

ภาคผนวก จ

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



right solutions.
right partner.

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

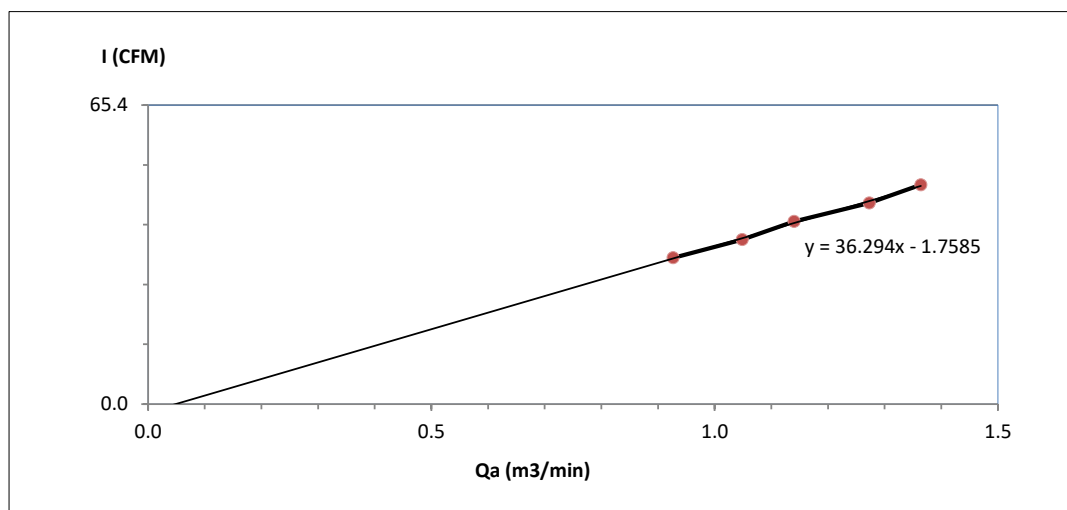
| Sample Name | Parameter | Equipment Name | ID No. | Calibrated Date | Next Cal | Freq. Calibrate (Months) |
|-------------|------------------------------|--------------------------------|------------|-----------------|-----------|--------------------------|
| Ambient | Particulate Matter (PM-10) | High Volume | BKK_FS0375 | - | - | On site Calibration |
| Ambient | Particulate Matter (PM-10) | High Volume | BKK_FS1377 | - | - | On site Calibration |
| Ambient | Particulate Matter (PM-10) | High Volume | BKK_FS0382 | - | - | On site Calibration |
| Ambient | Particulate Matter (PM-10) | Digital Balance | RYG_EN0001 | 22-Feb-24 | 22-Feb-25 | 12 |
| Ambient | Total Suspended Particulate | High Volume | BKK_FS1058 | - | - | On site Calibration |
| Ambient | Total Suspended Particulate | High Volume | BKK_FS0358 | - | - | On site Calibration |
| Ambient | Total Suspended Particulate | High Volume | BKK_FS1056 | - | - | On site Calibration |
| Ambient | Total Suspended Particulate | Digital Balance | RYG_EN0001 | 22-Feb-24 | 22-Feb-25 | 12 |
| Noise | Leq 24 hrs | Sound Calibrator | BKK_FS0630 | 27-Jun-24 | 27-Jun-25 | 12 |
| Noise | Leq 24 hrs | Sound Level Meter | BKK_FS0879 | 11-Dec-23 | 10-Dec-24 | 12 |
| Noise | Leq 24 hrs | Sound Level Meter | BKK_FS0880 | 11-Dec-23 | 10-Dec-24 | 12 |
| Noise | Leq 24 hrs | Sound Level Meter | BKK_FS0874 | 10-Jan-24 | 9-Jan-25 | 12 |
| Water Lab | pH at 25 °C | pH meter | BKK_EN0342 | 17-Oct-24 | 17-Oct-25 | 12 |
| Water Lab | Total Hardness | Burette | BKK_EN0171 | 27-Feb-24 | 27-Aug-25 | 18 |
| Water Lab | Turbidity | Chamber (Cooling Room) | BKK_EN0167 | 6-Dec-23 | 6-Jun-25 | 18 |
| Water Lab | Sulfate | Ion Chromatography | BKK_EN0069 | 12-Jan-24 | 12-Jan-25 | 12 |
| Water Lab | Total Suspended Solids | Electronic Top-Loading Balance | BKK_EN0003 | 2-Aug-24 | 2-Aug-25 | 12 |
| Water Lab | Total Suspended Solids | Oven | BKK_EN0273 | 14-May-24 | 14-Nov-25 | 18 |
| Water Lab | Total Dissolved Solids 180°C | Electronic Top-Loading Balance | BKK_EN0003 | 2-Aug-24 | 2-Aug-25 | 12 |
| Water Lab | Total Dissolved Solids 180°C | Oven | BKK_EN0273 | 14-May-24 | 14-Nov-25 | 18 |
| Water Lab | Lead | ICP-MS | BKK_EL0026 | 12-Dec-23 | 13-Jun-25 | 18 |
| Water Lab | Lead | Hot Block | BKK_EL0054 | 22-Sep-23 | 22-Mar-25 | 18 |
| Water Lab | Lead | Chamber (Cooling Room) | BKK_EN0167 | 6-Dec-23 | 6-Jun-25 | 18 |
| Water Lab | Total Iron | ICP-MS | BKK_EL0026 | 12-Dec-23 | 13-Jun-25 | 18 |
| Water Lab | Total Iron | Hot Block | BKK_EL0054 | 22-Sep-23 | 22-Mar-25 | 18 |
| Water Lab | Total Iron | Chamber (Cooling Room) | BKK_EN0167 | 6-Dec-23 | 6-Jun-25 | 18 |
| Water Lab | Arsenic | ICP-MS | BKK_EL0026 | 12-Dec-23 | 13-Jun-25 | 18 |
| Water Lab | Arsenic | Hot Block | BKK_EL0054 | 22-Sep-23 | 22-Mar-25 | 18 |
| Water Lab | Arsenic | Chamber (Cooling Room) | BKK_EN0167 | 6-Dec-23 | 6-Jun-25 | 18 |
| Water Lab | Cadmium | ICP-MS | BKK_EL0026 | 12-Dec-23 | 13-Jun-25 | 18 |
| Water Lab | Cadmium | Hot Block | BKK_EL0054 | 22-Sep-23 | 22-Mar-25 | 18 |
| Water Lab | Cadmium | Chamber (Cooling Room) | BKK_EN0167 | 6-Dec-23 | 6-Jun-25 | 18 |



High Volume Air Sampler Calibration Worksheet

| | | | |
|-----------------------|---|-------------------------------|------------|
| Project Site : | Siam city cement Public company limited | Barometric Pressure (mm Hg) : | 726.46 |
| Calibrate Location : | บ้านบุญบันดาล | Temperature (°C) : | 33.2 |
| Calibrate Date : | 7-Oct-24 | High Volume ID : | BKK_FS0375 |
| CalibrationSheet No.: | C-071024-BKK_FS0375 | High Volume Model : | TE-5009X |
| Calibrator ID: | BKK_FS0624 | High Volume S/N : | 5196 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.03303 |
| Calibrator S/N : | 2584 | Calibrator Intercept : | -0.01606 |

| Test No. | Delta H ₂ O (inch) | Qa (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|-------------------------------|--------------------------|-----------------|--|
| 1 | 2.1 | 0.927 | 32 | Slope : 36.2940 Intercept : -1.7585 Correlation Coefficient : 0.9984 |
| 2 | 2.7 | 1.049 | 36 | |
| 3 | 3.2 | 1.140 | 40 | |
| 4 | 4.0 | 1.273 | 44 | |
| 5 | 4.6 | 1.364 | 48 | |



Calibrated by Vanich P.
(Mr.Vanich Phanpipit)
Field Scientist(3)

