

ภาคผนวก จ  
ใบรับรองการสอบเทียบเครื่องมือ

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บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง  
คอนซัลแตนท์ จำกัด

### List of Instruments Certification for Air & Noise Quality Analysis

| No.          | Instrument/Equipment | Parameter                                                                   | Manufacturer              | Model/Serial No.           | Calibrator                          | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|--------------|----------------------|-----------------------------------------------------------------------------|---------------------------|----------------------------|-------------------------------------|-------------------|---------------------|-------------------------|--------|
| <b>Stack</b> |                      |                                                                             |                           |                            |                                     |                   |                     |                         |        |
| 1            | Pre-Test Console     | Total Suspended Particulate<br>Methyl Mercaptan<br>Dimethyl Sulfide         | Apex Instruments,<br>USA. | XC-572-V<br>0807047        | Envi Equipment Service Co., Ltd.    | E24-080074        | 26 Aug 24           | 25 Aug 25               | -      |
| 2            | Flue gas Analyzer    | Sulphur Dioxide<br>Oxide of Nitrogen as Nitrogen Dioxide<br>Carbon Monoxide | Testo                     | Testo 350<br>61658783/0419 | Entech Industrial Solutio Co., Ltd. | G 670512          | 26 Jul 24           | 25 Jul 25               | -      |

### List of Instruments Certification for Water Quality Analysis

| No.          | Instrument/Equipment | Parameter    | Manufacturer | Model/Serial No.     | Calibrator                                           | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|--------------|----------------------|--------------|--------------|----------------------|------------------------------------------------------|-------------------|---------------------|-------------------------|--------|
| <b>Water</b> |                      |              |              |                      |                                                      |                   |                     |                         |        |
| 1            | DO Meter             | DO           | YSI          | Pro 20i<br>24F101576 | Technology Promotion Association<br>(Thailand-Japan) | 24TW257           | 6 Dec 24            | 5 Dec 25                | -      |
| 2            | DO Meter             | DO           | YSI          | Pro 20i<br>24F101576 | Technology Promotion Association<br>(Thailand-Japan) | 24TW257           | 6 Dec 24            | 5 Dec 25                | -      |
| 3            | Conductivity Meter   | Conductivity | YSI          | Pro30<br>18K100976   | Technology Promotion Association<br>(Thailand-Japan) | 24CH1381          | 6 Nov 24            | 5 Nov 25                | -      |

## Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tumbon Bang Rak Phatthana, Amphur Bang Bua Thong, Nonthaburi 11110

Tel. 098 362 9152, 089 478 7885

E-mail: sales@envi-ees.com

Certificate No.: E24-080074

Page.: 1 of 6

## CERTIFICATE OF CALIBRATION

**Customer** : United Analyst and Engineering Consultant Co., Ltd.  
**Address** : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260  
**Description of Equipment** : Console meter  
**Manufacturer** : Apex Instrument  
**Model Number** : XC-572-V  
**Serial Number** : 0807047  
**ID./Control No.** : UAE.ANV 212/2551  
**Environment Conditions** : **Temperature** (25 ± 2) °C  
: **Humidity** (50 ± 15) % RH  
**Cal. Date** : 26/08/2024  
**Issue Date** : 26/08/2024

### Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (IS).

### Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level

Calibrated by : Mr. Sanya Sangnil

Approved by : 

(Mr. Mana Fuekhud)

Technical Manger

**เอกสารไม่ควบคุม**



**METHOD 5 CONSOLE CALIBRATION  
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425  
5-POINT METRIC UNIT**

| Meter Console Information |          |
|---------------------------|----------|
| Console Model Number      | XC-572-V |
| Console Serial Number     | 0807047  |
| DGM Model Number          | SK25EX   |
| DGM Serial Number         | 00003580 |

| Calibration Conditions    |      |              |          |
|---------------------------|------|--------------|----------|
| Date                      | Time | 26/08/2024   | 01:10 PM |
| Calibration Reference No. |      | SER24-080032 |          |
| Barometric Pressure       |      | 755.91       | mmHg     |
| Calibration Meter Gamma   |      | 1.001        |          |

| Factors/Conversions |       |       |
|---------------------|-------|-------|
| Std Temp            | 293   | K     |
| Std Press           | 760   | mm Hg |
| K <sub>1</sub>      | 0.386 |       |
| Console Leak Check  | PASS  |       |

| Calibration Data |                     |                    |                    |                     |                    |                    |                    |                     |                    |
|------------------|---------------------|--------------------|--------------------|---------------------|--------------------|--------------------|--------------------|---------------------|--------------------|
| Run Time         | Metering Console    |                    |                    |                     |                    | Calibration Meter  |                    |                     |                    |
| Elapsed          | DGM Orifice DH      | Volume Initial     | Volume Final       | Outlet Temp Initial | Outlet Temp Final  | Volume Initial     | Volume Final       | Outlet Temp Initial | Outlet Temp Final  |
| (Q)              | (P <sub>m</sub> )   | (V <sub>mi</sub> ) | (V <sub>mf</sub> ) | (t <sub>mi</sub> )  | (t <sub>mf</sub> ) | (V <sub>wi</sub> ) | (V <sub>wf</sub> ) | (t <sub>wi</sub> )  | (t <sub>wf</sub> ) |
| min              | mm H <sub>2</sub> O | m <sup>3</sup>     | m <sup>3</sup>     | °C                  | °C                 | m <sup>3</sup>     | m <sup>3</sup>     | °C                  | °C                 |
| 11.88            | 13.0                | 1160.277           | 1160.417           | 24                  | 24                 | 249.83548          | 249.97320          | 25                  | 25                 |
| 11.87            | 13.0                | 1160.417           | 1160.557           | 23                  | 23                 | 249.97320          | 250.11036          | 25                  | 25                 |
| 8.47             | 26.0                | 1160.565           | 1160.705           | 23                  | 23                 | 250.11794          | 250.25472          | 25                  | 25                 |
| 8.43             | 26.0                | 1160.705           | 1160.845           | 23                  | 23                 | 250.25472          | 250.39116          | 25                  | 25                 |
| 13.70            | 40.0                | 1160.856           | 1161.136           | 24                  | 24                 | 250.39676          | 250.67384          | 25                  | 25                 |
| 13.63            | 40.0                | 1161.136           | 1161.416           | 24                  | 24                 | 250.67384          | 250.94928          | 25                  | 25                 |
| 10.27            | 70.0                | 1161.428           | 1161.708           | 25                  | 25                 | 250.95446          | 251.23044          | 25                  | 25                 |
| 10.23            | 70.0                | 1161.708           | 1161.988           | 26                  | 26                 | 251.23044          | 251.50574          | 25                  | 25                 |
| 8.98             | 90.0                | 1162.001           | 1162.281           | 26                  | 26                 | 251.51066          | 251.78586          | 24                  | 24                 |
| 8.95             | 90.0                | 1162.281           | 1162.561           | 27                  | 27                 | 251.78586          | 252.06032          | 24                  | 24                 |



**METHOD 5 CONSOLE CALIBRATION  
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425  
5-POINT METRIC UNIT**

| Meter Console Information |          | Calibration Conditions    |      |              | Factors/Conversions |                    |       |       |
|---------------------------|----------|---------------------------|------|--------------|---------------------|--------------------|-------|-------|
| Console Model Number      | XC-572-V | Date                      | Time | 26/08/2024   | 01:10 PM            | Std Temp           | 293   | K     |
| Console Serial Number     | 0807047  | Calibration Reference No. |      | SER24-080032 |                     | Std Press          | 760   | mm Hg |
| DGM Model Number          | SK25EX   | Barometric Pressure       |      | 755.91       | mmHg                | K <sub>1</sub>     | 0.386 |       |
| DGM Serial Number         | 00003580 | Calibration Meter Gamma   |      | 1.001        |                     | Console Leak Check |       | PASS  |

| Calibration Data       |                        |                        |                        |                    |           |                              |                                          |                            |
|------------------------|------------------------|------------------------|------------------------|--------------------|-----------|------------------------------|------------------------------------------|----------------------------|
| Results                |                        |                        |                        |                    |           |                              |                                          |                            |
| Standardized Data      |                        |                        |                        | Dry Gas Meter      |           |                              |                                          |                            |
| Dry Gas Meter          |                        | Calibration Meter      |                        | Calibration Factor |           | Flowrate                     | .0212 m <sup>3</sup> <sub>std</sub> /min | Variation                  |
| (V <sub>m(std)</sub> ) | (Q <sub>m(std)</sub> ) | (V <sub>w(std)</sub> ) | (Q <sub>w(std)</sub> ) | Value              | Variation | Std & Corr                   |                                          |                            |
| m <sup>3</sup>         | m <sup>3</sup> /min    | m <sup>3</sup>         | m <sup>3</sup> /min    | (Y)                | (ΔY)      | (Q <sub>m(std)(corr)</sub> ) | (ΔH <sub>@</sub> )                       | (ΔH <sub>@</sub> )         |
|                        |                        |                        |                        |                    |           | m <sup>3</sup> /min          | mm H <sub>2</sub> O                      |                            |
| 0.137                  | 0.012                  | 0.135                  | 0.011                  | 0.981              | 0.005     | 0.011                        | 44.831                                   | -0.558                     |
| 0.137                  | 0.012                  | 0.134                  | 0.011                  | 0.977              | 0.001     | 0.011                        | 45.071                                   | -0.318                     |
| 0.137                  | 0.016                  | 0.134                  | 0.016                  | 0.974              | -0.003    | 0.016                        | 46.259                                   | 0.870                      |
| 0.137                  | 0.016                  | 0.133                  | 0.016                  | 0.971              | -0.005    | 0.016                        | 46.125                                   | 0.736                      |
| 0.275                  | 0.020                  | 0.271                  | 0.020                  | 0.985              | 0.008     | 0.020                        | 45.532                                   | 0.143                      |
| 0.275                  | 0.020                  | 0.269                  | 0.020                  | 0.979              | 0.002     | 0.020                        | 45.628                                   | 0.240                      |
| 0.276                  | 0.027                  | 0.270                  | 0.026                  | 0.978              | 0.001     | 0.026                        | 45.368                                   | -0.021                     |
| 0.276                  | 0.027                  | 0.269                  | 0.026                  | 0.976              | -0.001    | 0.026                        | 45.297                                   | -0.092                     |
| 0.277                  | 0.031                  | 0.270                  | 0.030                  | 0.973              | -0.003    | 0.030                        | 44.935                                   | -0.454                     |
| 0.277                  | 0.031                  | 0.269                  | 0.030                  | 0.971              | -0.006    | 0.030                        | 44.843                                   | -0.546                     |
|                        |                        |                        |                        | 0.977              | Y Average |                              | 45.389                                   | ΔH <sub>@</sub><br>Average |

**Note:** For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

For ΔH<sub>@</sub>, orifice pressure differential that equates to 0.75 cfm (0.0212 m<sup>3</sup>/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H<sub>2</sub>O.



