROVED BY | Savitri N. |
| NEXT CAL DATE | 06/12/25 |

Performance Verification Certificate for Mercury Analyzer

PRODUCT ID *Quicktrace M-8000 , Teledyne Leeman Labs*

Equipment ID **BKK_EL0128 Mercury Analyzer**
S/N: US22133002

BKK_EL0129 Autosampler
S/N: 052222A560

Customer Name ALS Laboratory Group (Thailand) Co., Ltd.

Address 104 Soi Pattana 40, Pattana Rd. Suan Luang, Suan Luang
Bangkok 10250 Thailand

Date of Qualified **December 6, 2024**

Next Due date **December 6, 2025**

This certifies for products which was performed in acceptable criteria specifications

| | |
|----------------------------------------------|---------------|
| Autosampler & Sample Introduction | PASSED |
| Analyzer | PASSED |
| Gas Liquid Separator & Dryer | PASSED |
| CVAFS Detector | PASSED |
| Electronics/Mechanical | PASSED |
| Data station/PC | PASSED |
| Analytical test | PASSED |

Provided by

Scientist Instrument Co.,Ltd.
113 Soi Ekachai 44, Ekachai Road
Klong Bang Phran, Bangbon
Bangkok 10150 Thailand

Certified by *Esawan*
Thunraphol Sakdayos

Service Engineer



Automation Service Co.,Ltd.

Head Office : 929,929/1 Soi Pattanakarn 30,
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Tel: 02-319-9994 Fax: 02-319-9596
www.automation.co.th

Sales & Service Center

Rayong : 1/15 Huaypong Rd., Muang, Rayong [T. 038-692-152]
Lamphun : 122/5 M.4, Ban Klang, Muang, Lamphun [T. 053-581-876]
Prachinburi : 688 M.10, Thatum, Srimahaphote, Prachinburi [T. 037-208-880]

MTOC : L-0614/2024

Report No. : ALS-799/01

ASI Maintenance Report

Instrument : Automatic Sample Injector Measuring : Vial 40 mL
Model : ASI-L Place of Installation : -
Serial No. : H57415200799 Department : LABOLATORY
Manufacture : Shimadzu

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaen Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand

Date of Maintenance : 26 / 06 / 2024

Ambient Condition : Temperature $25.5 \pm 5^\circ\text{C}$
: Humidifier $58 \pm 15\% \text{RH}$

REVIEW BY Ubon S.
APPROVED BY Siriluk P.
NEXT CAL. DATE 26/6/27

Maintenance By : T. Somri
(Mr. Tawatchai Somri)
Technician

Approved By : N. Phungsomsak
(Mr. Nipon Phungsomsak)
Technician Manager

User Name : Siriluk P
(Mr.)

SHIMADZU ANALYZER
1/3



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Prachinburi : 688 M.10, Thatum, Srimahaphote, Prachinburi [T. 037-208-880]

MTOC : L-0614/2024

Report No. : ALS-799/01

Maintenance Sheet

Customer : ALS Laboratory

Date : 26 / 06 / 2024

Model : ASI-L

Serial No. H57415200799

| Item | Carry out maintenance work | Result | Exchange | Comment |
|------|---------------------------------------------------------------|--------|----------|-------------------------------------------|
| 1. | Arm Drive section | O.K. | | |
| | Check Arm Drive Belt for wear and tension | O.K. | | |
| | Check grease of Screw Arm Drive | O.K. | | |
| 2. | Rinse pump (only ASI-V 24ml, 40ml) | O.K. | | |
| | Check pump rate(>40mL/min) | O.K. | | |
| | Check pump and tube connection for leakage | O.K. | | |
| | Check if outlet flow is in proper condition | O.K. | | |
| 3. | Check and if necessary exchange consumable, Maintenance parts | O.K. | | See appropriate list of maintenance parts |
| 4. | Check Stirrer [When installed] | O.K. | | |
| 5. | Verify ASI function via mechanical check | O.K. | | |

Inspection by :

T. Somri

(Mr. Tawatchai Somri)
Technician

SHIMADZU ANALYZER

2/3



Automation Service Co.,Ltd.

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Prachinburi : 688 M.10, Thatum, Srimahaphote, Prachinburi [T. 037-208-880]

MTOC : L-0614/2024

Report No. : ALS-799/01

List of Consumable, Maintenance parts

| Pos. | Part Number | Part Name | Result | Exchange | Recommended Interval |
|------|--------------|------------------------------------------------------------------------------|--------|----------|---------------------------------------------------------------|
| 1. | 017-27021-01 | Grease Paste, Lubricant 100g | O.K. | √ | 1 time per year |
| 2. | 032-22661-02 | Belt, 60S2m596, Arm Drive | O.K. | | 1 time per year Depending on condition |
| 3. | 034-03067-02 | Spring, F-642, Arm Drive | O.K. | | Depending on condition |
| 4. | 042-00405-11 | Pump Head, for ASI Rinse Pump (only ASI-V 24mL, 40mL) | O.K. | | After 300 h of operating |
| 5. | 638-41448-01 | Std. Needle Type1 24mL, 40mL* (for tube 2, 1x1, 6),[Sparge needle] | N/A | | Depending on condition |
| 6. | 638-41448-02 | Std. Needle Type1 125mL* (for tube 2, 1x1, 6) | N/A | | Depending on condition |
| 7. | 631-41660-03 | Flare Pipe 2x1,5x700mm* (for Standard Needle Type1 24mL,40mL, 125mL) | N/A | | Depending on condition (may cut to origin length 600mm) |
| 8. | 638-41450-01 | Needle for Suspended Particles,* 0,8mm (only ASI-V 24mL, 40mL) | N/A | | Depending on condition |
| 9. | 638-41450-01 | Std. Needle Type2 125mL* (for tube 1,4x0,9) | N/A | | Depending on condition |
| 10. | 638-41472-01 | Std. Needle Type2 24mL, 40mL* (for tube 1,4x0,9) | O.K. | | Depending on condition |
| 11. | 631-41660-02 | Flare Pipe 1,4x0,9x600mm* (for Suspended + Needle Type2) | O.K. | | Depending on condition |
| 12. | 638-41449-01 | Double Needle , only 24mL,40mL (simultaneous sparge type)* | N/A | | Depending on condition |
| 13. | 631-41660-01 | Flare Pipe 1,1x0,6x600mm* (for Double Needle 24mL,40mL) | N/A | | Depending on condition |