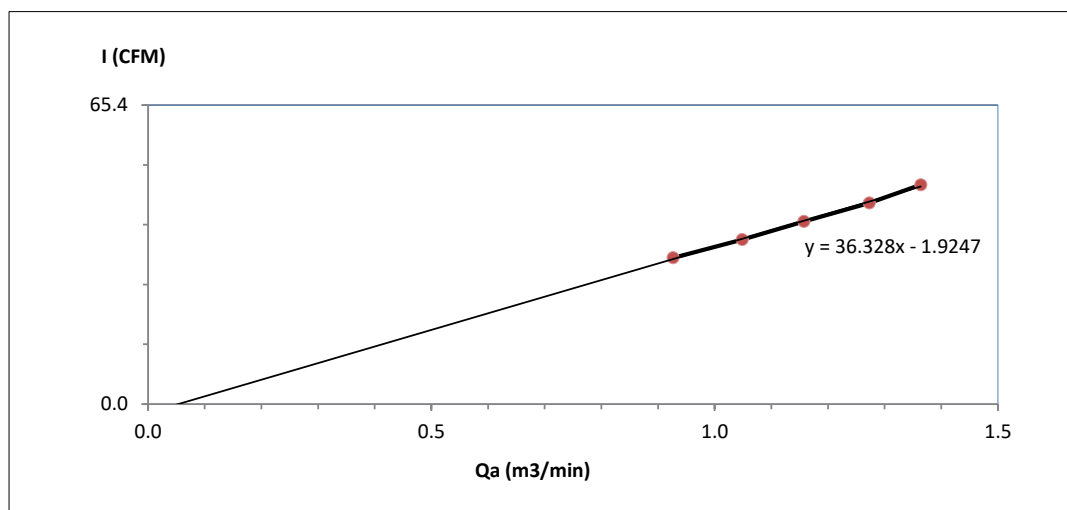
Approved by : Noppong Juntarupan
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

| | | | |
|-----------------------|---|-------------------------------|------------|
| Project Site : | Siam city cement Public company limited | Barometric Pressure (mm Hg) : | 726.46 |
| Calibrate Location : | บ้านชลประทาน | Temperature (°C) : | 33.2 |
| Calibrate Date : | 7-Oct-24 | High Volume ID : | BKK_FS1377 |
| CalibrationSheet No.: | C-071024-BKK_FS1377 | High Volume Model : | TE-5009X |
| Calibrator ID: | BKK_FS0624 | High Volume S/N : | 6262 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.03303 |
| Calibrator S/N : | 2584 | Calibrator Intercept : | -0.01606 |

| Test No. | Delta H ₂ O (inch) | Qa (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|-------------------------------|--------------------------|-----------------|--|
| 1 | 2.1 | 0.927 | 32 | Slope : 36.3284 Intercept : -1.9247 Correlation Coefficient : 0.9989 |
| 2 | 2.7 | 1.049 | 36 | |
| 3 | 3.3 | 1.158 | 40 | |
| 4 | 4.0 | 1.273 | 44 | |
| 5 | 4.6 | 1.364 | 48 | |



Calibrated by Vanich P.
(Mr.Vanich Phanpipit)
Field Scientist(3)

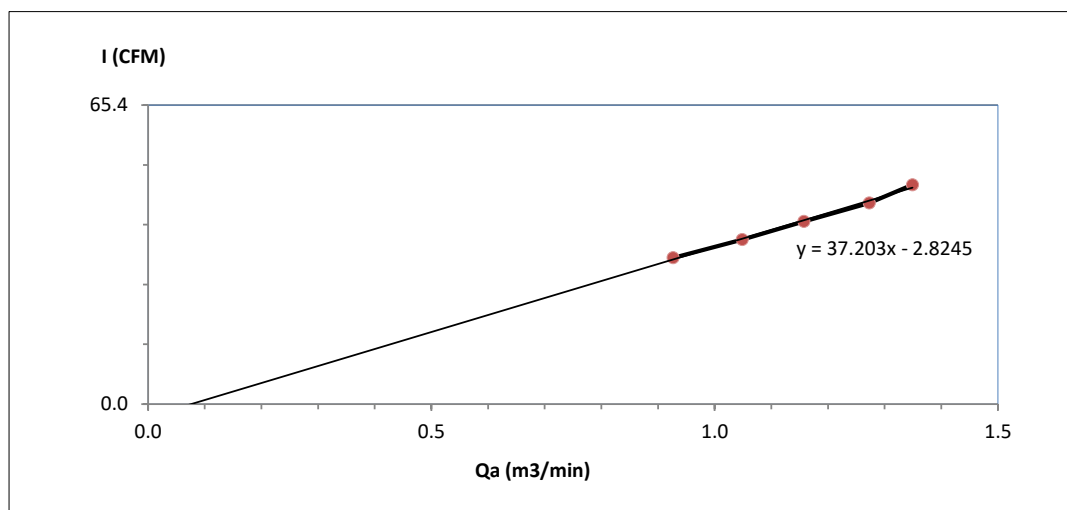
Approved by : Noppong Juntarupan
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

| | | | |
|-----------------------|---|-------------------------------|------------|
| Project Site : | Siam city cement Public company limited | Barometric Pressure (mm Hg) : | 726.46 |
| Calibrate Location : | บ้านเขาพระ | Temperature (°C) : | 33.2 |
| Calibrate Date : | 7-Oct-24 | High Volume ID : | BKK_FS0382 |
| CalibrationSheet No.: | C-071024-BKK_FS0382 | High Volume Model : | TE-5009X |
| Calibrator ID: | BKK_FS0624 | High Volume S/N : | 4786 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.03303 |
| Calibrator S/N : | 2584 | Calibrator Intercept : | -0.01606 |

| Test No. | Delta H ₂ O (inch) | Qa (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|-------------------------------|--------------------------|-----------------|--|
| 1 | 2.1 | 0.927 | 32 | Slope : 37.2030 Intercept : -2.8245 Correlation Coefficient : 0.9972 |
| 2 | 2.7 | 1.049 | 36 | |
| 3 | 3.3 | 1.158 | 40 | |
| 4 | 4.0 | 1.273 | 44 | |
| 5 | 4.5 | 1.349 | 48 | |



Calibrated by Vanich P.
(Mr.Vanich Phanpipit)
Field Scientist(3)

Approved by : Noppong Juntarupan
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



SARTORIUS

NSC-TISI-TIS 17025
CALIBRATION 0426

Certificate

of Calibration

Model Number : LA130S-F
Description : Analytical Balance
Serial Number : 25409664
ID No. : RYG_EN0001
Manufacturer : Sartorius

Certificate No. : 24BCI0068
Issued Date : Friday, February 23, 2024
Reference No. : 229196

Page No. : 1 of 2

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

Calibrated Place : ALS Laboratory Group (Thailand) Co., Ltd.(Balance Room)
616/10 Moo 5 T.Maenam Khu, A.Pluak Daeng, Rayong 21140, Thailand.

Calibrated By : Mr.Chonchai Inthana
Calibration Date : Thursday, February 22, 2024

Calibration
Procedure No. : This calibration was conducted by
Using in-house calibration procedure number (WI-003)
Based on UKAS LAB 14 : 2019

Metrological data :

Capacity : 150 g Readability : 0.0001 g

Ambients Conditions:

Temperature : 23.6 °C ± 5.0 °C
Humidity : 54.0 % RH ± 10.0 % RH
Pressure : ±

Reasons for calibration

☐ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance

Equipment Condition: ☒ Good Operate ☐ Fair

Measurement Method UKAS Publication Ref :Lab 14

The measurement uncertainty stated is the expended 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). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came form list of Sartorius Metrological Specifications.

Traceability:

| Model Number | Description | Traceability | Certificate No. | Due Date |
|---------------|---|--------------|-----------------|-------------|
| YCS011-522-00 | Sartorius weight set 1mg - 5000g E2,YCS011-522-00 | TCS | M2308197S | 23-Aug-2025 |
| MHB-382SD | Humidity/Barometer/Temp Lutron MHB-382SD | DKSH | C19231845 | 23-Aug-2024 |

This certificate relate and apply this equipment only.

This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division
Sartorius (Thailand) Co., Ltd.

Mr.chonchai Inthana(Technical Manager)

S
T
A
M
P



Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : LA130S-F

Description : Analytical Balance

Serial Number : 25409664

ID No. : RYG_EN0001

Manufacturer : Sartorius

Certificate No. : 24BCI0068

Issued Date : Friday, February 23, 2024

Reference No. : 229196

Page No. : 2 of 2

Calibration Results : Without Adjustment

Repeatability

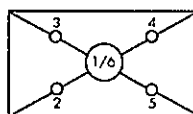
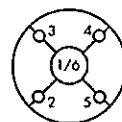
The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.

| | | |
|-----------------------------|---------|----------|
| Nominal Value : (Low Load) | 10.0000 | 99.9999 |
| 10 g | 10.0000 | 100.0000 |
| Tolerance | 10.0000 | 100.0001 |
| 0.0001 g | 10.0000 | 100.0001 |
| | 9.9999 | 100.0000 |
| Nominal Value : (High Load) | 10.0000 | 100.0001 |
| 100 g | 10.0000 | 100.0000 |
| Tolerance | 10.0000 | 100.0001 |
| 0.0001 g | 9.9999 | 100.0002 |
| | 9.9999 | 100.0001 |
| Standard Deviation | 0.00005 | 0.00008 |

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).