เอกสารไมคอบคุม

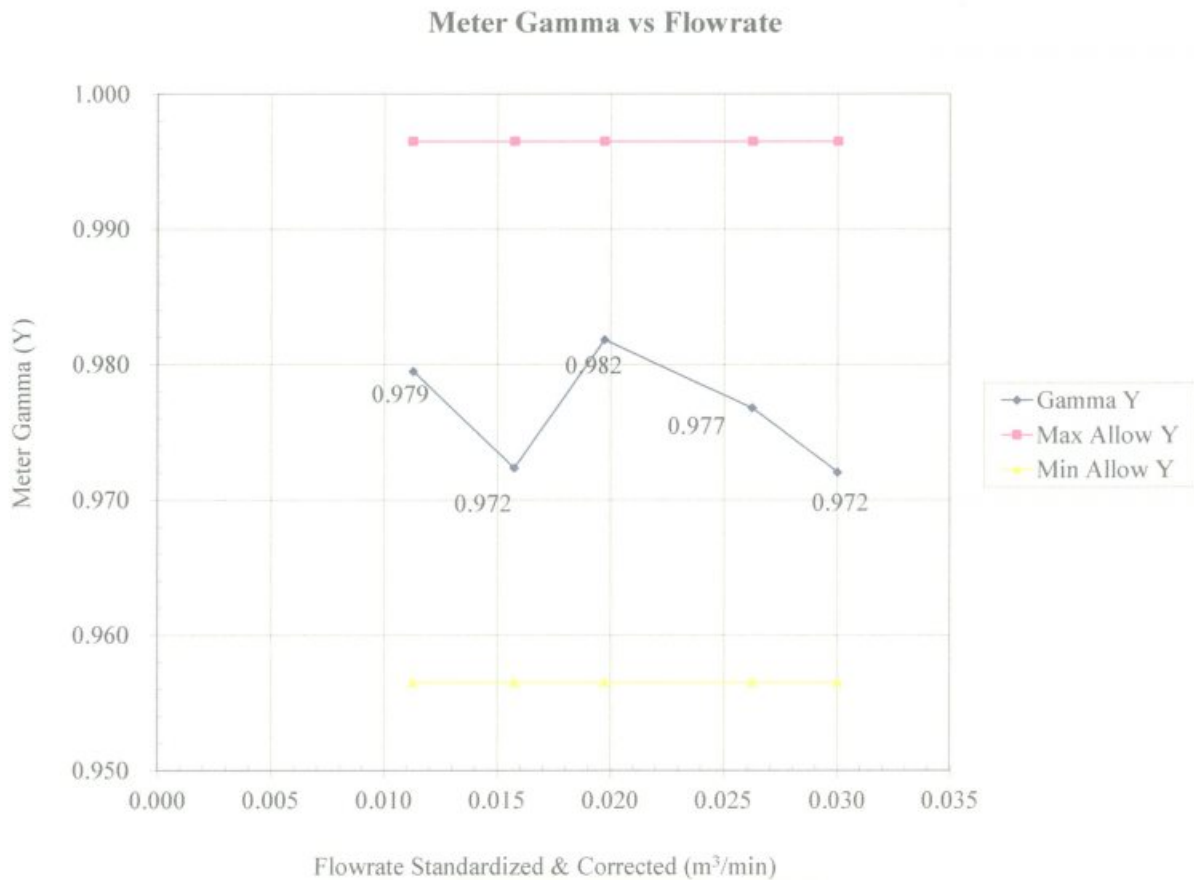
| Meter Console Information |          |
|---------------------------|----------|
| Console Model Number      | XC-572-V |
| Console Serial Number     | 0807047  |
| DGM Model Number          | SK25EX   |
| DGM Serial Number         | 00003580 |

| Calibration Conditions    |      |              |          |
|---------------------------|------|--------------|----------|
| Date                      | Time | 26/08/2024   | 01:10 PM |
| Calibration Reference No. |      | SER24-080032 |          |
| Barometric Pressure       |      | 755.91       | mmHg     |
| Calibration Meter Gamma   |      | 1.001        |          |

| Factors/Conversions |       |       |
|---------------------|-------|-------|
| Std Temp            | 293   | K     |
| Std Press           | 760   | mm Hg |
| K <sub>1</sub>      | 0.386 |       |
| Console Leak Check  | PASS  |       |

Calibration Date: 26-8-2024

Calibration Reference No: SER24-080032



Console Serial: 0807047

Console Model: XC-572-V



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| Meter Console Information |          |
|---------------------------|----------|
| Console Model Number      | XC-572-V |
| Console Serial Number     | 0807047  |
| DGM Model Number          | SK25EX   |
| DGM Serial Number         | 00003580 |

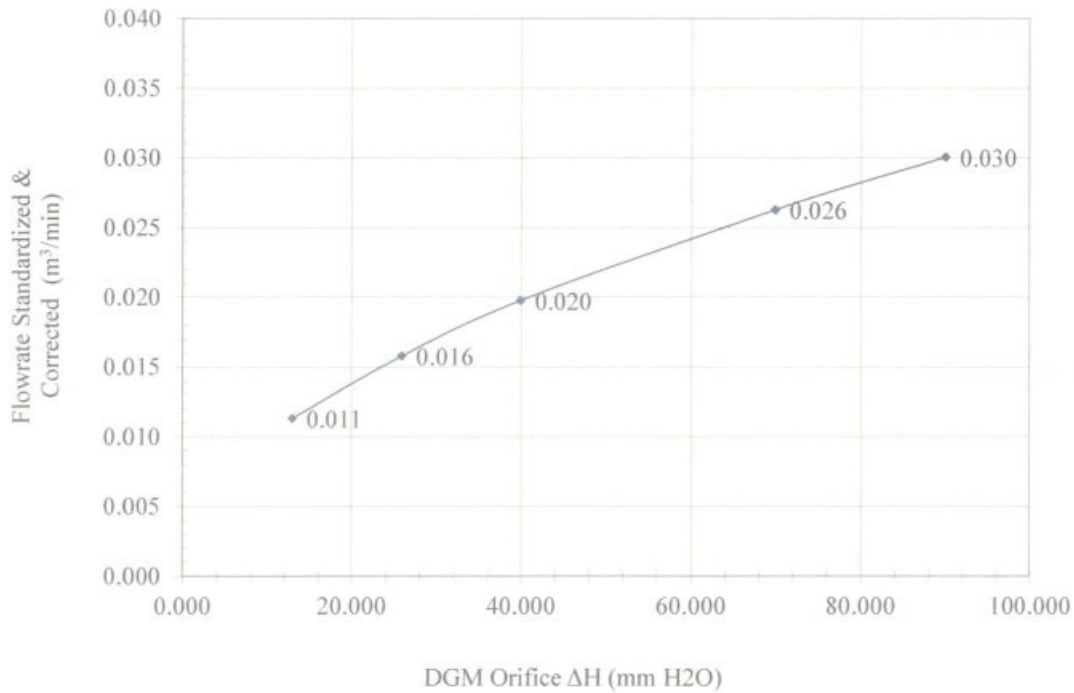
| Calibration Conditions    |      |              |          |
|---------------------------|------|--------------|----------|
| Date                      | Time | 26/08/2024   | 01:10 PM |
| Calibration Reference No. |      | SER24-080032 |          |
| Barometric Pressure       |      | 755.91       | mmHg     |
| Calibration Meter Gamma   |      | 1.001        |          |

| Factors/Conversions |       |       |
|---------------------|-------|-------|
| Std Temp            | 293   | K     |
| Std Press           | 760   | mm Hg |
| K <sub>1</sub>      | 0.386 |       |
| Console Leak Check  | PASS  |       |

Calibration Date: 26-8-2024

Calibration Reference No: SER24-080032

Meter Pressure vs Flowrate



Console Serial: 0807047

Console Model: XC-572-V



เอกสารไมควบคุม

## THERMOCOUPLES SYSTEM CALIBRATION

| Sampling System Equipment Information |              |
|---------------------------------------|--------------|
| Console Model Number                  | XC-572-V     |
| Console Serial Number                 | 0807047      |
| DGM Model Number                      | SK25EX       |
| DGM Serial Number                     | 00003080     |
| Meter Box Model Number                | JENCO 765 KF |
| Meter Box Serial Number               | JC 19778     |

| Calibration Conditions    |      |              |          |
|---------------------------|------|--------------|----------|
| Date                      | Time | 26/08/2024   | 03:10 PM |
| Calibration Reference No. |      | SER24-080032 |          |
| Reference Thermometer     |      | DIGICON      |          |
| Serial Number             |      | 183169105    |          |
|                           |      |              |          |
|                           |      |              |          |

| Results                        |                                              |      |      |      |       |       |       |       |       |       |        |
|--------------------------------|----------------------------------------------|------|------|------|-------|-------|-------|-------|-------|-------|--------|
| Console Thermocouple Simulator |                                              |      |      |      |       |       |       |       |       |       |        |
| Channel and test point         | Meter Box Channel Temperature Reading ( °C ) |      |      |      |       |       |       |       |       |       |        |
|                                | -18.0                                        | 25.0 | 38.0 | 93.0 | 149.0 | 260.0 | 371.0 | 482.0 | 593.0 | 816.0 | 1038.0 |
| Stack                          | -17.0                                        | 25.0 | 38.0 | 92.0 | 147.0 | 256.0 | 368.0 | 485.0 | 590.0 | 814.0 | 1036.0 |
| Aux                            | -17.0                                        | 25.0 | 38.0 | 92.0 | 147.0 |       |       |       |       |       |        |
| Probe                          | -17.0                                        | 25.0 | 38.0 | 92.0 | 147.0 |       |       |       |       |       |        |
| Filter                         | -17.0                                        | 25.0 | 38.0 | 92.0 | 147.0 |       |       |       |       |       |        |
| Oven                           | -17.0                                        | 25.0 | 38.0 | 92.0 | 147.0 |       |       |       |       |       |        |
| Exit                           | -17.0                                        | 25.0 | 38.0 |      |       |       |       |       |       |       |        |