*Note: needed parts depending on installed needle types!

Inspection by :

T. Somri

(Mr. Tawatchai Somri)
Technician

SHIMADZU ANALYZER



Automation Service Co.,Ltd.

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Rayong : 1/15 Huaypong Rd., Muang, Rayong [T. 038-692-152]
Lamphun : 122/5 M.4, Ban Klang, Muang, Lamphun [T. 053-581-876]
Prachinburi : 688 M.10, Thatum, Srimahaphote, Prachinburi [T. 037-208-880]

MTOC : L-0613/2024

Report No. : ALS-416/01

TOC-L Maintenance Report

Instrument : Total Organic Carbon Analyzer Measuring : TC 0 ~ 30000 mg/L
Model : TOC-LCSH Place of Installation :-
Serial No. : H54425300416 Department : LABORATORY
Manufacture : Shimadzu

Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaen Suan Luang, Khet Suan Luang,
Bangkok 10250 Thailand

Date of Maintenance : 26 / 06 / 2024

Ambient Condition : Temperature $25.5 \pm 5^\circ\text{C}$
: Humidifier $58 \pm 15\% \text{RH}$

REVIEW BY Ubon S.

APPROVED BY Siriluk P.

NEXT CAL. DATE 26/6/25

Maintenance By : T. Somri
(Mr. Tawatchai Somri)
Technician

Approved By : N. Phungsomsak
(Mr. Nipon Phungsomsak)
Technician Manager

User Name : Siriluk P.
()

SHIMADZU ANALYZER

1/4



Automation Service Co.,Ltd.

Head Office : 929,929/1 Soi Pattanakarn 30,
Pattanakarn Road, Suanluang, Bangkok
Tel: 02-319-9994 Fax: 02-319-9596
www.automation.co.th

Sales & Service Center

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Lamphun : 122/5 M.4, Ban Klang, Muang, Lamphun [T. 053-581-876]
Prachinburi : 688 M.10, Thatum, Srimahaphote, Prachinburi [T. 037-208-880]

MTOC : L-0613/2024

Report No. : ALS-416/01

Maintenance Sheet

Customer : ALS Laboratory

Date : 26 / 06 / 2024

Model : TOC-LCSH

Serial No. H54425300416

| Item | Carry out maintenance work | Result | Exchange | Comment |
|------|----------------------------------------------------------------------------------------------------|--------|----------|----------------------------------------------|
| 1. | Check functionality of the device | O.K. | | |
| | Check furnace temperature (Standard cat. 680 °C / for TN cat. 720 °C) | | | |
| | Check dehumidifier temperature (1 °C) | | | |
| | Check the entire flow line related to leakage | | | |
| | Check baseline status (OK) | | | |
| | Check carrier gas pressure (200 ±10 kPa) | | | |
| | Check carrier gas flow rate (150 mL/min) | | | |
| 2. | Tubes | O.K. | | |
| | Check all tubing for contamination, if necessary clean them | | | |
| | Check all tubing for tight connection | | | |
| 3. | Container and Drainage | O.K. | | |
| | Fill up humidifier with pure water to max. level | | | |
| | Check filling of dilution water and acid container | | | |
| | Rinse Drain Pot, after wards refill again with pure water | | | |
| | Check if outlet flow is in proper conditions | | | |
| 4. | TC and IC Injection | O.K. | | |
| | Clean injector Block | | | |
| | Check injector Block for wear | | | |
| | Check injection tube adjustment | | | |
| | Check injection for leakage | | | |
| | Check injection for clogging | | | |
| 5. | IC Measurement (N-type) | O.K. | | |
| | Check acidification in syringe | | | |
| | Check sparging in syringe | | | |
| 6. | Eye check of 8-Port valve, for sample residues or moist spots that indicate possible leakage | O.K. | | |
| 7. | Check and if necessary exchange consumable, Maintenance parts | O.K. | | See list of consumable, maintenance parts |

Inspection by :

T. Somri

(Mr. Tawatchai Somri)
Technician



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Prachinburi : 688 M.10, Thatum, Srimahaphote, Prachinburi [T. 037-208-880]

MTOC : L-0613/2024

Report No. : ALS-416/01

| Item | Carry out maintenance work | Result | Exchange | Comment |
|------|---------------------------------------------------------------------------------------------------------------------------|--------|----------|------------------|
| 8. | Due to instrument condition, clean the instrument inside and outside. | O.K. | | |
| 9. | After checking the system and exchanging of consumable and maintenance parts a new 1-3 point calibration have to be done. | O.K. | | Addition test 1. |
| 10. | After wards the calibration perform check sample measurement. | O.K. | | Addition test 2. |