Nominal value : 50 g
Tolerance 0.0004 g



Difference

| | |
|---|---------|
| 1 | — |
| 2 | -0.0001 |
| 3 | 0.0001 |
| 4 | 0.0002 |
| 5 | 0.0000 |
| 6 | - |

Linearity

The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance 0.0002 g

| Nominal Value (g) | Conventional Mass Value (g) | Displayed Value (g) | Deviation (g) | Uncertainty (g) |
|----------------------|--------------------------------|------------------------|------------------|--------------------|
| 0.01 | 0.0100 | 0.0100 | 0.0000 | 0.00020 |
| 0.05 | 0.0500 | 0.0500 | 0.0000 | 0.00021 |
| 0.1 | 0.1000 | 0.1000 | 0.0000 | 0.00021 |
| 0.5 | 0.5000 | 0.5000 | 0.0000 | 0.00021 |
| 1 | 1.0000 | 1.0000 | 0.0000 | 0.00021 |
| 2 | 2.0000 | 2.0000 | 0.0000 | 0.00021 |
| 5 | 5.0000 | 5.0000 | 0.0000 | 0.00021 |
| 10 | 10.0000 | 10.0001 | 0.0001 | 0.00024 |
| 20 | 20.0000 | 20.0001 | 0.0001 | 0.00021 |
| 100 | 100.0000 | 99.9999 | -0.0001 | 0.00024 |

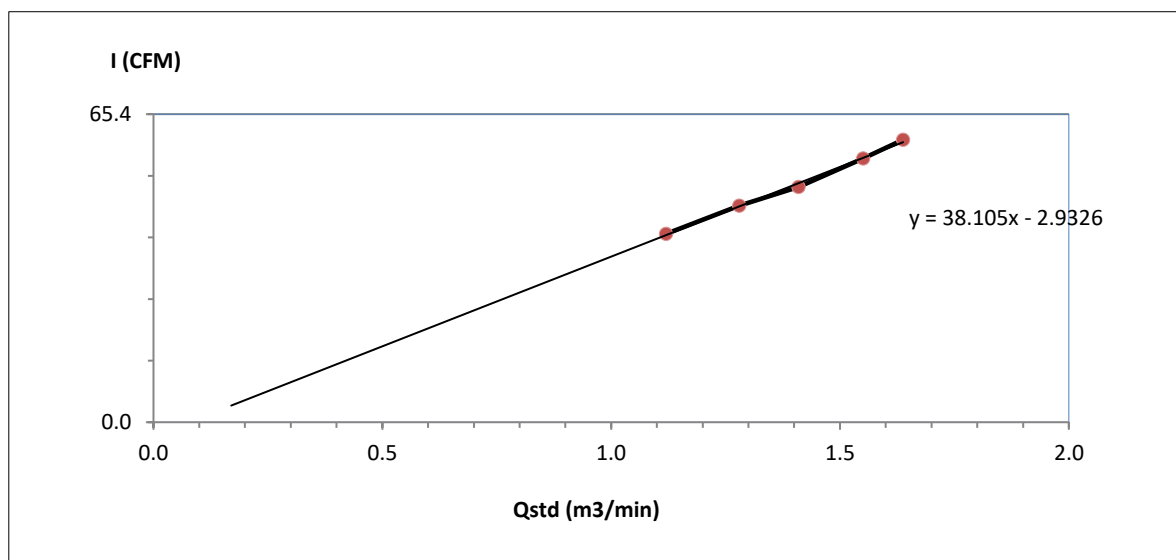
End of Report.



High Volume Air Sampler Calibration Worksheet

| | | | |
|-----------------------|---|-------------------------------|------------|
| Project Site : | Siam city cement Public company limited | Barometric Pressure (mm Hg) : | 726.46 |
| Calibrate Location : | บ้านบุญบันดาล | Temperature (°C) : | 33.2 |
| Calibrate Date : | 7-Oct-24 | High Volume ID : | BKK_FS1058 |
| CalibrationSheet No.: | C-071024-BKK_FS1058 | High Volume Model : | TE-5009X |
| Calibrator ID: | BKK_FS0624 | High Volume S/N : | 5689 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.64931 |
| Calibrator S/N : | 2584 | Calibrator Intercept : | -0.02579 |

| Test No. | Delta H ₂ O (inch) | Q _{std} (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|-------------------------------|--|-----------------|--|
| 1 | 3.5 | 1.1198 | 40 | Slope : 38.1046 Intercept : -2.9326 Correlation Coefficient : 0.9980 |
| 2 | 4.6 | 1.2800 | 46 | |
| 3 | 5.6 | 1.4097 | 50 | |
| 4 | 6.8 | 1.5507 | 56 | |
| 5 | 7.6 | 1.6379 | 60 | |



Calibrated by Vanich P.

(Mr.Vanich Phanpipit)
Field Scientist(3)

Approved by : [Signature]

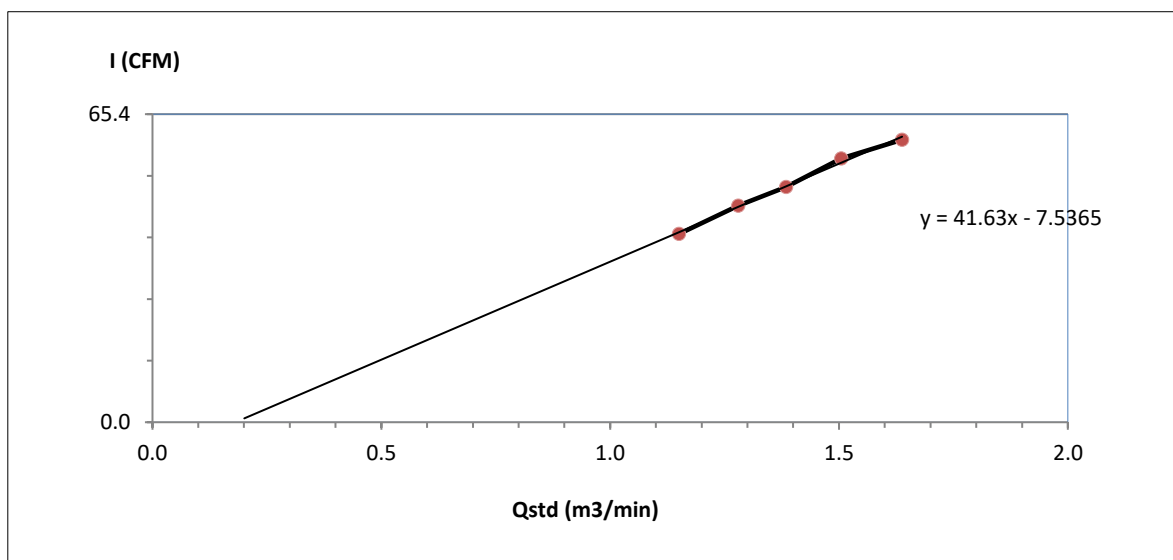
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

| | | | |
|-----------------------|---|-------------------------------|------------|
| Project Site : | Siam city cement Public company limited | Barometric Pressure (mm Hg) : | 726.46 |
| Calibrate Location : | บ้านชลประทาน | Temperature (°C) : | 33.2 |
| Calibrate Date : | 7-Oct-24 | High Volume ID : | BKK_FS0358 |
| CalibrationSheet No.: | C-071024-BKK_FS0358 | High Volume Model : | TE-5009X |
| Calibrator ID: | BKK_FS0624 | High Volume S/N : | 5193 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.64931 |
| Calibrator S/N : | 2584 | Calibrator Intercept : | -0.02579 |

| Test No. | Delta H ₂ O (inch) | Q _{std} (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|-------------------------------|--|-----------------|--|
| 1 | 3.7 | 1.1507 | 40 | Slope : 41.6298 Intercept : -7.5365 Correlation Coefficient : 0.9972 |
| 2 | 4.6 | 1.2800 | 46 | |
| 3 | 5.4 | 1.3847 | 50 | |
| 4 | 6.4 | 1.5052 | 56 | |
| 5 | 7.6 | 1.6379 | 60 | |



Calibrated by Vanich P.