### Tolerance Range

Stack     ± 1.50%     Absolute  
 Probe     ± 3.0 °C  
 Filter     ± 3.0 °C

Meter     ± 3.0 °C  
 Exit       ± 2.0 °C



เอกสารไม่ควบคุม

**Certificate No:** G 670512

**Date of issue :** 26-Jul-24

**Instrument description :** Flue Gas Analyzer  
**Instrument model :** Testo 350 New  
**Control unit serial no. :** 03345174/0419  
**Instrument serial no. :** 61658783/0419  
**ID no. or control no. :** UAE.EFM.121/2562  
**Manufacturer :** Testo SE & Co. KGaA  
**Probe description :** -  
**Probe model :** -  
**Probe serial no. :** -  
**Customer name :** UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.  
**Customer address :** 81 SOI UDOMSUK41,SUKHUMVIT ROAD,BANGCHAK PRAKANONG BANGKOK 10260

**Total pages of certificate :** 2 Pages  
**Receiving no. :** L-242916  
**Receiving date. :** 25-Jul-24  
**Parameter of calibration :** Gas Calibration(Oxygen 2.50,10.04,21.02 %vol, Carbon Monoxide 80.18,302,1007 ppm, Nitrogen Dioxide 30.34,81.32, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

**Condition of UUC. :** Used  
**Ambient condition :** All of the Measurement were carried out the stabilized laboratory  
Temperature : 23 ± 5 °C  
Humidity : 55 ± 15 %RH

**Calibration place :** 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210

**Calibration procedure no. :** This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

*The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement Multiplied by coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition.*  
*This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.*  
*This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).*

**Date of calibration :** 26-Jul-24



Mr. Kwanchai Khamdoug  
**Calibration Technician**



Mrs. Nongluck Wongsettee  
**Technical Manager**

Certificate No.: G 670512

**Standard References (Table 1)**

| Standard                                       | Certificate No. | Vendor | Due date  |
|------------------------------------------------|-----------------|--------|-----------|
| Oxygen ( O <sub>2</sub> ) 2.50 % Vol           | 2412/23         | Linde  | 27-Aug-27 |
| Oxygen ( O <sub>2</sub> ) 10.04 % Vol          | CG-0153-21      | Nimt   | 18-Nov-26 |
| Oxygen ( O <sub>2</sub> ) 21.02 % Vol          | CG-0041-22      | Nimt   | 10-Feb-27 |
| Carbon monoxide ( CO ) 80.18 ppm               | CG-0002-24      | Nimt   | 11-Jan-29 |
| Carbon monoxide ( CO ) 302 ppm                 | 1915/23         | Linde  | 16-Jun-25 |
| Carbon monoxide ( CO ) 1007 ppm                | 1870/24         | Linde  | 17-Jun-26 |
| Nitrogen Dioxide ( NO <sub>2</sub> ) 30.34 ppm | 2703/22         | Linde  | 22-Aug-24 |
| Nitrogen Dioxide ( NO <sub>2</sub> ) 81.32 ppm | 3546/23         | Linde  | 14-Jan-26 |
| Nitrogen Dioxide ( NO <sub>2</sub> ) 201.9 ppm | 1975/23         | Linde  | 17-Jul-25 |
| Nitric Oxide ( NO ) 30.01 ppm                  | CG-0014-23      | Nimt   | 19-Feb-25 |
| Nitric Oxide ( NO ) 151.5 ppm                  | 0161/23         | Linde  | 22-Jan-25 |
| Nitric Oxide ( NO ) 322.5 ppm                  | 1974/23         | Linde  | 17-Jul-25 |
| Sulphur Dioxide ( SO <sub>2</sub> ) 50.36 ppm  | 2004/23         | Linde  | 17-Jul-25 |
| Sulphur Dioxide ( SO <sub>2</sub> ) 100.8 ppm  | 3507/22         | Linde  | 09-Nov-24 |
| Sulphur Dioxide ( SO <sub>2</sub> ) 600.8 ppm  | 2003/23         | Linde  | 17-Jul-25 |

**Measured room conditions**

Temperature : 22.9 °C Humidity : 67.2 %RH Pressure : 1010.3 mbar

**Calibration conditions**

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1013.4 mbar

**Calibration Results (Without adjustment) (Table 2)**

| Parameter of Standard | Standard Values | Mean of UUC | Error | Uncertainty (±) |
|-----------------------|-----------------|-------------|-------|-----------------|
| O <sub>2</sub> (%Vol) | 2.50            | 2.53        | 0.03  | 0.15            |
| O <sub>2</sub> (%Vol) | 10.04           | 10.11       | 0.07  | 0.20            |
| O <sub>2</sub> (%Vol) | 21.02           | 21.13       | 0.11  | 0.30            |
| CO (ppm)              | 80.18           | 81          | 0.82  | 3.0             |
| CO (ppm)              | 302             | 302         | 0     | 6.0             |
| CO (ppm)              | 1007            | 1005        | -2    | 12              |
| NO <sub>2</sub> (ppm) | 30.34           | 29.5        | -0.84 | 8.0             |
| NO <sub>2</sub> (ppm) | 81.32           | 80.2        | -1.12 | 8.0             |
| NO <sub>2</sub> (ppm) | 201.9           | 200.1       | -1.8  | 12              |
| NO (ppm)              | 30.01           | 31          | 0.99  | 8.0             |
| NO (ppm)              | 151.5           | 152         | 0.5   | 8.0             |
| NO (ppm)              | 322.5           | 321         | -1.5  | 12              |
| SO <sub>2</sub> (ppm) | 50.36           | 51          | 0.64  | 6.0             |
| SO <sub>2</sub> (ppm) | 100.8           | 100         | -0.8  | 6.0             |
| SO <sub>2</sub> (ppm) | 600.8           | 598         | -2.8  | 13              |

Remark : 1 cmol/mol = 1 %vol. 1 μmol/mol = 1 ppm.

**End of Report**



**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 FAX. 0-2719-9484

## Certificate of Testing

**Cert.No.:** 24TW257

**Page.:** 1 of 2

**Equipment :** DO Meter  
**Manufacturer :** YSI Environmental  
**Model :** Pro 20i  
**Serial No. :** 24F101576  
**ID No. :** UEA.EFM.047/2567(EFM.DO.02/67)  
**Received Date :** 04 December 2024  
**Test Date :** 06 December 2024  
**Reference :** 2412-0102WSC-3  
**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong, Bangkok 10260  
**Laboratory Condition :** Temperature (  $25 \pm 5$  ) °C  
Humidity (  $50 \pm 20$  ) %  
**Test Procedure :** In - house method : CP-CH9  
by Comparison Technique with Azide Modification Method  
**Tested by :** Warakorn Lerngagtrakul  
**Approved by :**   
Approved Signatory  
( ) Unnophol Harachai  
( ) Ponpan Paipim  
(✓) Saithip Meangmai  
**Issue Date :** 09 December 2024



Cert.No.: 24TW257

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.: 24E100431

| <b>Titration Method<br/>(Azide Modification Method)</b><br>(mg/L) | <b>DO Meter<br/>Reading</b><br>(mg/L) | <b>Standard Deviation</b><br>(mg/L) |
|-------------------------------------------------------------------|---------------------------------------|-------------------------------------|
| 8.20                                                              | 8.21                                  | 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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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.: 24LM188

Page.: 1 of 2

**Equipment :** DO Meter with Sensor

**Manufacturer :** YSI Environmental

**Model :** Pro 20i

**Serial No. :** 24F101576

**ID No. :** UAE.EFM.047/2567(EFM.DO.02/67)

**Submitted by :** United Analyst and Engineering Consultant Co.,Ltd.  
3 Soi Udomsuk 41, Sukhumvit Road,  
Bangchak, Phrakhanong,  
Bangkok 10260

**Location :** TPA On Site Calibration Laboratory

**Received Order :** 04 December 2024

**Calibrated Date :** 06 December 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 :** 09 December 2024

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

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เอกสารไม่ควบคุม



**Equipment :** DO Meter with Sensor  
**Condition As-Received :** Used Item  
**Reference :** 2412-0102WSC-4

**Cert. No.:** 24LM188

**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 | 3240076           | 241317           | TPA              | 21 Mar 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.: 24E100431

| <u>Calibration Point</u><br>( °C ) | <u>Immersion Depth</u><br>( mm ) | <u>Standard Temperature</u><br>( °C ) | <u>UUC* Reading</u><br>( °C ) | <u>Error</u><br>( °C ) | <u>Uncertainty</u><br>( ± °C ) | <u>Coverage Factor</u><br><b>k</b> |
|------------------------------------|----------------------------------|---------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------------------|
| 15.0                               | 80                               | 15.003                                | 15.0                          | -0.003                 | 0.16                           | 2.00                               |
| 30.0                               | 80                               | 30.003                                | 30.0                          | -0.003                 | 0.16                           | 2.00                               |
| 45.0                               | 80                               | 45.001                                | 45.0                          | -0.001                 | 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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## Certificate of Calibration