Addition test

| Test no. | Test conditions | Meas. value | Result |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------------------------|
| 1. | Calibration TC standard solution at 0, 0.1, 0.5, 1, 5 10, 20 injection volume 50 µL No. of measurement 2 times (Max.3) | | Attachment : ALS-416/01 Page 1/4 -2/4 |
| | Criteria : $R^2 = 0.995$ or more | 0.9996 | Pass |
| 2. | Measurement of reagent water and TC standard solution at 5.0 mg/L injection volume 50 µL No. of measurement 2 times (Max.3) and calculate accuracy by <u>Meas. of TC standard - Meas. of Reagent water</u> | | Attachment : ALS-416/01 Page 3/4 - 4/4 |
| | Criteria : Accuracy %Recovery 10% or less | 5.216 - 0.2800 = 4.936 ppm | Pass |

Inspection by : T. Somri

(Mr. Tawatchai Somri)
Technician



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Prachinburi : 688 M.10, Thatum, Srimahaphote, Prachinburi [T. 037-208-880]

MTOC : L-0613/2024

Report No. : ALS-416/01

List of Consumable, Maintenance parts

| Pos. | Part Number | Part Name | Result | Exchange | Recommended Interval |
|------|--------------|-------------------------------------------------------|--------|----------|--------------------------------------------|
| 1. | 036-11209-84 | O-ring, 4D P10A (Viton , for TC,IC Slider) | O.K. | √ | 1 time per year, Depending on condition |
| 2. | 036-11219-84 | O-ring, 4D P20 (for sealing TC-Combustion tube) | O.K. | √ | 1 time per year, Depending on condition |
| 3. | 638-15025 | O-ring, PIFE (for TC,IC-Slider) | O.K. | √ | 1 time per year, Depending on condition |
| 4. | 630-00105-01 | Platinum net, (2pcs-set) (to support catalyst) | O.K. | √ | 6 month same time as catalyst exchange |
| 5. | 630-00557 | Silica Wool (to support catalyst) | O.K. | √ | 6 month same time as catalyst exchange |
| 6. | 630-00992 | Halogen Scrubber | O.K. | √ | 6 month |
| 7. | 630-00996 | High Sensitivity TC Catalyst (When installed) | N/A | | Depending on condition |
| 8. | 638-60116 | Regular Catalyst (33g) (When installed) | O.K. | √ | 6 month |
| 9. | 638-56251-01 | 8-Port valve rotor | O.K. | | 1 time per year |
| 10. | 638-41323 | TC-Combustion Tube | O.K. | √ | 6 month same time as catalyst exchange |
| 11. | 631-43404-01 | Packing, gasket slider (for TC-Injection tube) | O.K. | | 1 time per year, Depending on condition |
| 12. | 638-59296 | Syringe 5mL | O.K. | | Depending on condition |
| 13. | 638-59296-01 | Plunger Tip (for syringe 5mL) | O.K. | | 6 month |
| 14. | 042-00405-11 | IC reagent supply pump head | O.K. | | 1 time per year |
| 15. | 630-00999 | CO2-Absorber (for cell space purge) | O.K. | | 1 time per year |
| 16. | 630-00964 | Molecular Sieves 13x | O.K. | √ | 1 time per year |

Note. Table indicates the guidelines replacement periods when NPOC measurement is performed on sample that are comparatively as clean as tap water ,use standard catalyst and at a rate of about 500 sample per month (operating five days a week)

Inspector By

T. Somri

(Mr. Tawatchai Somri)
Technician

TOC-Control L Report

ALS
2024_06_26_001_PM.tlx

Instr.Information

Instrument Options
Catalyst

TOC/ASI/IC Unit/
Regular Sensitivity

Cal. Curve

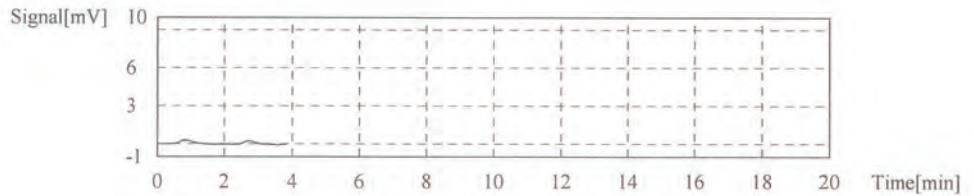
Sample Name: Untitled
Sample ID: Untitled
Cal. Curve: TC 0.1 - 20 ppm.2024_06_26_13_54_50.cal
Status: Completed

| Type | Anal. |
|----------|-------|
| Standard | TC |

Conc: 0.000mg/L

| No. | Area | Inj. Vol. | Aut. Dil. | Rem. | Ex. | Date / Time |
|-----|--------|-----------|-----------|-------|-----|----------------------|
| 1 | 0.7202 | 50uL | 1.000 | ***** | | 6/26/2024 1:59:37 PM |
| 2 | 0.5997 | 50uL | 1.000 | ***** | | 6/26/2024 2:01:47 PM |