(Mr.Vanich Phanpipit)
Field Scientist(3)

Approved by : [Signature]

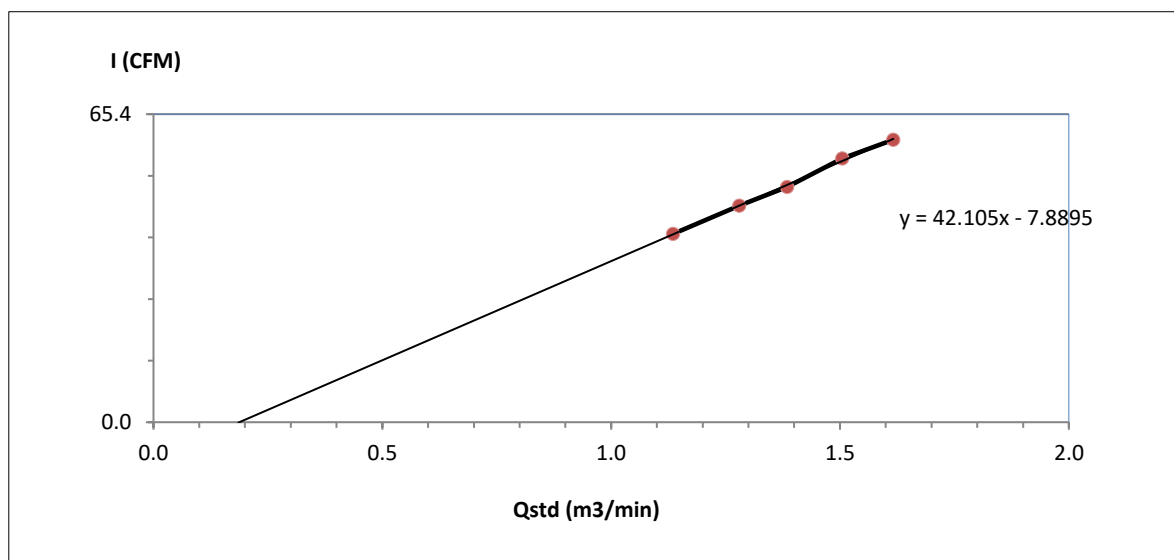
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)



High Volume Air Sampler Calibration Worksheet

| | | | |
|-----------------------|---|-------------------------------|------------|
| Project Site : | Siam city cement Public company limited | Barometric Pressure (mm Hg) : | 726.46 |
| Calibrate Location : | บ้านเขวฬระ | Temperature (°C) : | 33.2 |
| Calibrate Date : | 7-Oct-24 | High Volume ID : | BKK_FS1056 |
| CalibrationSheet No.: | C-071024-BKK_FS1056 | High Volume Model : | TE-5009X |
| Calibrator ID: | BKK_FS0624 | High Volume S/N : | 5499 |
| Calibrator Model : | TE-5028A | Calibrator Slope : | 1.64931 |
| Calibrator S/N : | 2584 | Calibrator Intercept : | -0.02579 |

| Test No. | Delta H ₂ O (inch) | Q _{std} (m ³ /min) | I : Chart (CFM) | Linear Regression |
|----------|-------------------------------|--|-----------------|--|
| 1 | 3.6 | 1.1353 | 40 | Slope : 42.1053 Intercept : -7.8895 Correlation Coefficient : 0.9991 |
| 2 | 4.6 | 1.2800 | 46 | |
| 3 | 5.4 | 1.3847 | 50 | |
| 4 | 6.4 | 1.5052 | 56 | |
| 5 | 7.4 | 1.6166 | 60 | |



Calibrated by Vanich P.

(Mr. Vanich Phanpipit)
Field Scientist(3)

Approved by : [Signature]

(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

Cert. No. : ACC24026

Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No.: 34178117
ID No.: BKK_FS0630

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 : 11 JUNE 2024
Calibration Date : 27 JUNE 2024
Date of Issue : 28 JUNE 2024

| | |
|----------------|--------------|
| REVIEW BY | Nathakorn P. |
| APPROVED BY | [Signature] |
| NEXT CAL. DATE | 27/6/25 |

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.

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. : ACC24026

Job No. : VC67AC0105

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).

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. : ACC24026

Job No. : VC67AC0105

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 | 94.14 | 0.14 | 0.14 | 0.40 |

2. Frequency

| Specified Frequency (Hz) | Measured value (Hz) | Deviated value (%) | Uncertainty (%) | Acceptance limit (%) |
|--------------------------------|---------------------------|----------------------------|----------------------|------------------------------|
| 1000 | 1001.7 | 0.2 | 0.1 | 1.0 |

3. Total distortion

| Measured value (%) | Uncertainty (%) | Acceptance limit (%) |
|----------------------|-------------------|------------------------|
| 1.56 | 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 —————

G. Petch.

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23385

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572563 / 170399 / 72900
ID No.: BKK_FS0879

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 : 17 NOVEMBER 2023
Calibration Date : 11-13 DECEMBER 2023
Date of Issue : 18 DECEMBER 2023

| | |
|----------------|--------------|
| REVIEW BY | Nathakorn P. |
| APPROVED BY | [Signature] |
| NEXT CAL. DATE | 10/12/24 |

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.

Continuation of Calibration Certificate

Cert. No. : ACL23385

Job No. : VC67AC0028

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based 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-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 14-FEB-24 |

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).

Continuation of Calibration Certificate

Cert. No. : ACL23385

Job No. : VC67AC0028

Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Pass | Fail | 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 | - | - | - | 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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23385

Job No. : VC67AC0028

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 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 | Measured value (dB) |
|------------------------|--------------------------|
| A - weight | 9.9 |
| C - weight | 16.5 |
| Flat | 22.3 |

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 | 0.3 | 0.3 | ± 1.5 |
| 1000 | 0.0 | 0.0 | 0.0 | ± 1.0 |
| 8000 | -0.7 | -0.7 | -0.7 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23385
Job No. : VC67AC0028
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 |

Continuation of Calibration Certificate

Cert. No. : ACL23385
Job No. : VC67AC0028
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 | 29.9 | -0.1 | ± 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 |

Continuation of Calibration Certificate

Cert. No. : ACL23385
Job No. : VC67AC0028
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) |
|-------|--------------------------------|-----------------------------|-----------------------------|--------------------------------|
| Auto | 94.0 | 94.0 | 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 |

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 | 133.0 | 133.0 | 0.0 | ±3.0 |
| One | 136.4 | 136.1 | -0.3 | ±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 |

Continuation of Calibration Certificate

Cert. No. : ACL23385

Job No. : VC67AC0028

Pages : 8 of 8

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

SITHIPHORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY



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

NSC-TISI-TIS 17025
CALIBRATION 0394

Cert. No. : ACL23386

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572564 / 170401 / 72902
ID No.: BKK_FS0880

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG 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 : 17 NOVEMBER 2023
Calibration Date : 11-13 DECEMBER 2023
Date of Issue : 18 DECEMBER 2023



Calibrated by : Nathakorn Pisutpaisan

Approved by :

()
(Thanakul Petchurai)

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

Continuation of Calibration Certificate

Cert. No. : ACL23386

Job No. : VC67AC0028

Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based 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-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 14-FEB-24 |

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).

Continuation of Calibration Certificate

Cert. No. : ACL23386
Job No. : VC67AC0028
Pages : 3 of 8

Summary of Measurement Result :

| Parameter | Pass | Fail | 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 | - | - | - | 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 |

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

Continuation of Calibration Certificate

Cert. No. : ACL23386

Job No. : VC67AC0028

Pages : 4 of 8

Result of calibration :**1. Absolute sensitivity**

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 16.3 |

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

| Frequency Weighting | Measured value (dB) |
|------------------------|--------------------------|
| A - weight | 12.0 |
| C - weight | 18.4 |
| Flat | 24.2 |

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 | 0.0 | 0.0 | ± 1.5 |
| 1000 | -0.2 | -0.2 | -0.2 | ± 1.0 |
| 8000 | 0.1 | 0.3 | 0.4 | ±5.0 |

Continuation of Calibration Certificate

Cert. No. : ACL23386

Job No. : VC67AC0028

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 | -0.1 | -0.1 | -0.1 | ±2.0 |
| 125 | -0.1 | 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 | 0.1 | 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 |

Continuation of Calibration Certificate

Cert. No. : ACL23386
Job No. : VC67AC0028
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 | 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 |

Continuation of Calibration Certificate

Cert. No. : ACL23386
Job No. : VC67AC0028
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) |
|-------|--------------------------|-----------------------|-----------------------|--------------------------|
| Auto | 94.0 | 94.0 | 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 |

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 | 133.0 | 133.0 | 0.0 | ±3.0 |
| One | 136.4 | 136.0 | -0.4 | ±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 |

Continuation of Calibration Certificate

Cert. No. : ACL23386

Job No. : VC67AC0028

Pages : 8 of 8

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

SITHIPORN ASSOCIATES CO., LTD.
CALIBRATION LABORATORY

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

SITHIPORN
associates



Cert. No. : ACL24016

Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00572565 / 170402 / 72903
ID No.: BKK_FS0874

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 : 22 DECEMBER 2023
Calibration Date : 10-11 JANUARY 2024
Date of Issue : 12 JANUARY 2024

| | |
|----------------|---------------------|
| REVIEW BY | <i>Nathakorn P.</i> |
| APPROVED BY | <i>[Signature]</i> |
| NEXT CAL. DATE | 9/1/25 |

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

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

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Cert. No. : ACL24016

Job No. : VC67AC0045

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-0009-23 | 07-FEB-24 |
| Waveform Generator | 33511B | MY52302742 | EF-0010-23 | 07-FEB-24 |
| Digital Multimeter | 33461A | MY53220104 | EEL.BP 30/0266 | 13-FEB-24 |
| Digital Multimeter | 33461A | MY53220076 | EEL.BP 29/0266 | 13-FEB-24 |
| Digital Multimeter | 34461A | MY60024273 | EEL.BP 31/0266 | 14-FEB-24 |
| Programmable Attenuator | MAT-1070 | 62100114 | EF-0011-23 | 08-FEB-24 |
| Condenser Microphone | 4180 | 2977900 | AA-1001-23 | 14-FEB-24 |
| Measuring Amplifier | NA-42KAI | 34560495 | AA-3002-23 | 14-FEB-24 |