Cert.No.: 24CH1381

Page.: 1 of 3

|                        |                                                                                                                                                     |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment :            | Conductivity Meter                                                                                                                                  |
| Manufacturer :         | YSI                                                                                                                                                 |
| Model :                | Pro 30                                                                                                                                              |
| Serial No. :           | 18K100976                                                                                                                                           |
| ID No. :               | UAE.EFM.071/2562(ENV.SCT.01/62)                                                                                                                     |
| Condition As-Received: | Used Item                                                                                                                                           |
| Received Date :        | 05 November 2024                                                                                                                                    |
| Calibration Date :     | 06 November 2024                                                                                                                                    |
| Reference :            | 2411-0124WSC-2                                                                                                                                      |
| Submitted by :         | United Analyst and Engineering Consultant Co.,Ltd.<br>3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,<br>Phrakhanong, Bangkok 10260                     |
| Ambient Temperature :  | (25 ± 2.5) °C                                                                                                                                       |
| Relative Humidity :    | (50 ± 15) %                                                                                                                                         |
| Calibration Procedure: | In -house method :<br>- CP-CH6 by direct measurement<br>with certified reference material (CRM)<br>- CP-CH8 by comparison with temperature standard |
| Calibrated by :        | Warakorn Lergagtrakul                                                                                                                               |
| Approved by :          | <hr/> Approved Signatory                                                                                                                            |
| ( ) Unnophol Harachai  |                                                                                                                                                     |
| ( ) Ponpan Paipim      |                                                                                                                                                     |
| (✓) Saithip Meangmai   |                                                                                                                                                     |
| Issue Date :           | 11 November 2024                                                                                                                                    |

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH1381

Page.: 2 of 3

**Condition of this result of calibration**

1. Reference Standard Instrument :-

| <u>Instrument</u>       | <u>Serial No.</u> | <u>ID No.</u> | <u>Certificate No.</u> | <u>Due date</u> |
|-------------------------|-------------------|---------------|------------------------|-----------------|
| 1) Thermometer          | 1963878           | 130RC095      | 24I995                 | 09 Sep 2025     |
| 2) Ref. Std.Thermometer | 4982054           | 110RC044      | 24I757                 | 14 July 2025    |

- This Certification is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials :-

- Conductivity calibration solution, CPA chem Ltd., The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

| <u>Conductivity Solution</u> | <u>Manufacturer</u> | <u>Lot No.</u> | <u>Exp. date</u> |
|------------------------------|---------------------|----------------|------------------|
| 1412.9 $\mu$ S/cm            | CPA Chem            | 1005307        | 15 June 2025     |
| 12.881 mS/cm                 | CPA Chem            | 1005308        | 15 June 2025     |

- Control Conductivity calibration solution temperature by Water bath ( $25 \pm 0.1$ ) °C

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

**Calibration results**

**Function : Conductivity Measurement**

(\*) After Adjustment at 1412.9  $\mu$ S/cm

Conductivity Electrode Serial No.: 18L00008

| <b>Standard Conductivity Solution</b> | <b>Before Adjustment UUC* Reading</b> | <b>After Adjustment UUC* Reading</b> | <b>Uncertainty of Measurement (<math>\pm</math>)</b> | <b>Coverage factor <i>k</i></b> |
|---------------------------------------|---------------------------------------|--------------------------------------|------------------------------------------------------|---------------------------------|
| 1412.9 $\mu$ S/cm                     | 1146 $\mu$ S/cm                       | 1413 $\mu$ S/cm                      | 9.2 $\mu$ S/cm                                       | 2.00                            |
| 12.881 mS/cm                          | 10.17 mS/cm                           | 12.48 mS/cm                          | 0.086 mS/cm                                          | 2.00                            |

**Remark :** - UUC\* = Unit Under Calibration

**Calibration Results****Function : Temperature Measurement**

This equipment was connected with Temperature Probe;

- Model : 9383
- Serial No. : 18L00008

Dimension of probe;

- Length : 104 mm
- Diameter : 16 mm
- Immersion Depth : 90 mm

**Calibration Result : Without adjustment**

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of Measurement (± °C) | Coverage factor <i>k</i> |
|------------------------|---------------------------|-------------------|------------|-----------------------------------|--------------------------|
| 15.0                   | 15.004                    | 14.9              | -0.104     | 0.13                              | 2.00                     |
| 30.0                   | 30.002                    | 29.9              | -0.102     | 0.13                              | 2.00                     |
| 45.0                   | 45.005                    | 45.0              | -0.005     | 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-

บริษัท อินทิเกรทเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด



# Certificate of Calibration

**Equipment:** Balance  
**Model:** BSA224S-CW  
**Serial No. (or ID.):** 34490341  
**Manufacturer:** Sartorius  
**Condition:** In condition

**Certificate No.:** C01243398  
**Issued Date:** 06 November 2024  
**Job No.:** WO-00047130  
**Page:** 1 of 2

**Customer:** Integrated Research Center Co.,Ltd.  
 122 Moo 2, Tambol Thatoom,  
 Amphur Srimahaphote, Prachinburi 25140 Thailand

**Environment Condition:** Temperature 24 °C ± 0.4 °C  
 Humidity 60 %RH ± 3.3 %RH

**Calibration Place:** Double A (1991) Public Company Limited.  
 (Water Laboratory IP1 (Balance Room))  
 1 Moo 2, Thatoom, Srimahaphot,  
 Prachinburi 25140 Thailand.

**Calibration By:** Mr. Piyapat Saidoung  
**Calibration Date:** 30 October 2024

**The Method used:** In-house method, CAL-WI-47, based on UKAS Lab 14

**Traceability:** This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Co., Ltd. Certificate No. C02231944

**Calibration Results:**

**Without Adjustment**

**Eccentric Error:** Weight to be 1/3 or 1/2 of Maximum capacity, taken from the center of the pan as a zero reference.

|                      |        |         |         |         |  |  |
|----------------------|--------|---------|---------|---------|--|--|
| Nominal Test Value   |        | 100 (g) |         |         |  |  |
| Reference Points (g) |        |         |         |         |  |  |
| A                    | B      | C       | D       | E       |  |  |
| -                    | 0.0001 | 0.0001  | -0.0001 | -0.0001 |  |  |

**Repeatability:** Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

| Nominal test value (g) | Standard Deviation |
|------------------------|--------------------|
| 20                     | 0.00004            |
| 200                    | 0.00006            |

**Error of Indication from nominal or conventional mass value.,** Readability 0.0001 (g)

| Nominal Value (g) | Conventional Mass (g) | Displayed Value (g) | Error of Indication (g) | Uncertainty (g) | k    |
|-------------------|-----------------------|---------------------|-------------------------|-----------------|------|
| 0.1               | 0.10001               | 0.1000              | 0.0000                  | 0.00011         | 2.04 |
| 0.2               | 0.20001               | 0.2000              | 0.0000                  | 0.00011         | 2.04 |
| 0.5               | 0.50001               | 0.5000              | 0.0000                  | 0.00011         | 2.04 |
| 1                 | 1.00001               | 1.0000              | 0.0000                  | 0.00011         | 2.04 |
| 2                 | 2.00002               | 2.0000              | 0.0000                  | 0.00011         | 2.04 |
| 5                 | 5.00002               | 5.0000              | 0.0000                  | 0.00011         | 2.04 |
| 10                | 10.00001              | 10.0000             | 0.0000                  | 0.00011         | 2.04 |
| 20                | 20.00001              | 20.0000             | 0.0000                  | 0.00012         | 2.03 |
| 50                | 50.00001              | 50.0000             | 0.0000                  | 0.00013         | 2.02 |
| 100               | 100.00003             | 100.0000            | 0.0000                  | 0.00017         | 2.01 |
| 200               | 200.00000             | 200.0000            | 0.0000                  | 0.00030         | 2.00 |

The End of Certificate

*(Signature)*  
 (Mr. Piyapat Saidoung)  
 Person in charge

*(Signature)*  
 (Mr. Adisai Maknoi)  
 Authorized signatory

This certificate is issued in 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. This report shall not be reproduced except in full without approval of DKSH Technology Limited.

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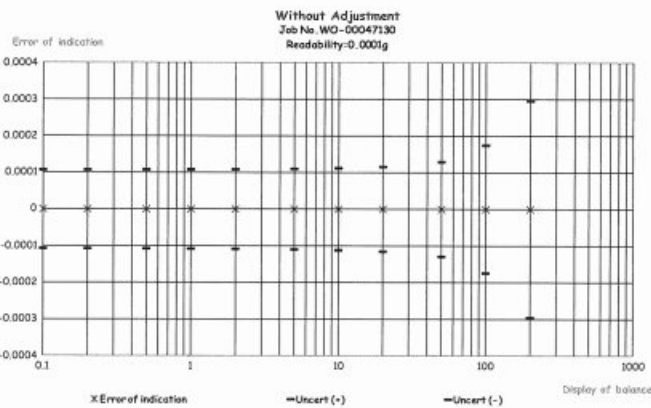
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CAL-FM-C01-14: 12 Sep 2022



## ใบตรวจสอบสภาพเครื่องชั่ง

เลขที่ใบงาน: WO-00047130

ชนิดเครื่องมือ: Balance

รุ่น: BSA224S-CW

หมายเลขเครื่อง: 34490341

| ตรวจสอบ (รับ)                       |                          | รายการตรวจสอบ                                     | ตรวจสอบ (ส่ง)                       |                          | หมายเหตุ |
|-------------------------------------|--------------------------|---------------------------------------------------|-------------------------------------|--------------------------|----------|
| 30 Oct 2024                         |                          |                                                   | 30 Oct 2024                         |                          |          |
| ปกติ                                | ไม่ปกติ                  | ปกติ                                              | ไม่ปกติ                             |                          |          |
| <b>General</b>                      |                          |                                                   |                                     |                          |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. สายไฟ/Adapter, power supply 220/110V           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. ความสมบูรณ์ชุดกรงจากกันลม (Cover)              | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. ความสมบูรณ์ชุดชั่งระดับน้ำ                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. การปรับระดับของขาตั้งเครื่อง                   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. การทดสอบของชั่งไม่ตก                           | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 6. ความสมบูรณ์ของ Display                         | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 7. การแสดงผลของ Display หลังวางน้ำหนัก            | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 8. ชุดรองจานชั่ง (Stopper) / pan support          | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 9. การทำงานของ Function Internal / External       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 10. ความสะอาดของตัวเครื่องภายนอกและแผ่น load cell | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 11. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง             | <input checked="" type="checkbox"/> | <input type="checkbox"/> |          |

หมายเหตุเพิ่มเติม/ข้อแนะนำ :

Mr. Piyapat Saidoung  
 Service Engineer



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Mechanical Engineering Standards Laboratory Soi 1, Bangpoo Industrial Estate, Muang, Samutprakan 10280, Thailand.