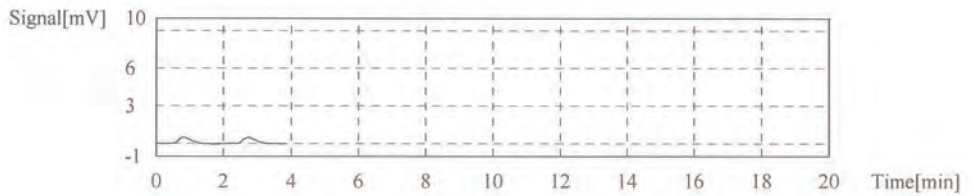
Acid Add. 0.000%
Mean Area 0.6600
SD Area 0.08521
CV Area 12.91%



Conc: 0.1000mg/L

| No. | Area | Inj. Vol. | Aut. Dil. | Rem. | Ex. | Date / Time |
|-----|-------|-----------|-----------|-------|-----|----------------------|
| 1 | 1.249 | 50uL | 10.00 | ***** | | 6/26/2024 2:08:39 PM |
| 2 | 1.139 | 50uL | 10.00 | ***** | | 6/26/2024 2:11:28 PM |

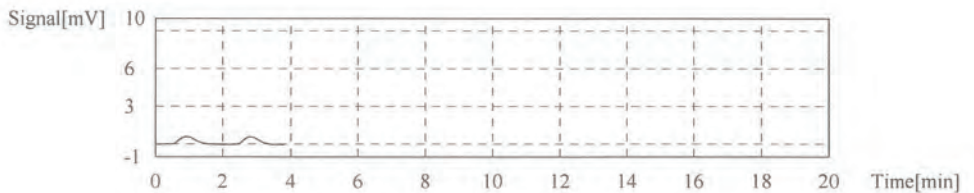
Acid Add. 0.000%
Mean Area 1.194
SD Area 0.07778
CV Area 6.51%



Conc: 0.5000mg/L

| No. | Area | Inj. Vol. | Aut. Dil. | Rem. | Ex. | Date / Time |
|-----|-------|-----------|-----------|-------|-----|----------------------|
| 1 | 1.899 | 50uL | 2.000 | ***** | | 6/26/2024 2:17:43 PM |
| 2 | 1.779 | 50uL | 2.000 | ***** | | 6/26/2024 2:19:52 PM |

Acid Add. 0.000%
Mean Area 1.839
SD Area 0.08485
CV Area 4.61%



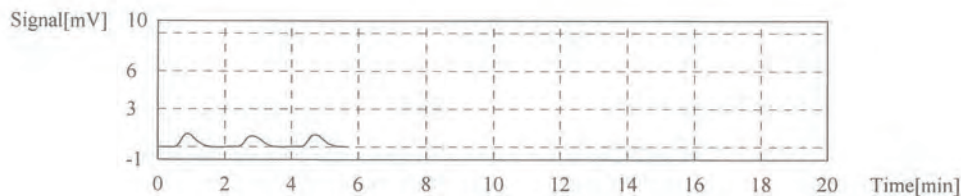
Conc: 1.000mg/L

TOC-Control L Report

ALS
2024_06_26_001_PM.tlx

| No. | Area | Inj. Vol. | Aut. Dil. | Rem. | Ex. | Date / Time |
|-----|-------|-----------|-----------|-------|-----|----------------------|
| 1 | 3.121 | 50uL | 1.000 | ***** | E | 6/26/2024 2:22:58 PM |
| 2 | 2.930 | 50uL | 1.000 | ***** | | 6/26/2024 2:25:08 PM |
| 3 | 2.899 | 50uL | 1.000 | ***** | | 6/26/2024 2:27:18 PM |

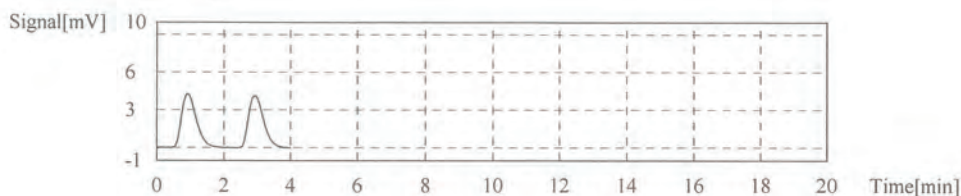
Acid Add. 0.000%
Mean Area 2.915
SD Area 0.02192
CV Area 0.75%



Conc: 5.000mg/L

| No. | Area | Inj. Vol. | Aut. Dil. | Rem. | Ex. | Date / Time |
|-----|-------|-----------|-----------|-------|-----|----------------------|
| 1 | 12.98 | 50uL | 4.000 | ***** | | 6/26/2024 2:34:18 PM |
| 2 | 13.01 | 50uL | 4.000 | ***** | | 6/26/2024 2:37:06 PM |

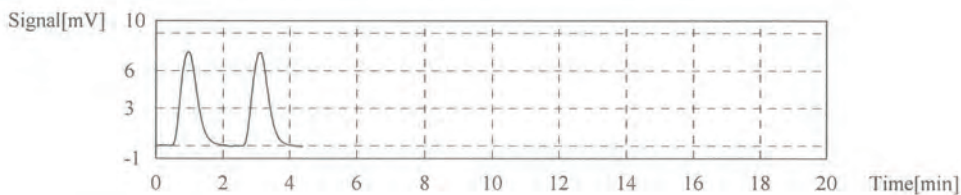
Acid Add. 0.000%
Mean Area 13.00
SD Area 0.02121
CV Area 0.16%