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. Petcha

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Cert. No. : ACL24016
Job No. : VC67AC0045
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 | - | 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

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Cert. No. : ACL24016

Job No. : VC67AC0045

Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

| Reference Acoustic Signal (dB) | Measured Value (dB) | Deviation (dB) | Acceptance Limit (dB) |
|--|-----------------------------|---------------------|-------------------------------|
| 93.9 (93.98) | 93.9 | 0.0 | ±0.3 |

2. Self-generated noise

2.1 Normal test

| Measured Value (dB) |
|--------------------------|
| 17.2 |

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

| Frequency Weighting | Measured value (dB) |
|------------------------|--------------------------|
| A - weight | 13.1 |
| C - weight | 19.4 |
| Flat | 25.1 |

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 | 0.8 | 0.7 | 0.8 | ±5.0 |

T. Ketchum

Cert. No. : ACL24016
Job No. : VC67AC0045
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 | -0.1 | -0.1 | -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 | 0.1 | 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. Ratan

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Cert. No. : ACL24016

Job No. : VC67AC0045

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 | 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 |

T. Petch

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Cert. No. : ACL24016

Job No. : VC67AC0045

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) |
|-------|--------------------------|-----------------------|-----------------------|--------------------------|
| Auto | 94.0 | 94.0 | 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 |

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 | 133.0 | 133.0 | 0.0 | ±3.0 |
| One | 136.4 | 136.3 | -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 | 133.0 | 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 |

G. Peter

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Cert. No. : ACL24016

Job No. : VC67AC0045

Pages : 8 of 8

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** —————

T. Petch



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.: 24CH1295

Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Hach
Model : HQ411d
Serial No. : 200100031163
ID No. : BKK_EN0342
Condition As-Received: Used Item
Received Date : 16 October 2024
Calibration Date : 17 October 2024
Reference : 2410-0548DSC-5
Submitted by :

REVIEW BY

Jinda K

APPROVED BY

Siriluk P

NEXT CAL DATE

17/10/25

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lerngagtrakul

Approved by :

Saithip

Approved Signatory

- () Unnopphol Harachai
() Ponpan Paipim
(✓) Saithip Meangmai

Issue Date : 21 October 2024

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.



Cert.No.: 24CH1295

Page.: 2 of 3

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)Ref. Standard Thermometer | 2188080 | 130RC044 | 24I1022 | 16 Sep 2025 |

- This Certification is traceable to SI Through 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 4.008 | CPA chem | 1034203 | 27 Sep 2026 |
| pH 6.999 | Hach Lenge GmbH | C03145 | 28 Feb 2026 |
| pH 10.010 | CPA chem | 1034205 | 27 Sep 2025 |

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

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7,10)

| <u>Unit Under Calibration</u> | <u>Standard pH Buffer Solution</u> | <u>Actual pH Reading</u> | <u>Actual mV Reading (mV)</u> | <u>Uncertainty of pH Measurement (±)</u> | <u>Coverage factor k</u> |
|------------------------------------|------------------------------------|--------------------------|-------------------------------|--|--------------------------|
| pH Electrode S/N.: 230473042902 | 4.008 | 4.028 | 174.6 | 0.0044 | 2.00 |
| | 6.999 | 7.014 | 1.4 | 0.0084 | 2.05 |
| | 10.010 | 10.018 | -172.8 | 0.0066 | 2.00 |

Remark - Can not connect the BNC because the plug does not match with the socket.



Cert.No.: 24CH1295

Page.: 3 of 3

Calibration Results

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : PHC281
- Serial No. : 230473042902

Dimension of probe

- Length : 103 mm.
- Diameter : 12 mm.
- Immersion Depth : 90 mm.

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of measurement (± °C) | Coverage factor <i>k</i> |
|--------------------------------|-----------------------------------|---------------------------|-----------------|---|--------------------------------|
| 25.0 | 25.002 | 25.0 | -0.002 | 0.13 | 2.00 |

Remark : 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 %.

-o0o-



Certificate of Calibration

Cert.No.: 24CG952

Page.: 1 of 2

| | |
|-------------------------|--|
| Equipment : | Burette |
| Capacity : | 50 mL |
| Serial No. : | - |
| ID. No. : | BKK_EN0171 |
| Manufacturer : | Witeg |
| Made in : | Germany |
| Submitted by : | ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand |
| Ambient Temperature : | (20 ± 2.5) °C |
| Relative Humidity : | (50 ± 10) % |
| Barometric Pressure : | 760 mmHg |
| Calibration Procedure : | ASTM E 542 - 01 |
| Calibrated by : | Natcha Chayingcheiw |

Approved by :

Approved Signatory

- () Unnopphol Harachai
(✓) Srisuda Khamtha
() Sa-ngeunkam Wongsu

Issue Date :

27 February 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Burette
Received Date : 23 February 2024
Condition As-Received : New Item
Calibration Date : 27 February 2024
Reference : 2402-0757DSC-1

Cert.No.: 24CG952
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 | XP205DR | 1126143764 | 140RC004 | 23MM538 | TPA | 15 Sep 2024 |
| 2) Thermo-Hygrograph | THDX-CE | 00016540 | 140EC001 | 23H1275 | TPA | 09 June 2024 |
| 3) Thermometer | - | 0834181 | 140EC005 | 23I948 | TPA | 10 Aug 2024 |

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 |
|------------------------------------|---------------------------|---------------------------------|---------------------|
| 50 | 50.0032 | 0.010 | 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 %.

-o0o-



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.

Certificate No. T232160

Page 2 of 4

Calibration Report

Equipment : Chamber (Cooling Room)
Date of Calibration : 6 December 2023
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 | TN161-TN170 | T230773 | 10 April 2024 |
| TC | TYPE T | TN171-TN180 | T230773 | 10 April 2024 |
| DATA LOGGER | 34970A | T149 | T230773 | 10 April 2024 |

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 30 Minute At 3 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

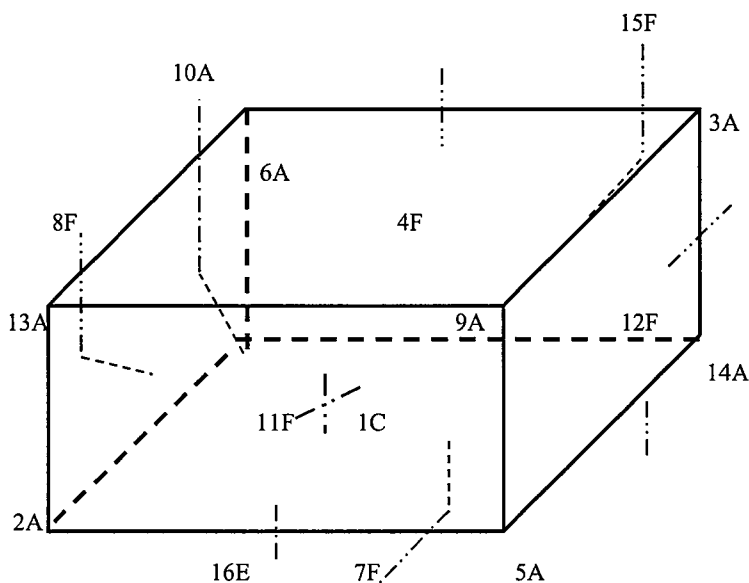
5. Adjustment :

(X) without adjustment

() after adjustment

Approved By. 

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. 



REVIEW BY Autcharawan S.

APPROVED BY Tanyatorn M.

NEXT CAL. DATE 12 Jan 2025

Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co., Ltd.

ICS-2100 S/N: 15010977

AS-HV S/N: 5450A36659

For

ALS Laboratory Group (Thailand) Co., Ltd.



Operator Signature: Nutdanai

Date: Jan 12, 2024

(Mr. Nutdanai Laekhwan)

Application Chemist

Sartorius (Thailand) Co., Ltd.

129 Rama 9 Road, Huaykwang, Huaykwang, Bangkok 10310

Tel: +66 2643 8361-6 , e-mail: service.thailand@sartorius.com



NSC-TIS-TIS 17025

CALIBRATION 0426

SARTORIUS

REVIEW BY

Jinda K

APPROVED BY

Siriluk P

NEXT CAL DATE

02/08/25

Certificate

of Calibration

Model Number : MSE224S-100-DU

Description : Analytical Balance

Serial Number : 0027405555

ID No. : BKK_EN0003

Manufacturer : Sartorius

Certificate No. : 24BCI0270

Issued Date : Monday, August 05, 2024

Reference No. : 240942

Page No. : 1 of 2

Customer Name : ALS Laboratory Group (Thailand)Co., Ltd.