Request No.23-68/0221

MTC.No.23-68/0221

Request No.23-68/0221

2/2

MTC.No.23-68/0221

Number of page(s) 2

### CALIBRATION CERTIFICATE

#### Nomenclature : PERSONAL AIR PUMP SAMPLING PUMP CALIBRATION

Calibration point : (0.05, 0.5, 1, 1.5, 2) l/min

Manufacturer : MesaLabs

Ambient condition : Temperature ( 23 ± 3 ) °C , Relative humidity ( 55 ± 15 ) %

Serial No. : 210155

Atmospheric pressure ( 1010±13) hPa

Model : Defender 510

Calibration method : The flowmeter (UUC) was calibrated by comparison method with standard flowmeter according to CP-370.01.

Scale range : 50 ml/min to 5000 ml/min

The reported value is the value that converted to value at reference condition within pressure and temperature of the actual gas entering the UUC

Subdivision : (0.00001, 0.0001) l/min

Submitted by : INTEGRATED RESEARCH CENTER COMPANY LIMITED.

122 T.Thatoom A.Srimahaphote,

Prachinburi 25140, Thailand.

Received date : 15 January 2025 Condition of measured item : Normal

Calibration date : 3 February 2025

| Standard                            | Standard      | Certificate No. | Date due | Tracability |
|-------------------------------------|---------------|-----------------|----------|-------------|
| RTD Thermometer                     | PSL-T 0611/67 | 3-Jul-26        | TISTR    |             |
| Molbox/Pressure Transducer/UpStream | MP-0076-23    | 2-Apr-25        | NIMT     |             |
| Primary Flow Calibrator S/N 119521  | MW-0033-23    | 6-Jun-25        | NIMT     |             |

Calibrated by : (Mr.Terasak Panna)

Approved by : (Ms.Kirana Luangniran)  
Director  
Mechanical Engineering Standards Laboratory  
Ref. 2013268011500202001  
Issued Date 5 February 2025

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Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TSI-715-17025  
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NSC - TSI - TIS 17025  
CALIBRATION 0367

Flow measurement laboratory  
Calibration services department



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number COF-013-67

Page 2 of 2 Pages

### CERTIFICATE OF CALIBRATION

Certificate No. : COF-013-67

Page 1 of 2 Pages

**MEASUREMENT ITEM** : Top Load Orifice  
**MANUFACTURER** : TSCM  
**MODEL/TYPE** : 16-5028A  
**SERIAL NUMBER** : 2926  
**ID NUMBER** : -  
**CONDITION AS-RECEIVED** : Used Item  
**CUSTOMER** : Integrated Research Center Company Limited,  
 122 Muo 2, Thatoom, Srimahaphote,  
 Prachinburi 25140, Thailand.

**RECEIVED DATE** : 10 May 2024  
**MEASUREMENT DATE** : 05 Jun 2024  
**ISSUE DATE** : 06 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

**CALIBRATION CONDITION:**  
Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 22.9 °C and 53.2 %RH.

**NOTE:** 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 Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/MC/W2 up. The MP-CL-004 was used as a calibration guideline.

**Traceability:**  
This certificate provides a traceability of the measurement to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW0062-23.

**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)

#### MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The humid air was used as a medium in the system. The standard conditions are 25 °C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

| Rate | Flow rate<br>m <sup>3</sup> /min | Pressure<br>[Pa]<br>mmHg | Temperature<br>[T <sub>a</sub> ]<br>°C | Temperature<br>[T <sub>m</sub> ]<br>°C | Ap_meter<br>mmHg | Ap_Orifice<br>inH <sub>2</sub> O | Y     | Standard Flow [Q <sub>s</sub> ]<br>m <sup>3</sup> /min |
|------|----------------------------------|--------------------------|----------------------------------------|----------------------------------------|------------------|----------------------------------|-------|--------------------------------------------------------|
| 1    | 0.703                            | 754.942                  | 22.82                                  | 22.17                                  | 58.515           | 1.094                            | 1.046 | 0.653                                                  |
| 2    | 1.001                            | 754.951                  | 22.99                                  | 22.44                                  | 44.435           | 2.340                            | 1.530 | 0.944                                                  |
| 3    | 1.117                            | 754.835                  | 23.23                                  | 22.73                                  | 38.752           | 2.948                            | 1.716 | 1.060                                                  |
| 4    | 1.170                            | 754.975                  | 23.31                                  | 22.88                                  | 35.376           | 3.257                            | 1.804 | 1.116                                                  |
| 5    | 1.411                            | 755.078                  | 23.55                                  | 23.13                                  | 24.261           | 4.921                            | 2.216 | 1.365                                                  |

Slope (a): 1.63522  
Intercept (b): -0.01721  
Correlation coefficient (r): 0.99975  
Uncertainty (k=2): 0.015 m<sup>3</sup>/min

Table 2: The results of Q actual calibration data

| Rate | Flow rate<br>m <sup>3</sup> /min | Pressure<br>[Pa]<br>mmHg | Temperature<br>[T <sub>a</sub> ]<br>°C | Temperature<br>[T <sub>m</sub> ]<br>°C | Ap_meter<br>mmHg | Ap_Orifice<br>inH <sub>2</sub> O | Y     | Standard Flow [Q <sub>s</sub> ]<br>m <sup>3</sup> /min |
|------|----------------------------------|--------------------------|----------------------------------------|----------------------------------------|------------------|----------------------------------|-------|--------------------------------------------------------|
| 1    | 0.703                            | 754.942                  | 22.82                                  | 22.17                                  | 58.515           | 1.094                            | 0.655 | 0.650                                                  |
| 2    | 1.001                            | 754.951                  | 22.99                                  | 22.44                                  | 44.435           | 2.340                            | 0.958 | 0.944                                                  |
| 3    | 1.117                            | 754.835                  | 23.23                                  | 22.73                                  | 38.752           | 2.948                            | 1.076 | 1.061                                                  |
| 4    | 1.170                            | 754.975                  | 23.31                                  | 22.88                                  | 35.376           | 3.257                            | 1.131 | 1.117                                                  |
| 5    | 1.411                            | 755.078                  | 23.55                                  | 23.13                                  | 24.261           | 4.921                            | 1.391 | 1.367                                                  |

Slope (a): 1.02416  
Intercept (b): -0.01068  
Correlation coefficient (r): 0.99975  
Uncertainty (k=2): 0.015 m<sup>3</sup>/min

\*\*\*End of Certificate of Calibration\*\*\*

Calibrated by:  
Mr. Siraporn Thachulad  
Mr. Jiraporn Lertsomphol



Approved signature:   
Mr. Parinya Booncharoen  
Calibration Department Manager





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159 MTC No. EEL. BP. 80/0168

**CALIBRATION CERTIFICATE**

**Submitted by** : Integrated Research Center Company Limited.  
**Address** : 122 Moo 2, T.Thatoom, A.Srimahaphote, Pachinburi, 25140.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

**Instrument Calibrated :**  
 Description : Sound Calibrator  
 Manufacturer : ACO  
 Model : 2127  
 Serial No. : 100012

**Ambient Environment**  
 Temperature : (23 ± 3) °C  
 Relative Humidity : (50 ± 15) %  
 Ambient Pressure : (101.325 ± 1.500) kPa

- Standards used :**
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
  2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
  3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
  4. Digital Multimeter Agilent 34401A S/N MY44005560.
  5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
  6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
  7. Condenser Microphone B&K 4180 S/N 2889871.

**Calibration Procedure:** CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

**Date of Receipt** : 14 Jan. 2025

**Date of Calibration** : 21 Jan. 2025

1 / 2

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FM.BL.MTC.002 Rev.5

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159 MTC No. EEL. BP. 82/0168

**CALIBRATION CERTIFICATE**

**Submitted by** : Integrated Research Center Company Limited.  
**Address** : 122 Moo 2, T.Thatoom, A.Srimahaphote, Pachinburi, 25140.  
**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
 Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

**Instrument Calibrated :**  
 Description : Sound Calibrator  
 Manufacturer : Delta Ohm  
 Model : HD9102  
 Serial No. : 10038483

**Ambient Environment**  
 Temperature : (23 ± 3) °C  
 Relative Humidity : (50 ± 15) %  
 Ambient Pressure : (101.325 ± 1.500) kPa

- Standards used :**
1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
  2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
  3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
  4. Digital Multimeter Agilent 34401A S/N MY44005560.
  5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
  6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
  7. Condenser Microphone B&K 4180 S/N 2889871.

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

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

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

**Date of Receipt** : 14 Jan. 2025

**Date of Calibration** : 22 Jan. 2025

1 / 3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159 MTC No. EEL. BP. 80/0168

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

**Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz**

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

**1. Sound Pressure Level**

| Standard Microphone Type  | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 1 |
|---------------------------|------------------------------------|---------------------|------------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 93.91                              | -0.09               | ± 0.10           | ±0.40 dB                              |

**2. Frequency**

| Standard Microphone Type  | Measured Frequency (Hz) | Deviated value (Hz) | Uncertainty (Hz) | Tolerance limit IEC60942:2003 Class 1 |
|---------------------------|-------------------------|---------------------|------------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 1000.0                  | 0.0                 | ± 1.5            | ±1.0%                                 |

**3. Total Distortion**

| Standard Microphone Type  | Measured Total Distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 1 |
|---------------------------|-------------------------------|-----------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 1.50                          | ± 0.50          | ±3.0%                                 |

- Note :**
1. No adjustment.
  2. The calibrator pressure correction was not included.
  3. The microphone volume correction was not included.