Conc: 10.00mg/L

| No. | Area | Inj. Vol. | Aut. Dil. | Rem. | Ex. | Date / Time |
|-----|-------|-----------|-----------|-------|-----|----------------------|
| 1 | 25.20 | 50uL | 2.000 | ***** | | 6/26/2024 2:43:28 PM |
| 2 | 25.42 | 50uL | 2.000 | ***** | | 6/26/2024 2:45:58 PM |

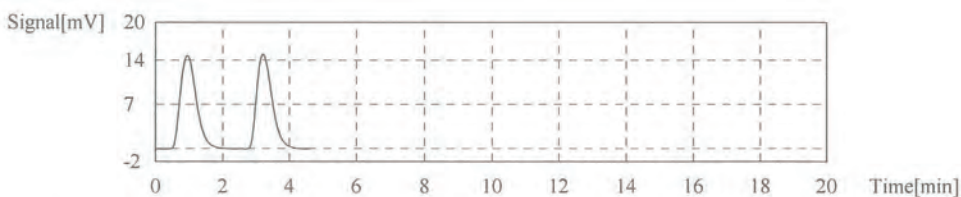
Acid Add. 0.000%
Mean Area 25.31
SD Area 0.1556
CV Area 0.61%



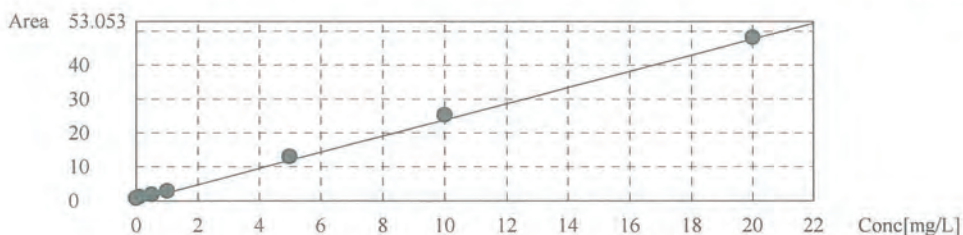
Conc: 20.00mg/L

| No. | Area | Inj. Vol. | Aut. Dil. | Rem. | Ex. | Date / Time |
|-----|-------|-----------|-----------|-------|-----|----------------------|
| 1 | 48.40 | 50uL | 1.000 | ***** | | 6/26/2024 2:49:27 PM |
| 2 | 48.06 | 50uL | 1.000 | ***** | | 6/26/2024 2:52:01 PM |

Acid Add. 0.000%
Mean Area 48.23
SD Area 0.2404
CV Area 0.50%



Slope: 2.388
Intercept 0.000
r² 0.9996
r 0.9998
RSE(%) N/A
Zero Shift Yes



TOC-Control L Report

ALS
2024_06_26_001_PM.tlx

Instr.Information

Instrument Options
Catalyst

TOC/ASI/IC Unit/
Regular Sensitivity

Sample

Sample Name:
Sample ID:
Origin:
Status
Chk. Result

Std. TC
5 ppm
TC 0.1 - 20 ppm.cal
Completed

| Type | Anal. | Manual Dilution | Result |
|---------|-------|-----------------|--------------|
| Unknown | TC | 1.000 | TC:5.216mg/L |

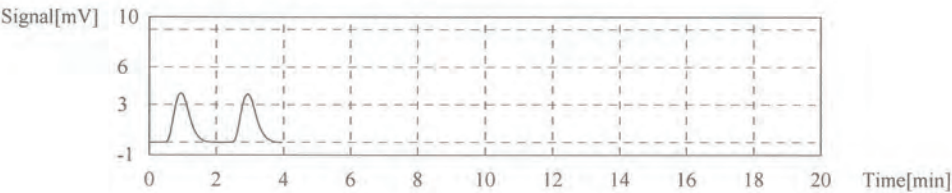
1. Det

Anal.: TC

| No. | Area | Conc. | Inj. Vol. | Aut. Dil. | Ex | Cal. Curve | Date / Time |
|-----|-------|-----------|-----------|-----------|----|-----------------------------------------|----------------------|
| 1 | 12.50 | 5.235mg/L | 50uL | 1.000 | | TC 0.1 - 20 ppm.2024_06_26_13_54_50.cal | 6/26/2024 3:01:28 PM |
| 2 | 12.41 | 5.197mg/L | 50uL | 1.000 | | TC 0.1 - 20 ppm.2024_06_26_13_54_50.cal | 6/26/2024 3:03:42 PM |

Mean Area
Mean Conc.

12.46
5.216mg/L



TOC-Control L Report

ALS
2024_06_26_001_PM.tlx

Instr.Information

Instrument Options
Catalyst

TOC/ASI/IC Unit/
Regular Sensitivity

Sample

Sample Name: water
Sample ID: Untitled
Origin: TC 0.1 - 20 ppm.cal
Status: Completed
Chk. Result:

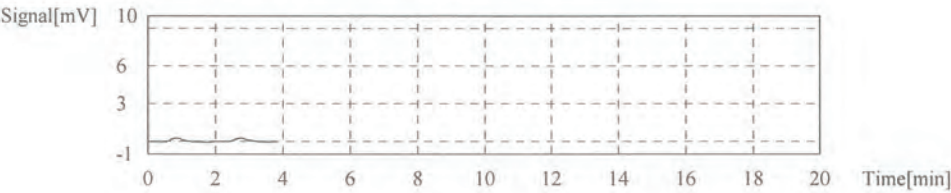
| Type | Anal. | Manual Dilution | Result |
|---------|-------|-----------------|---------------|
| Unknown | TC | 1.000 | TC:0.2800mg/L |