104 Phatthanakan 40,Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250.

Calibrated Place : Lab Room

Calibrated By : Mr.Chonchai Inthana

Calibration Date : Friday, August 02, 2024

Calibration

Procedure No. : This calibration was conducted by

Using in-house calibration procedure number (WI-003)

Based on UKAS LAB 14 : 2019

Metrological data :

Capacity : 220 g Readability : 0.0001 g

Ambients Conditions:

Temperature : 23.0 °C ± 5.0 °C

Humidity : 55.0 % RH ± 10.0 % RH

Pressure : ±

Reasons for calibration☒ New Installation ☐ Service / Repaired ☒ Re-calibration/ Maintenance**Equipment Condition:** ☒ Good Operate ☐ Fair**Measurement Method****UKAS Publication Ref :Lab 14**

The measurement uncertainty stated is the expended 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). The calibration certificate documents the traceability to National Standards, which realise the unit of measurement according to the International Standard System of Units (SI). Report of Tolerance came form list of Sartorius Metrological Specifications.

Traceability:

| Model Number | Description | Traceability | Certificate No. | Due Date |
|---------------|---|--------------|--------------------|-------------|
| YCS011-522-00 | Sartorius weight set 1mg - 5000g E2,YCS011-522-00 | TCS | M23081975 | 23-Aug-2025 |
| Testo 174 H | Thermo-Hygrometer , Testo 174H | ENTECH | H/T 661303,H661140 | 12-Nov-2024 |

This certificate relate and apply this equipment only.

This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

Mr.chonchai Inthana(Technical Manager)

S
T
A
M
P

Sartorius (Thailand) Co., Ltd.

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Tel: +66 2643 8361-6 Fax: +66 2643-8367, e-mail: service.thailand@sartorius.com

SARTORIUS

Certificate of Calibration

Model Number : MSE224S-100-DU

Description : Analytical Balance

Serial Number : 0027405555

ID No. : BKK_EN0003

Manufacturer : Sartorius


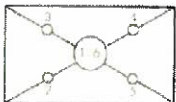
Certificate No. : 24BCI0270

Issued Date : Monday, August 05, 2024

Reference No. : 240942

Page No. : 2 of 2

Calibration Results : Without Adjustment

| Repeatability | | | Eccentricity (Off-center loading error) | | | | | | | | | | | | | | | | |
|--|---------|----------|---|--|--|------------|--|---|---|---|--------|---|--------|---|--------|---|--------|---|---|
| <i>The reproducibility is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express reproducibility quantitatively.</i> | | | <i>The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R76).</i> | | | | | | | | | | | | | | | | |
| Nominal Value : (Low Load) | 20.0000 | 200.0000 | Nominal value : | 100 | g | | | | | | | | | | | | | | |
| 20 g | 20.0000 | 199.9999 | Tolerance | 0.0004 | g | | | | | | | | | | | | | | |
| Tolerance | 20.0001 | 200.0000 |  |  | <table border="1"><thead><tr><th colspan="2">Difference</th></tr></thead><tbody><tr><td>1</td><td>-</td></tr><tr><td>2</td><td>0.0000</td></tr><tr><td>3</td><td>0.0000</td></tr><tr><td>4</td><td>0.0000</td></tr><tr><td>5</td><td>0.0001</td></tr><tr><td>6</td><td>-</td></tr></tbody></table> | Difference | | 1 | - | 2 | 0.0000 | 3 | 0.0000 | 4 | 0.0000 | 5 | 0.0001 | 6 | - |
| Difference | | | | | | | | | | | | | | | | | | | |
| 1 | - | | | | | | | | | | | | | | | | | | |
| 2 | 0.0000 | | | | | | | | | | | | | | | | | | |
| 3 | 0.0000 | | | | | | | | | | | | | | | | | | |
| 4 | 0.0000 | | | | | | | | | | | | | | | | | | |
| 5 | 0.0001 | | | | | | | | | | | | | | | | | | |
| 6 | - | | | | | | | | | | | | | | | | | | |
| 0.0001 g | 20.0000 | 200.0000 | | | | | | | | | | | | | | | | | |
| Nominal Value : (High Load) | 20.0000 | 200.0000 | | | | | | | | | | | | | | | | | |
| 200 g | 20.0001 | 200.0001 | | | | | | | | | | | | | | | | | |
| Tolerance | 20.0000 | 200.0000 | | | | | | | | | | | | | | | | | |
| 0.0001 g | 20.0000 | 199.9999 | | | | | | | | | | | | | | | | | |
| | 20.0000 | 200.0000 | | | | | | | | | | | | | | | | | |
| Standard Deviation | 0.00004 | 0.00006 | | | | | | | | | | | | | | | | | |

| Linearity | | | | |
|--|-------------------------|-----------------|-----------|-------------|
| <i>The linearity, also called linearity error. Describes the deviation of the characteristic curve of a weighing instrument from the linear slope.</i> | | | | |
| Tolerance 0.0002 g | | | | |
| Nominal Value | Conventional Mass Value | Displayed Value | Deviation | Uncertainty |
| (g) | (g) | (g) | (g) | (g) |
| 0.01 | 0.0100 | 0.0100 | 0.0000 | 0.00015 |
| 0.1 | 0.1000 | 0.1000 | 0.0000 | 0.00015 |
| 1 | 1.0000 | 1.0000 | 0.0000 | 0.00015 |
| 2 | 2.0000 | 2.0000 | 0.0000 | 0.00015 |
| 5 | 5.0000 | 5.0000 | 0.0000 | 0.00015 |
| 10 | 10.0000 | 10.0000 | 0.0000 | 0.00015 |
| 20 | 20.0000 | 20.0000 | 0.0000 | 0.00015 |
| 50 | 50.0000 | 50.0001 | 0.0001 | 0.00016 |
| 100 | 100.0000 | 100.0001 | 0.0001 | 0.00019 |
| 200 | 200.0000 | 200.0000 | 0.0000 | 0.00029 |

End of Report.

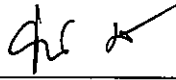
Certificate No. T240904

Page 1 of 3

Certificate of Calibration**Equipment** : Chamber (Oven)**Manufacturer** : Memmert**Model** : UF 450**Serial No.** : B717.0531**Customer Code** : BKK_EN0273**ID No.** : T8042A4**Customer** : ALS Laboratory Group (Thailand) Co.,Ltd.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

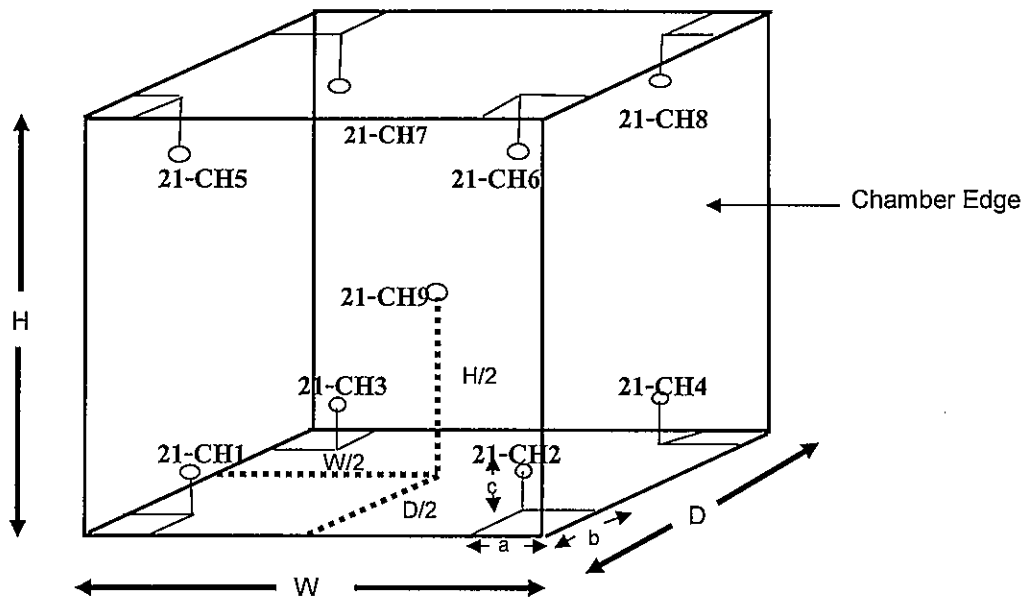
Customer Location : Laboratory (Oven Room)**Date of Receipt** : 08 May 2024**Calibrated By** : Preecha Phisassutthikul (Temperature Calibration Manager)**Approved By** :  / Nuafun Sungchum (Metrology Manager)**Date of Issue** : 23 MAY 2024

| | |
|----------------|-------------------|
| REVIEW BY | <i>finda k</i> |
| APPROVED BY | <i>Siriluk P.</i> |
| NEXT CAL. DATE | 14/11/25 |

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.