**Calibrated by :**  
 (Mr.Weerchai Deechaiyae)

**Approved by :**  
 Director  
 Electrical and Electronic Standards Laboratory  
 Industrial Metrology and Testing Service Centre

**Date of Calibration** : 21 Jan. 2025

**Date of Issue** : 23 Jan. 2025

**Ref :** 2011268011400184001

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159 MTC No. EEL. BP. 82/0168

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

**Nominal Output of Unit Under Test = 94 dB re 20µPa at 1000 Hz**

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

**1. Sound Pressure Level**

| Standard Microphone Type  | Measured Sound Pressure Level (dB) | Deviated value (dB) | Uncertainty (dB) | Tolerance limit IEC60942:2003 Class 2 |
|---------------------------|------------------------------------|---------------------|------------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 93.88                              | -0.12               | ± 0.10           | ±0.75 dB                              |

**2. Frequency**

| Standard Microphone Type  | Measured Frequency (Hz) | Deviated value (Hz) | Uncertainty (Hz) | Tolerance limit IEC60942:2003 Class 2 |
|---------------------------|-------------------------|---------------------|------------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 988.3                   | -11.7               | ± 1.5            | ±2.0%                                 |

**3. Total distortion**

| Standard Microphone Type  | Measured Total distortion (%) | Uncertainty (%) | Tolerance limit IEC60942:2003 Class 2 |
|---------------------------|-------------------------------|-----------------|---------------------------------------|
| 1/2 inch Bruel&Kjaer 4180 | 1.00                          | ± 0.50          | ±4.0%                                 |

- Note :**
1. No adjustment.
  2. The calibrator pressure correction was not included.
  3. The microphone volume correction was not included.

**Date of Calibration** : 22 Jan. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159

MTC No. EEL. BP. 82/0168

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

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

1. Sound Pressure Level

Table with 5 columns: Standard Microphone Type, Measured Sound Pressure Level (dB), Deviated value (dB), Uncertainty (dB), Tolerance limit IEC60942:2003 Class 2. Row 1: 1/2 inch Bruel&Kjaer 4180, 113.86, -0.14, ± 0.10, ±0.75 dB

2. Frequency

Table with 5 columns: Standard Microphone Type, Measured Frequency (Hz), Deviated value (Hz), Uncertainty (Hz), Tolerance limit IEC60942:2003 Class 2. Row 1: 1/2 inch Bruel&Kjaer 4180, 988.4, -11.6, ± 1.5, ±2.0%

3. Total Distortion

Table with 4 columns: Standard Microphone Type, Measured Total Distortion (%), Uncertainty (%), Tolerance limit IEC60942:2003 Class 2. Row 1: 1/2 inch Bruel&Kjaer 4180, 0.21, ± 0.50, ±4.0%

Note: 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by:

(Mr. Weerachai Deechaiyai)

Approved by:

(Mr. Prayate Khuyyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration: 22 Jan. 2025

Date of Issue: 23 Jan. 2025

Ref: 2011268011400184003

End of Certificate

3 / 3

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159

MTC No. EEL. BP. 81/0168

CALIBRATION CERTIFICATE

Submitted by: Integrated Research Center Company Limited.

Address: 122 Moo 2, T.Thatoom, A.Srimahaphote, Pachinburi, 25140.

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

Instrument Calibrated:

Description: Sound Calibrator

Manufacturer: Rion

Model: NC-74

Serial No.: 35046798

Ambient Environment

Temperature: (23 ± 3) °C

Relative Humidity: (50 ± 15) %

Ambient Pressure: (101.325 ± 1.500) kPa

- Standards used: 1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037. 2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484. 3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214. 4. Digital Multimeter Agilent 34401A S/N MY44005560. 5. Pressure Transmitter Vaisala PTB202AD S/N T0650001. 6. Audio Analyzer Panasonic VP-7722A S/N 041477D122. 7. Condenser Microphone B&K 4180 S/N 2633526.

Calibration Procedure: CP-102-04 based on IEC 60942:2003; The sound pressure level generated by sound calibrator under test shall be measured by standard microphone using an insert voltage technique.

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

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

Date of Receipt: 14 Jan. 2025

Date of Calibration: 22 Jan. 2025

1 / 2

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0159

MTC No. EEL. BP. 81/0168

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

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

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

1. Sound Pressure Level

Table with 5 columns: Standard Microphone Type, Measured Sound Pressure Level (dB), Deviated value (dB), Uncertainty (dB), Tolerance limit IEC60942:2003 Class 1. Row 1: 1/2 inch Bruel&Kjaer 4180, 93.91, -0.09, ± 0.10, ±0.40 dB

2. Frequency

Table with 5 columns: Standard Microphone Type, Measured Frequency (Hz), Deviated value (Hz), Uncertainty (Hz), Tolerance limit IEC60942:2003 Class 1. Row 1: 1/2 inch Bruel&Kjaer 4180, 1001.5, 1.5, ± 1.5, ±1.0%

3. Total Distortion

Table with 4 columns: Standard Microphone Type, Measured Total Distortion (%), Uncertainty (%), Tolerance limit IEC60942:2003 Class 1. Row 1: 1/2 inch Bruel&Kjaer 4180, 1.35, ± 0.50, ±3.0%

Note: 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was included at level of 0.16 dB from manual.

Calibrated by:

(Mr. Weerachai Deechaiyai)

Approved by:

(Mr. Prayate Khuyyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration: 22 Jan. 2025

Date of Issue: 23 Jan. 2025

Ref: 2011268011400184002

End of Certificate

2 / 2

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 89/0168

CALIBRATION CERTIFICATE

Submitted by: Integrated Research Center Company Limited.

Address: 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi, 25140.

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

Instrument Calibrated:

Description: Integrating Sound Level Meter

Manufacturer: ACO

Model: 6226

Serial No.: 100144

Microphone: Type 7052 No.79844

Preamplifier: -

Ambient Environment

Temperature: (23 ± 3) °C

Relative Humidity: (50 ± 15) %

Ambient Pressure: (101.325±1.5) kPa

- Standards used: 1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712. 2. Condenser Microphone Bruel&Kjaer 4180 S/N 2889871. 3. Decade Attenuator Ando AL-205 S/N 00464602. 4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668. 5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037. 6. Sound Calibrator Bruel&Kjaer 4231 S/N 3015154. 7. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.

Date of Receipt: 14 Jan. 2025

Date of Calibration: 17-18 Feb. 2025

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

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 17-18 Feb. 2025

2 / 9

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**3. Acoustical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 125               | -0.3                                   | 0.2      | 0.1  | 1.5                               | 0.45                 | 0.6                                                   |
| 1 000             | -0.1                                   | -0.1     | 0.0  | 1.0                               | 0.45                 | 0.6                                                   |
| 8 000             | -4.8                                   | -4.7     | -4.8 | 5.0                               | 0.45                 | 0.7                                                   |

**4. Electrical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 63                | 0.2                                    | 0.1      | 0.1  | 2.0                               | 0.20                 | 0.6                                                   |
| 125               | 0.1                                    | 0.2      | 0.1  | 1.5                               | 0.20                 | 0.6                                                   |
| 250               | 0.2                                    | 0.1      | 0.1  | 1.5                               | 0.20                 | 0.6                                                   |
| 500               | 0.1                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 1 000             | 0.0                                    | 0.0      | 0.0  | 1.0                               | 0.20                 | 0.6                                                   |
| 2 000             | -0.1                                   | 0.0      | 0.1  | 2.0                               | 0.20                 | 0.6                                                   |
| 4 000             | -0.4                                   | -0.2     | 0.0  | 3.0                               | 0.20                 | 0.6                                                   |
| 8 000             | -0.4                                   | -0.2     | -0.1 | 5.0                               | 0.20                 | 0.7                                                   |

Date of Calibration : 17-18 Feb. 2025

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Bangkok 10900, Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
(66) 08 1889 6827

**1. Absolute Sensitivity**

| Reference Acoustic<br>Signal (dB) | Measured value (dB) |              | Deviation<br>value (dB) | Acceptance limit<br>Class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-----------------------------------|---------------------|--------------|-------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
|                                   | Before adjust       | After adjust |                         |                                   |                      |                                                       |
| 93.99                             | 93.7                | 94.0         | 0.0                     | 1.0                               | 0.30                 | N/A                                                   |

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.1 dB.

**2. Self-generated noise**

**2.1 Normal test**

| Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|----------------------|-------------------------------------------------------|
| 18.5                   | 0.10                 | N/A                                                   |

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

| Frequency<br>Weighting | Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|----------------------|-------------------------------------------------------|
| A-Weight               | 16.3                   | 0.10                 | N/A                                                   |
| C-Weight               | 24.7                   | 0.10                 | N/A                                                   |
| Flat                   | 26.7                   | 0.10                 | N/A                                                   |

Date of Calibration : 17-18 Feb. 2025

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**5. Long-term stability**

| Time  | Measured Value<br>(dB) | Deviated value<br>(dB) | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------|------------------------|------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
| Begin | 94.0                   | 0.0                    | 0.3                               | 0.10                 | 0.1                                                   |
| End   | 94.0                   |                        |                                   |                      |                                                       |

**6. Frequency and time weightings at 1 kHz**

**6.1 Frequency weightings at 1 kHz**

| Frequency<br>Weighting | Measured Value<br>(dB) | Deviated value<br>(dB) | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
| A-weight               | 94.0                   | 0.0                    | 0.2                               | 0.20                 | 0.2                                                   |
| C-weight               | 94.0                   | 0.0                    | 0.2                               | 0.20                 | 0.2                                                   |
| Flat                   | 94.1                   | 0.1                    | 0.2                               | 0.20                 | 0.2                                                   |

**6.2 Time weightings at 1 kHz**

| Frequency<br>Weighting | Measured Value<br>(dB) | Deviated value<br>(dB) | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
| Fast                   | 94.0                   | 0.0                    | 0.1                               | 0.20                 | 0.2                                                   |
| Slow                   | 94.0                   | 0.0                    | 0.1                               | 0.20                 | 0.2                                                   |
| Leq                    | 94.0                   | 0.0                    | 0.1                               | 0.20                 | 0.2                                                   |

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## 7. Level linearity on the reference level range