1. Det

Anal.: TC

| No. | Area | Conc. | Inj. Vol. | Aut. Dil. | Ex. | Cal. Curve | Date / Time |
|-----|--------|------------|-----------|-----------|-----|-----------------------------------------|----------------------|
| 1 | 0.6729 | 0.2818mg/L | 50uL | 1.000 | | TC 0.1 - 20 ppm.2024_06_26_13_54_50.cal | 6/26/2024 3:08:11 PM |
| 2 | 0.6642 | 0.2782mg/L | 50uL | 1.000 | | TC 0.1 - 20 ppm.2024_06_26_13_54_50.cal | 6/26/2024 3:10:21 PM |

Mean Area 0.6685
Mean Conc. 0.2800mg/L



Certificate of System Qualification

GC-OQ + GCMS-OQ

System ID: GM-10
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Patthanakarn 40, Patthanakarn Rd., Kwang Suan Luang, Khet Suan Luang, Bangkok 10250

Date: November 21, 2024 2:12:44 PM
EQP Name: AgilentRecommended , AgilentRecommended

EQP Revision: GC.02.55, GCMS.02.56
Overall Qualification Status: Pass

REVIEW BY *Suchada T.*
APPROVED BY *Nant Somb*
NEXT CAL. DATE *21-May-26*

CDS Logon Verification - GC

Logon: asbkk.env03

Overall CDS Logon Verification Test Status

Pass

System Inspection and Basic Safety and Operation

Name: 7890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: 7890

Front MMI

Setpoint Status: Pass

| | Setpoint | | Actual | |
|----------------------|----------|-----|--------|-----|
| Inlet Pressure: | 25.0 | psi | 25.2 | psi |
| Accuracy: | | | 0.2 | psi |
| Agilent Recommended: | | | <= 1.2 | |

Date: November 21, 2024 2:12:44 PM
System ID: GM-10

Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name: 7890

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 230.0 228.2 °C

Accuracy: -1.8 °C

Agilent Recommended:

| | | | |
|----|------|-----------------|-------------|
| >= | -1.0 | % setpoint in K | (-5.0 °C) |
| <= | 1.0 | % setpoint in K | (5.0 °C) |

Setpoint Status: Pass

Zone: Oven

Setpoint/Actual

Temperature: 100.0 100.7 °C

Accuracy: 0.7 °C

Agilent Recommended:

| | | | |
|----|------|-----------------|-------------|
| >= | -1.0 | % setpoint in K | (-3.7 °C) |
| <= | 1.0 | % setpoint in K | (3.7 °C) |

Overall GC Oven Temperature Accuracy Test Status

Pass

NOTE: This test's 2 comment(s) and 0 deviation(s) are available in the Attachments section.

GC Oven Temperature Stability

Name: 7890

Setpoint Status: Pass

Setpoint/Average

Temperature: 100.0 100.7333 °C

Stability: 0.1 °C

Agilent Recommended:

| | |
|----|-----|
| <= | 0.5 |
|----|-----|

Date: November 21, 2024 2:12:44 PM
System ID: GM-10

Overall GC Oven Temperature Stability Test Status

Pass

NOTE: This test's 1 comment(s) and 0 deviation(s) are available in the Attachments section.

Tune EI

Tested Combination1

Front

MMI

/ External

TQ

Name:

7000D

Setpoint Status:

Pass

Filament:

1

Setpoint Status:

Pass

Filament:

2

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination1

Front

MMI

/ External

TQ

Injection Tower

Name:

7693A

Source:

EI - Extractor

Setpoint Status:

Completed

Injection Volume on Column:

1.0

uL

Overall Scouting Run Status

Completed

Instrument Detection Limit

Tested Combination1

Front

MMI

/ External

TQ

Injection Tower

Name:

7693A

Source:

EI - Extractor

Date:

November 21, 2024 2:12:44 PM

System ID:

GM-10

Setpoint Status:

Pass

Injection Volume on Column:

1.0 uL

Minimum RSD:

Area
4.58 %

Retention Time

0.01 %

Agilent Recommended:

<= 12.00

<= 1.00

Status:

Pass

Pass

Instrument Detection Limit:

1.54238 fg

Agilent Recommended:

<= 4.03800

Status:

Pass

Overall Instrument Detection Limit Test Status

Pass

Mass Ratio Precision

Tested Combination1

Front

MMI

/ External

TQ

Injection Tower

Name:

7693A

Source:

EI - Extractor

Setpoint Status:

Pass

Injection Volume on Column:

0.5 uL

Area Mass 1

Mass Ratio

Abundance*s

RSD:

2.23 %

0.10 %

Agilent Recommended:

<= 5.00

<= 5.00

Pass

Pass

Overall Mass Ratio Precision Test Status

Pass

Date:

November 21, 2024 2:12:44 PM

System ID:

GM-10

Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

| | |
|------------------------|-----------------------------------|
| System ID | GM-10 |
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Flow Data Input | Manual Data |
| Temperature Data Input | Manual Data or Other Data Logging |

Tested Combination1

| | |
|---------------------|-----------------|
| Injection Technique | Injection Tower |
| Inlet | Front |
| Detector | External |
| LTM Included? | No |