Calibration Report



Remark :

Internal Dimensions of Chamber : W (Width) = 104 cm. , H(Height)=72 cm. and D(Depth)=60 cm.
 Size of Installed Standard sensor number 21-CH1 to number 21-CH8 : a = 5 cm. , b = 5 cm. and c = 5 cm.
 Size of Installed Standard sensor number 21-CH9 : W/2=104 cm./2 , H/2=72 cm./2 and D/2=60 cm./2

Measurement Results

| Calibration Point | Average Standard Reading at each position (°C) | | | | | | | | |
|-------------------|--|--------|--------|--------|--------|--------|--------|--------|--------|
| | 21-CH1 | 21-CH2 | 21-CH3 | 21-CH4 | 21-CH5 | 21-CH6 | 21-CH7 | 21-CH8 | 21-CH9 |
| 104 | 103.4 | 105.0 | 103.7 | 103.6 | 103.3 | 104.6 | 103.3 | 104.0 | 103.9 |
| 180 | 179.5 | 181.1 | 179.2 | 179.5 | 179.0 | 181.3 | 179.8 | 179.9 | 180.2 |

| Chamber (Oven) | | | Temperature Distribution | | | | |
|------------------|---------------|---------|--------------------------|------------------|-----------------|--------------------|--------------------------|
| Setting (°C) | Reading (°C) | | Average (°C) | Stability (± °C) | Uniformity (°C) | Uncertainty (± °C) | Coverage Factor <i>k</i> |
| | Min , Max | Average | | | | | |
| 104.0 | 103.9 , 104 | 104.0 | 103.85 | 0.14 | 1.27 | 0.44 | 2.00 |
| 180.0 | 179.9 , 180.1 | 180.0 | 179.94 | 0.39 | 2.29 | 0.76 | 2.00 |

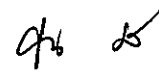
* The quoted uncertainty exclude "uniformity"

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. 


Agilent Technologies

Agilent Technologies (Thailand) Limited
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Email: ccc-smt@agilent.com
Website: www.agilent.com/chem

Customer Contact:

ALS Laboratory Group (Thailand) Co
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Head Office
104 Phatthanakan 40 Phatthanakan Rd
Khwaeng Phatthanakan Khet Suan
TAX ID : 0105540004859
Chanattagarn.lmchom@alsglobal.com
27603068

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: 6006041263 | Service Confirmation: 6905338201 |

| | |
|----------------|-------------|
| REVIEW BY | Supakwan N. |
| APPROVED BY | Savitri N. |
| NEXT CAL. DATE | 13/06/2025 |

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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Citibank N.A. Bangkok Branch
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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: 6905338201

Service Confirmation Date: 12.12.2023

Service Instrument:

| Model Number | Model Description | Serial Number | System Handle | Parent Asset |
|---------------|---------------------------------------|---------------|--------------------|---------------|
| SYS-IM-7700-E | ICPMS 7700 System Enhanced | | ICP MS 7700 (HPLC) | |
| G1316A | 1260 Thermostatted Column Compartment | DEACN12300 | ICP MS 7700 (HPLC) | SYS-IM-7700-E |
| G1329B | 1260 Standard Autosampler | DEAAC11098 | ICP MS 7700 (HPLC) | SYS-IM-7700-E |
| G1311B | 1260 Quaternary Pump | DEAB704380 | ICP MS 7700 (HPLC) | SYS-IM-7700-E |
| G3281A | Agilent 7700x ICP-MS | JP12091612 | ICP MS 7700 (HPLC) | SYS-IM-7700-E |

Service Items:



| Item | Service/Part # | Description | Qty | Entitlement | Service Start | Service End |
|------|----------------|--------------------------------------|------|---------------------------------------|---------------|-------------|
| 1000 | EOQ | Enterprise Operational Qualification | 1.00 | Agreement Entitlement - 100 % covered | 12.12.2023 | 12.12.2023 |
| 1010 | 5185-5850 | ICP-MS Checkout Solutions | 1.00 | Agreement Entitlement - 100 % covered | | |

Additional Information:

Service Confirmation Number: 6905338201

Service Confirmation Date: 12.12.2023

Service Information:

| | | |
|---|--|-----------------------------|
| Problem Description: WU-OQ-IM/HPLC-7700-5001143313 | | |
| Service Provided: Perform OQ Hardware control test CSD logon, Autosample , ISIS , Auto tune , BG and Stability. After done the instrument BKK_EL0026 calibrated pass all. | | |
| Service Overview Code: Reason Code: Scheduled Service Diagnosis Code: Scheduled Service Resolution Code: Scheduled Service | | |
| Reported Hours: 6.0 | Travel Hours: 1.0 | |
| Customer Field Service Representative Name: Panthep Kurasathain | Customer Field Service Representative Signature:  | Date: 12 Dec 2023 |
| Customer Name: Supakwan Mak | Customer Signature:  | Date: 12 Dec 2023 |
| Additional Comments: | | |

Certificate No. T231676

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 : 13 September 2023****Calibrated By : Sanee Musikawan (Site Calibration Manager)****Approved By :  / Sujjar Naknakred (Site Calibration Manager)****Date of Issue : 26 SEP 2023**

| | |
|----------------|--------------|
| REVIEW BY | Tattaporn C. |
| APPROVED BY | Saenit N. |
| NEXT CAL. DATE | 22/03/25 |

The uncertainties are for a confidence probability of approximately 95%.

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Certificate No. T231676

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 22 September 2023
Environment : Temperature : 21.8-23.1 °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 20 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 | TN21-TN30 | T230014 | 17 January 2024 |
| TC | TYPE T | TN31-TN40 | T230014 | 17 January 2024 |
| DATA LOGGER | 34970A | T151 | T230014 | 17 January 2024 |

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 :

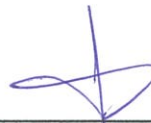
Time Constant 2 Hour 20 Minute At 95 °C
Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment