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 ( $\pm$ dB) | Uncertainty ( $\pm$ dB) | Maximum-permitted uncertainty of measurement ( $\pm$ dB) |
|------------------------|---------------------|---------------------|--------------------------------------|-------------------------|----------------------------------------------------------|
| 122                    | 122.0               | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 121                    | 121.1               | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 120                    | 120.0               | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 119                    | 119.1               | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 114                    | 114.0               | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 109                    | 109.0               | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 104                    | 104.0               | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 99                     | 99.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 94                     | 94.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 89                     | 89.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 84                     | 84.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 79                     | 79.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 74                     | 74.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 69                     | 69.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 64                     | 64.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 59                     | 59.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 54                     | 54.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 49                     | 49.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 44                     | 44.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 39                     | 39.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 34                     | 34.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 33                     | 33.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |

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## 7. Level linearity on the reference level range

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 ( $\pm$ dB) | Uncertainty ( $\pm$ dB) | Maximum-permitted uncertainty of measurement ( $\pm$ dB) |
|------------------------|---------------------|---------------------|--------------------------------------|-------------------------|----------------------------------------------------------|
| 32                     | 32.1                | 0.1                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 31                     | 31.3                | 0.3                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 30                     | 30.3                | 0.3                 | 1.1                                  | 0.30                    | 0.3                                                      |

## 8. Level linearity including the level range control

At reference sound level on the reference level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 ( $\pm$ dB) | Uncertainty ( $\pm$ dB) | Maximum-permitted uncertainty of measurement ( $\pm$ dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------------|-------------------------|----------------------------------------------------------|
| 40-130 | 94.0                   | 94.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 30-120 | 94.0                   | 94.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 20-110 | 94.0                   | 94.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 20-100 | 94.0                   | 94.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |

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## 8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 ( $\pm$ dB) | Uncertainty ( $\pm$ dB) | Maximum-permitted uncertainty of measurement ( $\pm$ dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------------|-------------------------|----------------------------------------------------------|
| 40-130 | 45                     | 45.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 30-120 | 35                     | 35.0                | 0.0                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 20-110 | 25                     | 25.5                | 0.5                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 20-100 | 25                     | 25.5                | 0.5                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 20-90  | 25                     | 25.4                | 0.4                 | 1.1                                  | 0.30                    | 0.3                                                      |
| 20-80  | 25                     | 25.4                | 0.4                 | 1.1                                  | 0.30                    | 0.3                                                      |

## 9. Tone burst response

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 ( $\pm$ dB) | Uncertainty ( $\pm$ dB) | Maximum-permitted uncertainty of measurement ( $\pm$ dB) |
|----------------|-----------------------------|---------------------|---------------------|--------------------------------------|-------------------------|----------------------------------------------------------|
| Fast           | 200                         | 115.8               | -0.2                | $\pm 1.0$                            | 0.20                    | 0.3                                                      |
|                | 2                           | 98.8                | -0.2                | +1.0; -2.5                           | 0.20                    | 0.3                                                      |
|                | 0.25                        | 89.6                | -0.4                | +1.5; -5.0                           | 0.20                    | 0.3                                                      |
| Slow           | 200                         | 109.4               | -0.2                | $\pm 1.0$                            | 0.20                    | 0.3                                                      |
|                | 2                           | 89.8                | -0.2                | +1.0; -5.0                           | 0.20                    | 0.3                                                      |
| SEL            | 200                         | 109.9               | -0.1                | $\pm 1.0$                            | 0.20                    | 0.3                                                      |
|                | 2                           | 90.0                | 0.0                 | +1.0; -2.5                           | 0.20                    | 0.3                                                      |
|                | 0.25                        | 80.9                | -0.1                | +1.5; -5.0                           | 0.20                    | 0.3                                                      |

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## 10. Peak C sound level

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 ( $\pm$ dB) | Uncertainty ( $\pm$ dB) | Maximum-permitted uncertainty of measurement ( $\pm$ dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------------|-------------------------|----------------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.8               | 0.4                 | 3.0                                  | 0.20                    | 0.35                                                     |
| Positive half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                                  | 0.20                    | 0.35                                                     |
| Negative half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                                  | 0.20                    | 0.35                                                     |

## 11. Overload indication

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 ( $\pm$ dB) | Uncertainty ( $\pm$ dB) | Maximum-permitted uncertainty of measurement ( $\pm$ dB) |      |
|-------------------------|-------------------------|---------------------|--------------------------------------|-------------------------|----------------------------------------------------------|------|
| Positive one-half cycle | Negative one-half cycle | 131.1               | 0.0                                  | 1.5                     | 0.20                                                     | 0.25 |

## 12. High-level stability

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 ( $\pm$ dB) | Uncertainty ( $\pm$ dB) | Maximum-permitted uncertainty of measurement ( $\pm$ dB) |
|-------|---------------------|---------------------|--------------------------------------|-------------------------|----------------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                                  | 0.10                    | 0.1                                                      |
| End   | 129.0               |                     |                                      |                         |                                                          |

Calibrated by:   
(Mr. Pannasit Phasingari)

Approved by:   
(Mr. Pravithe Khuyyap)  
Director

Electrical and Electronic Standards Laboratory

Date of Calibration : 17-18 Feb. 2025

Industrial Metrology and Testing Service Centre

Date of Issue : 24 Feb. 2025

Ref: 2011268011400185007

End of Certificate

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## CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi, 25140.

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

## Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6226

Serial No. : 100145

Microphone : Type 7052NR No.78402

Preamplifier : -

## Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

## Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Bruel&Kjaer 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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## 1. Absolute Sensitivity

| Reference Acoustic<br>Signal (dB) | Measured value (dB) |              | Deviation<br>value (dB) | Acceptance limit<br>Class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-----------------------------------|---------------------|--------------|-------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
|                                   | Before adjust       | After adjust |                         |                                   |                      |                                                       |
| 93.99                             | 92.9                | 94.0         | 0.0                     | 1.0                               | 0.30                 | N/A                                                   |

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 117.0 dB.

## 2. Self-generated noise

## 2.1 Normal test

| Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|----------------------|-------------------------------------------------------|
| 25.3                   | 0.10                 | N/A                                                   |

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

| Frequency<br>Weighting | Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|----------------------|-------------------------------------------------------|
| A-Weight               | 24.5                   | 0.10                 | N/A                                                   |
| C-Weight               | 26.7                   | 0.10                 | N/A                                                   |
| Flat                   | 31.3                   | 0.10                 | N/A                                                   |

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

## Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

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## 3. Acoustical signal test of frequency weightings

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 125               | 0.4                                    | 0.1      | -0.1 | 1.5                               | 0.45                 | 0.6                                                   |
| 1 000             | 0.1                                    | 0.2      | 0.2  | 1.0                               | 0.45                 | 0.6                                                   |
| 8 000             | -4.2                                   | -3.6     | -4.4 | 5.0                               | 0.45                 | 0.7                                                   |

## 4. Electrical signal test of frequency weightings

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 63                | 0.1                                    | 0.1      | 0.1  | 2.0                               | 0.20                 | 0.6                                                   |
| 125               | 0.1                                    | 0.1      | 0.1  | 1.5                               | 0.20                 | 0.6                                                   |
| 250               | 0.1                                    | 0.1      | 0.1  | 1.5                               | 0.20                 | 0.6                                                   |
| 500               | 0.1                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 1 000             | 0.0                                    | 0.0      | 0.0  | 1.0                               | 0.20                 | 0.6                                                   |
| 2 000             | -0.1                                   | 0.0      | 0.1  | 2.0                               | 0.20                 | 0.6                                                   |
| 4 000             | -0.3                                   | -0.1     | 0.0  | 3.0                               | 0.20                 | 0.6                                                   |
| 8 000             | -0.3                                   | -0.1     | -0.1 | 5.0                               | 0.20                 | 0.7                                                   |

Date of Calibration : 17-18 Feb. 2025

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**5. Long-term stability**

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

**6. Frequency and time weightings at 1 kHz**

**6.1 Frequency weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.1                | 0.1                 | 0.2                            | 0.20              | 0.2                                                |

**6.2 Time weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 32                     | 32.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 31                     | 31.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 30                     | 30.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |

**8. Level linearity including the level range control**

At reference sound level on the reference level range

| Range (dB) | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130     | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120     | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110     | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100     | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 122                    | 121.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 121                    | 120.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 120                    | 119.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 119.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 113.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 108.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 103.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 88.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 79.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 69.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 63.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 58.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 54                     | 53.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 48.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 38.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 34.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 33                     | 33.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |

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**8. Level linearity including the level range control**

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 45                     | 45.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 35                     | 35.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 25                     | 25.4                | 0.4                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 25                     | 25.5                | 0.5                 | 1.1                            | 0.30              | 0.3                                                |
| 20-90  | 25                     | 25.6                | 0.6                 | 1.1                            | 0.30              | 0.3                                                |
| 20-80  | 25                     | 25.5                | 0.5                 | 1.1                            | 0.30              | 0.3                                                |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast           | 200                         | 115.8               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 98.8                | -0.2                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 89.6                | -0.4                | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                         | 109.4               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 89.8                | -0.2                | +1.0; -5.0                     | 0.20              | 0.3                                                |
| SEL            | 200                         | 109.9               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 90.0                | 0.0                 | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 80.9                | -0.1                | +1.5; -5.0                     | 0.20              | 0.3                                                |

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**10. Peak C sound level**

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.8               | 0.4                 | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                            | 0.20              | 0.35                                               |

**11. Overload indication**

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 131.1                   | 131.1                   | 0.0                 | 1.5                            | 0.20              | 0.25                                               |

**12. High-level stability**

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 129.0               |                     |                                |                   |                                                    |

Calibrated by   
(Mr. Pannasit Phasingsri)

Approved by:   
(Mr. Pravit Kijyapa)  
Director  
Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref: 2011268011400185008

End of Certificate

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**CALIBRATION CERTIFICATE**

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi, 25140.