Sampler 1

| | |
|---------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Type | Injection Tower |
| Name | 7693A |
| Model Number | G4513A |
| Serial Number | CN18180003 |
| Firmware Revision | A.11.02 |
| Usage | Sample Injection |
| Location | Front |
| Syringe Volume (µL) | 10 |

Sampler 2

| | |
|-------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Type | Tray |
| Name | 7693A |
| Model Number | G4514A |
| Serial Number | CN18170137 |
| Firmware Revision | A.11.03 |
| Vial Heater | Not installed |

Mainframe 1

| | |
|-------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Model Number | G3442B |
| Serial Number | CN18153080 |
| Firmware Revision | B.02.05 |
| Oven Type | Standard |

Inlet 1

| | |
|--------------|-----------------------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Type | MMI |
| Location | Front |
| Carrier Gas | Helium |
| Control Type | Electronic Pressure Control (EPC) |
| Purged Inlet | Yes |

Inlet 2

| | |
|--------------|-----------------------------------|
| Manufacturer | Agilent Technologies |
| Name | 7890 |
| Type | SSL |
| Location | Back |
| Carrier Gas | Helium |
| Control Type | Electronic Pressure Control (EPC) |
| Purged Inlet | Yes |

Detector 1

| | |
|--------------|----------------------|
| Manufacturer | Agilent Technologies |
| Name | Mass Spectrometer |
| Type | Mass Spectrometer |
| Location | External |

Mass Spectrometer 1

| | |
|----------------------------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Type | TQ |
| Name | 7000D |
| Model Number | G7000D |
| Serial Number | US1826U108 |
| Firmware Revision | G.7000.085A |
| High Vacuum System | Turbo Pump |
| Liquid Injection Scouting Run Standard | OFN Std |

MS EI Source 1

| | |
|---------------------|----------------------|
| Manufacturer | Agilent Technologies |
| Source Type | EI - Extractor |
| Number of filaments | 2 |

Electronic Signature

Purpose

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

Details

| | |
|--------------------------|-------------------------------------------------------------------|
| Full Name of Signer: | Supasak Nimsongtham |
| Logged On User Name: | supasak.nimsongtham@agilent.com |
| Signature Creation Date: | November 21, 2024 |
| Reason for Signature: | Executed protocol and published this original version of document |

ACE Self Qualification Status

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

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

Warranty

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Date: November 21, 2024 2:12:44 PM
System ID: GM-10

User Name: supasak.nimsongtham
Report Generated by Hostname: 5CG1115HKC

System Id: GM-10
Print Date: November 21, 2024 2:12:46 PM

GM-10 2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|----------------------------------|-------------------|--------------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| November 21, 2024 11:58:17 AM | Audit | SessionCreated | Session | Host Name: 5CG1115HKC, Drive Serial Number: C2031778 |
| November 21, 2024 11:58:17 AM | start | Configuration | Session | None |
| November 21, 2024 11:58:17 AM | Audit | Entitlement | Licensing | User is FieldEngineer and does not require an unlock code |
| November 21, 2024 12:01:59 PM | Audit | EqpLoaded | Session | EQP details for primary technique [Gc] - File path: [ProtocolPacks/Gc/Configurat ions/02.55/Gc.02.55.eqp], EQP File Name: [Gc.02.55.eqp], EQP Name: [AgilentRecommended],Proto col Revision :[Gc.02.55] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GcMs/Config urations/02.56/GcMs.02.56.e qp], EQP File Name: [GcMs.02.56.eqp], EQP Name: [AgilentRecommended] |
| November 21, 2024 12:02:04 PM | End | Configuration | Session | None |
| November 21, 2024 12:02:12 PM | start | Qualification | Session | OQ |
| November 21, 2024 12:02:12 PM | start | Execution | CDS Logon Verification - GC - 7890: - Qualitative test | None |
| November 21, 2024 12:03:09 PM | End | Execution | CDS Logon Verification - GC - 7890: - Qualitative test | Run Count : 1 |

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User Name: supasak.nimsongtham
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System Id: GM-10
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GM-10 2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|----------------------------------|-------------------|--------------------|----------------------------------------------------------------------------------------------------------------|----------------------|
| November 21, 2024 12:03:11 PM | start | Execution | System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated | None |
| November 21, 2024 12:03:20 PM | End | Execution | System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated | Run Count : 1 |
| November 21, 2024 12:03:23 PM | start | Execution | Inlet Pressure Accuracy - Front MMI: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi | None |
| November 21, 2024 12:03:28 PM | End | Execution | Inlet Pressure Accuracy - Front MMI: - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi | Run Count : 1 |
| November 21, 2024 12:03:30 PM | start | Execution | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | None |
| November 21, 2024 12:06:02 PM | Audit | Data | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Manual Data Entry |
| November 21, 2024 12:06:05 PM | End | Execution | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Run Count : 1 |
| November 21, 2024 12:06:07 PM | start | Execution | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | None |
| November 21, 2024 12:06:20 PM | Audit | Data | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Manual Data Entry |

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User Name: supasak.nimsongtham
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System Id: GM-10
Print Date: November 21, 2024 2:12:46 PM