(X) after adjustment

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

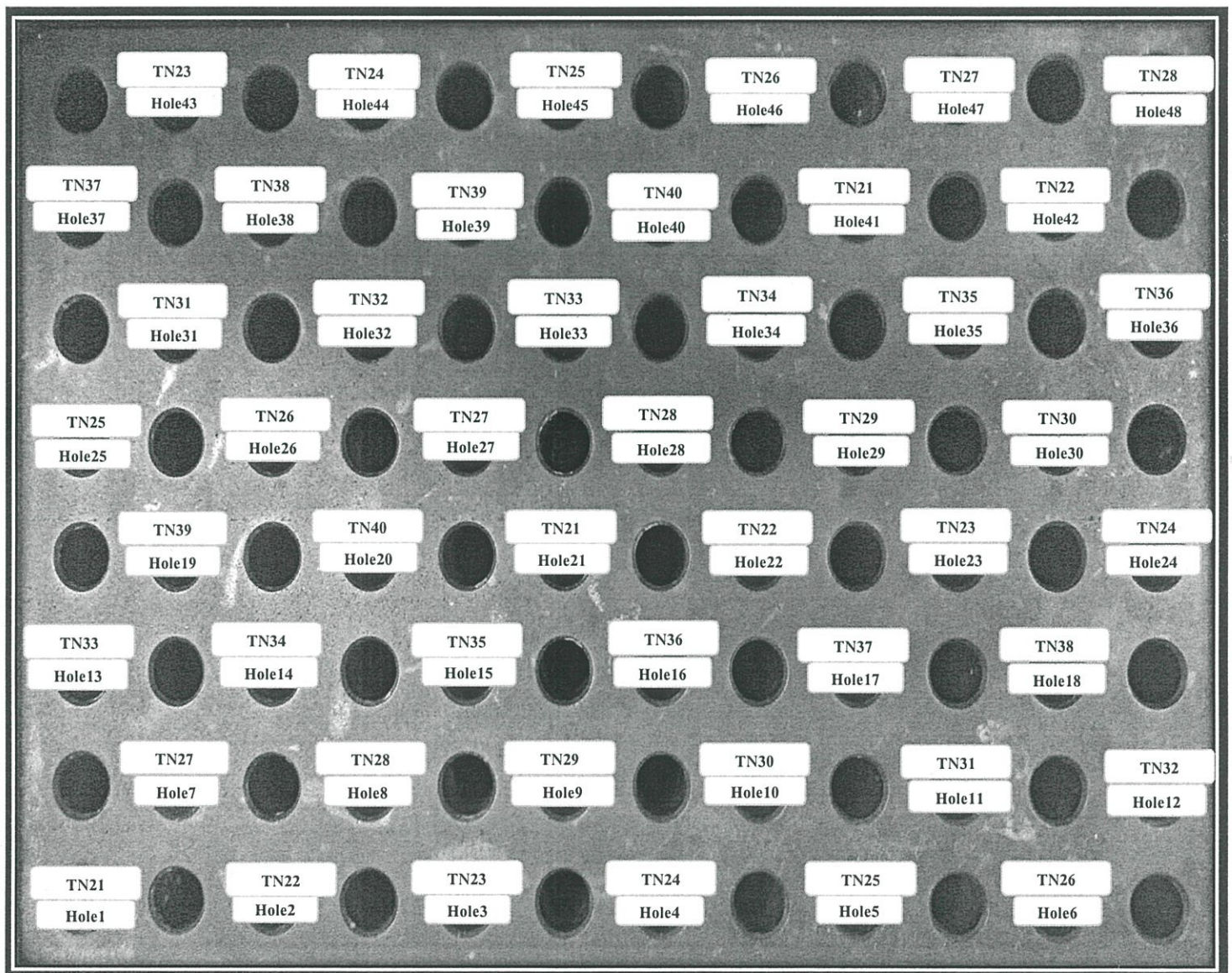
Website : www.scieco.co.th

E-Mail : calibrate@scg.co.th

Certificate No. T231676

Page 3 of 6

Calibration Report



FRONT CONTROL

Approved By. _____

Certificate No T231676

Page 4 of 6

Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (° C) | | | | | |
|-------------------------|---------|---|-------------|-------------|-------------|-------------|-------------|
| R1 Hole1-Hole6 | | TN21 | TN22 | TN23 | TN24 | TN25 | TN26 |
| CAL POINT | Max | 95.01 | 94.41 | 95.20 | 95.41 | 94.51 | 95.17 |
| 95 | Min | 94.57 | 93.95 | 94.75 | 94.92 | 94.00 | 94.72 |
| | Average | 94.79 | 94.18 | 94.98 | 95.17 | 94.26 | 94.95 |
| R2 Hole7-Hole12 | | TN27 | TN28 | TN29 | TN30 | TN31 | TN32 |
| | Max | 95.36 | 95.43 | 95.19 | 95.16 | 95.35 | 94.97 |
| | Min | 94.94 | 94.95 | 94.72 | 94.71 | 94.90 | 94.57 |
| | Average | 95.15 | 95.19 | 94.96 | 94.94 | 95.13 | 94.77 |
| R3 Hole13-Hole18 | | TN33 | TN34 | TN35 | TN36 | TN37 | TN38 |
| | Max | 95.37 | 95.50 | 95.22 | 95.21 | 95.33 | 95.31 |
| | Min | 94.99 | 95.09 | 94.78 | 94.82 | 94.88 | 94.96 |
| | Average | 95.18 | 95.30 | 95.00 | 95.02 | 95.11 | 95.13 |
| R4 Hole19-Hole24 | | TN39 | TN40 | TN21 | TN22 | TN23 | TN24 |
| | Max | 95.59 | 94.42 | 94.52 | 94.24 | 94.63 | 94.67 |
| | Min | 95.21 | 94.06 | 94.13 | 93.88 | 94.28 | 94.27 |
| | Average | 95.40 | 94.24 | 94.33 | 94.06 | 94.45 | 94.47 |
| R5 Hole25-Hole30 | | TN25 | TN26 | TN27 | TN28 | TN29 | TN30 |
| | Max | 95.19 | 95.38 | 92.93 | 95.30 | 95.14 | 95.03 |
| | Min | 94.83 | 95.03 | 92.56 | 94.95 | 94.79 | 94.70 |
| | Average | 95.01 | 95.20 | 92.75 | 95.12 | 94.96 | 94.87 |
| R6 Hole31-Hole36 | | TN31 | TN32 | TN33 | TN34 | TN35 | TN36 |
| | Max | 94.63 | 94.90 | 94.77 | 94.31 | 94.24 | 93.87 |
| | Min | 94.24 | 94.55 | 94.44 | 93.98 | 93.92 | 93.56 |
| | Average | 94.43 | 94.72 | 94.60 | 94.14 | 94.08 | 93.71 |
| R7 Hole37-Hole42 | | TN37 | TN38 | TN39 | TN40 | TN21 | TN22 |
| | Max | 94.30 | 94.44 | 94.04 | 93.81 | 94.89 | 95.35 |
| | Min | 93.95 | 94.05 | 93.67 | 93.48 | 94.39 | 94.90 |
| | Average | 94.13 | 94.24 | 93.86 | 93.65 | 94.64 | 95.12 |
| R8 Hole43-Hole48 | | TN23 | TN24 | TN25 | TN26 | TN27 | TN28 |
| | Max | 95.99 | 95.63 | 95.28 | 95.29 | 95.45 | 94.87 |
| | Min | 95.57 | 95.15 | 94.82 | 94.84 | 94.99 | 94.48 |
| | Average | 95.78 | 95.39 | 95.05 | 95.07 | 95.22 | 94.68 |

Approved By. _____



Certificate No T231676

Page 5 of 6

Calibration Report

Measurement Results

| Calibration Point | | Average Standard Reading at each position (° C) | | | | | |
|-------------------------|---------|---|-------------|-------------|-------------|-------------|-------------|
| R1 Hole1-Hole6 | | TN21 | TN22 | TN23 | TN24 | TN25 | TN26 |
| CAL POINT | Max | 105.23 | 104.32 | 105.43 | 105.25 | 104.44 | 105.27 |
| 105 | Min | 104.94 | 103.95 | 105.15 | 105.04 | 104.11 | 104.96 |
| | Average | 105.09 | 104.13 | 105.29 | 105.15 | 104.28 | 105.12 |
| R2 Hole7-Hole12 | | TN27 | TN28 | TN29 | TN30 | TN31 | TN32 |
| | Max | 105.30 | 105.12 | 105.18 | 105.22 | 105.12 | 105.16 |
| | Min | 105.11 | 104.92 | 104.96 | 105.00 | 104.92 | 104.97 |
| | Average | 105.20 | 105.02 | 105.07 | 105.11 | 105.02 | 105.06 |
| R3 Hole13-Hole18 | | TN33 | TN34 | TN35 | TN36 | TN37 | TN38 |
| | Max | 105.37 | 105.63 | 105.02 | 104.80 | 104.69 | 105.19 |
| | Min | 105.17 | 105.37 | 104.75 | 104.59 | 104.50 | 105.00 |
| | Average | 105.27 | 105.50 | 104.88 | 104.69 | 104.60 | 105.09 |
| R4 Hole19-Hole24 | | TN39 | TN40 | TN21 | TN22 | TN23 | TN24 |
| | Max | 105.31 | 104.43 | 106.41 | 104.71 | 105.63 | 105.82 |
| | Min | 105.08 | 104.22 | 106.15 | 104.41 | 105.37 | 105.56 |
| | Average | 105.19 | 104.33 | 106.28 | 104.56 | 105.50 | 105.69 |
| R5 Hole25-Hole30 | | TN25 | TN26 | TN27 | TN28 | TN29 | TN30 |
| | Max | 104.95 | 106.26 | 103.34 | 105.78 | 105.59 | 105.87 |
| | Min | 104.67 | 105.96 | 103.08 | 105.56 | 105.36 | 105.68 |
| | Average | 104.81 | 106.11 | 103.21 | 105.67 | 105.48 | 105.77 |
| R6 Hole31-Hole36 | | TN31 | TN32 | TN33 | TN34 | TN35 | TN36 |
| | Max | 104.75 | 104.86 | 104.80 | 105.20 | 104.50 | 104.39 |
| | Min | 104.54 | 104.63 | 104.59 | 105.00 | 104.32 | 104.18 |
| | Average | 104.65 | 104.75 | 104.69 | 105.10 | 104.41 | 104.28 |
| R7 Hole37-Hole42 | | TN37 | TN38 | TN39 | TN40 | TN21 | TN22 |
| | Max | 104.30 | 104.90 | 104.85 | 104.65 | 104.88 | 104.85 |
| | Min | 104.09 | 104.72 | 104.66 | 104.49 | 104.63 | 104.52 |
| | Average | 104.19 | 104.81 | 104.75 | 104.57 | 104.76 | 104.68 |
| R8 Hole43-Hole48 | | TN23 | TN24 | TN25 | TN26 | TN27 | TN28 |
| | Max | 105.71 | 105.85 | 105.39 | 105.61 | 105.42 | 105.19 |
| | Min | 105.45 | 105.61 | 105.14 | 105.27 | 105.18 | 104.94 |
| | Average | 105.58 | 105.73 | 105.27 | 105.44 | 105.30 | 105.07 |

Approved By. _____



Certificate No. T231676

Page 6 of 6

Calibration Report

Measurement Results:

| HEATING BLOCK | | | Temperature Distribution | |
|----------------|----------------|---------|--------------------------|----------------------|
| Setting (°C) | Reading (°C) | | Stability (± °C) | Uncertainty (± °C) |
| | Min , Max | Average | | |
| 100.0 | 100.3 , 100.5 | 100.4 | 0.26 | 0.81 |
| 107.0 | 107.0 , 107.1 | 107.1 | 0.19 | 0.78 |

* 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. _____