GM-10 2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|----------------------------------|-------------------|--------------------|----------------------------------------------------------------------------------------------------------------|----------------------|
| November 21, 2024 12:06:23 PM | End | Execution | GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K | Run Count : 1 |
| November 21, 2024 12:06:25 PM | start | Execution | GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C | None |
| November 21, 2024 12:07:10 PM | Audit | Data | GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C | Manual Data Entry |
| November 21, 2024 12:07:14 PM | End | Execution | GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C | Run Count : 1 |
| November 21, 2024 12:07:16 PM | start | Execution | Tune EI - 7000D TQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated) | None |
| November 21, 2024 12:07:26 PM | End | Execution | Tune EI - 7000D TQ: - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated) | Run Count : 1 |
| November 21, 2024 12:07:28 PM | start | Execution | Tune EI - 7000D TQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated) | None |
| November 21, 2024 12:07:39 PM | End | Execution | Tune EI - 7000D TQ: - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated) | Run Count : 1 |
| November 21, 2024 12:07:41 PM | start | Execution | Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation | None |

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User Name: supasak.nimsongtham

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Report Generated by Hostname: 5CG1115HKC

Print Date: November 21, 2024 2:12:46 PM

GM-10 2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|----------------------------------|-------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| November 21, 2024 12:08:53 PM | Audit | Data | Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation | Data files Path : C:\GM-10 OQ2024\SC001.D |
| November 21, 2024 12:09:23 PM | Audit | Reporting | Reintegration | Reintegration Count: 1 -- [Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 50; Integration: Off at 0; Integration: On at 4] |
| November 21, 2024 12:09:50 PM | End | Execution | Scouting Run - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor- Part of GCMS System Preparation | Run Count : 1 |
| November 21, 2024 12:09:53 PM | start | Execution | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | None |
| November 21, 2024 12:16:46 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL001.D |
| November 21, 2024 12:16:46 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL002.D |

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Date:
System ID:

November 21, 2024 2:12:44 PM
GM-10

User Name: supasak.nimsongtham

Report Generated by Hostname: 5CG1115HKC

System Id: GM-10

Print Date: November 21, 2024 2:12:46 PM

GM-10 2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|----------------------------------|-------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| November 21, 2024 12:16:46 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL003.D |
| November 21, 2024 12:16:46 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL004.D |
| November 21, 2024 12:16:47 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL005.D |
| November 21, 2024 12:16:47 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL006.D |
| November 21, 2024 12:16:47 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL007.D |
| November 21, 2024 12:16:47 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL008.D |
| November 21, 2024 12:16:47 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL009.D |

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User Name: supasak.nimsongtham
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GM-10 2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|----------------------------------|-------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| November 21, 2024 12:16:47 PM | Audit | Data | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Data files Path : C:\GM-10 OQ2024\IDL010.D |
| November 21, 2024 12:18:15 PM | Audit | Reporting | Reintegration | Reintegration Count: 1 -- [Integration Type: Injection; Baseline Correction Mode: Advanced; Initial Slope Sensitivity: 10; Initial Peak Width: 0.01; Initial Area Reject: 0; Initial Height Reject: 50; Integration: Off at 0; Integration: On at 4] |
| November 21, 2024 12:22:43 PM | End | Execution | Instrument Detection Limit - Injection Tower, Front MMI, TQ: - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00% | Run Count : 1 |
| November 21, 2024 12:22:52 PM | start | Execution | Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): <= 5.00% | None |
| November 21, 2024 12:27:38 PM | Audit | Data | Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): <= 5.00% | Data files Path : C:\GM-10 OQ2024\MRP002.D |
| November 21, 2024 12:27:38 PM | Audit | Data | Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): <= 5.00% | Data files Path : C:\GM-10 OQ2024\MRP003.D |
| November 21, 2024 12:27:38 PM | Audit | Data | Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): <= 5.00% | Data files Path : C:\GM-10 OQ2024\MRP004.D |

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User Name: supasak.nimsongtham

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System Id: GM-10

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GM-10 2024 Transaction log :

| Time | Transaction State | Activity Performed | Type of Transaction | Optional Information |
|----------------------------------|-------------------|--------------------|-------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| November 21, 2024 12:27:38 PM | Audit | Data | Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): ≤ 5.00% | Data files Path : C:\GM-10 OQ2024\MRP005.D |
| November 21, 2024 12:27:39 PM | Audit | Data | Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): ≤ 5.00% | Data files Path : C:\GM-10 OQ2024\MRP006.D |
| November 21, 2024 12:27:39 PM | Audit | Data | Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): ≤ 5.00% | Data files Path : C:\GM-10 OQ2024\MRP007.D |
| November 21, 2024 12:33:20 PM | Audit | Reporting | Reintegration | Reintegration Count: 1 -- [Integration Type: Injection;Baseline Correction Mode: Advanced;Initial Slope Sensitivity: 10;Initial Peak Width: 0.01;Initial Area Reject: 0;Initial Height Reject: 50000;Integration: Off at 0;Integration: On at 4] |
| November 21, 2024 12:36:42 PM | End | Execution | Mass Ratio Precision - Injection Tower, Front MMI, TQ: - Source: EI - Extractor - L (RSD): ≤ 5.00% | Run Count : 1 |
| November 21, 2024 12:37:11 PM | End | Qualification | Session | OQ |
| November 21, 2024 12:37:11 PM | start | Reporting | Session | None |
| November 21, 2024 1:11:02 PM | Audit | Reporting | Session | Report Generated : Certificate |
| November 21, 2024 1:37:20 PM | Audit | Reporting | Session | Report Generated : Report |

Date:

November 21, 2024 2:12:44 PM

System ID:

GM-10