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

Instrument Calibrated :

Description : Integrating Sound Level Meter

Manufacturer : ACO

Model : 6226

Serial No. : 100146

Microphone : Type 7052NR No.78402

Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

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**1. Absolute Sensitivity**

| Reference Acoustic Signal (dB) | Measured value (dB) |              | Deviation value (dB) | Acceptance limit Class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------------------------------|---------------------|--------------|----------------------|--------------------------------|-------------------|----------------------------------------------------|
|                                | Before adjust       | After adjust |                      |                                |                   |                                                    |
| 93.99                          | 92.7                | 94.0         | 0.0                  | 1.0                            | 0.30              | N/A                                                |

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 95.1 dB.

**2. Self-generated noise**
**2.1 Normal test**

| Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|-------------------|----------------------------------------------------|
| 23.1                | 0.10              | N/A                                                |

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

| Frequency | Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-----------|---------------------|-------------------|----------------------------------------------------|
| Weighting |                     |                   |                                                    |
| A-Weight  | 22.5                | 0.10              | N/A                                                |
| C-Weight  | 27.6                | 0.10              | N/A                                                |
| Flat      | 30.1                | 0.10              | N/A                                                |

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**3. Acoustical signal test of frequency weightings**

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 125            | 0.7                                    | 0.5      | 0.0  | 1.5                            | 0.45              | 0.6                                                |
| 1 000          | 0.2                                    | 0.1      | 0.1  | 1.0                            | 0.45              | 0.6                                                |
| 8 000          | -4.4                                   | -4.2     | -4.4 | 5.0                            | 0.45              | 0.7                                                |

**4. Electrical signal test of frequency weightings**

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 63             | 0.3                                    | 0.1      | 0.1  | 2.0                            | 0.20              | 0.6                                                |
| 125            | 0.1                                    | 0.1      | 1.3  | 1.5                            | 0.20              | 0.6                                                |
| 250            | 0.1                                    | 0.1      | 0.1  | 1.5                            | 0.20              | 0.6                                                |
| 500            | 0.1                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 1 000          | 0.0                                    | 0.0      | 0.0  | 1.0                            | 0.20              | 0.6                                                |
| 2 000          | -0.1                                   | 0.0      | 0.1  | 2.0                            | 0.20              | 0.6                                                |
| 4 000          | -0.4                                   | -0.2     | 0.0  | 3.0                            | 0.20              | 0.6                                                |
| 8 000          | -0.3                                   | -0.2     | -0.1 | 5.0                            | 0.20              | 0.7                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 122                    | 121.8               | -0.2                | 1.1                            | 0.30              | 0.3                                                |
| 121                    | 120.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 120                    | 119.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 118.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 113.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 108.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 103.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 88.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 78.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 73.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 68.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 63.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 58.8                | -0.2                | 1.1                            | 0.30              | 0.3                                                |
| 54                     | 53.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 48.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 39.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 34.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 33                     | 33.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |

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(66) 08 1889 6827

**5. Long-term stability**

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

**6. Frequency and time weightings at 1 kHz**

**6.1 Frequency weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.1                | 0.1                 | 0.2                            | 0.20              | 0.2                                                |

**6.2 Time weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 32                     | 32.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |
| 31                     | 31.4                | 0.4                 | 1.1                            | 0.30              | 0.3                                                |
| 30                     | 30.4                | 0.4                 | 1.1                            | 0.30              | 0.3                                                |

**8. Level linearity including the level range control**

At reference sound level on the reference level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

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**8. Level linearity including the level range control**

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 45                     | 45.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 35                     | 35.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 25                     | 25.8                | 0.8                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 25                     | 25.8                | 0.8                 | 1.1                            | 0.30              | 0.3                                                |
| 20-90  | 25                     | 25.6                | 0.6                 | 1.1                            | 0.30              | 0.3                                                |
| 20-80  | 25                     | 25.7                | 0.7                 | 1.1                            | 0.30              | 0.3                                                |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast           | 200                         | 115.8               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 98.8                | -0.2                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 89.6                | -0.4                | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                         | 109.4               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 89.8                | -0.2                | +1.0; -5.0                     | 0.20              | 0.3                                                |
| SEL            | 200                         | 109.9               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 90.0                | 0.0                 | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 80.9                | -0.1                | +1.5; -5.0                     | 0.20              | 0.3                                                |

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**CALIBRATION CERTIFICATE**

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi, 25140.

Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

**Instrument Calibrated :**

Description : Sound Level Meter

Manufacturer : Delta OHM

Model : HD 2010UC

Serial No. : 11040842479

Microphone : Type UC-52 No.114674

Preamplifier : Delta Type HD2010PNE2 No.11001018

**Standards used :**

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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**10. Peak C sound level**

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.8               | 0.4                 | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                            | 0.20              | 0.35                                               |

**11. Overload indication**

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 131.1                   | 131.1                   | 0.0                 | 1.5                            | 0.20              | 0.25                                               |

**12. High-level stability**

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 129.0               |                     |                                |                   |                                                    |

 Calibrated by   
 (Mr. Pannasit Phasingiri)

 Approved by :   
 (Mr. Praswate Klauyapa)  
 Director  
 Electrical and Electronic Standards Laboratory  
 Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 2011268011400185009

End of Certificate

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

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**1. Absolute Sensitivity**

| Reference Acoustic Signal (dB) | Measured value (dB) |              | Deviation value (dB) | Acceptance limit Class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------------------------------|---------------------|--------------|----------------------|--------------------------------|-------------------|----------------------------------------------------|
|                                | Before adjust       | After adjust |                      |                                |                   |                                                    |
| 93.95                          | 93.3                | 94.0         | 0.1                  | 1.0                            | 0.30              | N/A                                                |

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 94.0 dB.

**2. Self-generated noise**
**2.1 Normal test**

| Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|-------------------|----------------------------------------------------|
| 19.6                | 0.10              | N/A                                                |

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

| Frequency Weighting | Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|-------------------|----------------------------------------------------|
| A-Weight            | 18.3                | 0.10              | N/A                                                |
| C-Weight            | 24.5                | 0.20              | N/A                                                |
| Flat                | 26.9                | 0.30              | N/A                                                |

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**5. Long-term stability**

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

**6. Frequency and time weightings at 1 kHz**
**6.1 Frequency weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.1                | 0.1                 | 0.2                            | 0.20              | 0.2                                                |

**6.2 Time weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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**3. Acoustical signal test of frequency weightings**

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 125            | 0.4                                    | 0.3      | 0.2  | 1.5                            | 0.45              | 0.6                                                |
| 1 000          | -0.5                                   | -0.5     | -0.5 | 1.0                            | 0.45              | 0.6                                                |
| 8 000          | -4.0                                   | -3.9     | -4.0 | 5.0                            | 0.45              | 0.7                                                |

**4. Electrical signal test of frequency weightings**

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 63             | -0.1                                   | -0.2     | -0.3 | 2.0                            | 0.20              | 0.6                                                |
| 125            | -0.1                                   | -0.1     | -0.2 | 1.5                            | 0.20              | 0.6                                                |
| 250            | 0.0                                    | -0.1     | -0.1 | 1.5                            | 0.20              | 0.6                                                |
| 500            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 1 000          | 0.0                                    | 0.0      | 0.0  | 1.0                            | 0.20              | 0.6                                                |
| 2 000          | 0.0                                    | 0.1      | 0.1  | 2.0                            | 0.20              | 0.6                                                |
| 4 000          | 0.1                                    | 0.1      | 0.1  | 3.0                            | 0.20              | 0.6                                                |
| 8 000          | 0.1                                    | 0.1      | 0.1  | 5.0                            | 0.20              | 0.7                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 120                    | 120.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 119.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 114.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 109.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 104.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 89.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 79.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 69.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 64.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 59.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 54                     | 54.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 49.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 43                     | 43.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 42                     | 42.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

7. Level linearity on the reference level range

Table with 6 columns: Anticipated value (dB), Measured Value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows show data for 41, 40, and 39 dB.

8. Level linearity including the level range control

Table with 7 columns: Range, Anticipated value (dB), Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows show data for ranges 60-140, 50-130, 40-120, 30-110, and 20-100.

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

10. Peak C sound level

Table with 7 columns: Number of cycles in test signal, Anticipated value (dB), Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows show data for Complete cycle, Positive half cycle, and Negative half cycle.

11. Overload indication

Table with 6 columns: Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows show data for Positive one-half cycle and Negative one-half cycle.

12. High-level stability

Table with 6 columns: Time, Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows show data for Begin and End.

Calibrated by: (Signature) (Mr. Pannasit Phasingri)

Approved by: (Signature) (Mr. Pravee Klungsap)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 17-18 Feb. 2025

Date of Issue : 24 Feb. 2025

Ref : 2011268011400185012

End of Certificate

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 94/0168

8. Level linearity including the level range control

Table with 7 columns: Range, Anticipated value (dB), Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows show data for ranges 60-140, 50-130, 40-120, 30-110, and 20-100.

9. Tone burst response

Table with 7 columns: Time, Weighting, Toneburst Duration, T<sub>b</sub> (ms), Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows show data for Fast and Slow weighting with 200ms and 0.25ms durations, and SEL weighting with 200ms and 0.25ms durations.

Date of Calibration : 17-18 Feb. 2025

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-68/0160

MTC No. EEL. BP. 92/0168

CALIBRATION CERTIFICATE

Submitted by : Integrated Research Center Company Limited. Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi, 25140. Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre. Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated : Description : Sound Level Meter, Manufacturer : Rion, Model : NI-42, Serial No. : 00433730, Microphone : Type UC-52 No.144953, Preamplifier : Type NH-24 No.33780. Ambient Environment : Temperature : (23 ± 3) °C, Relative Humidity : (50 ± 15) %, Ambient Pressure : (101.325 ± 1.5) kPa.

- Standards used : 1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712. 2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871. 3. Decade Attenuator Ando AL-205 S/N 00464602. 4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668. 5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037. 6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154. 7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan. 2025

Date of Calibration : 17-18 Feb. 2025

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

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 17-18 Feb. 2025

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**3. Acoustical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 125               | 0.1                                    | 0.3      | 0.0  | 1.5                               | 0.45                 | 0.6                                                   |
| 1 000             | 0.1                                    | 0.0      | 0.1  | 1.0                               | 0.45                 | 0.6                                                   |
| 8 000             | -4.6                                   | -4.4     | -4.7 | 5.0                               | 0.45                 | 0.7                                                   |

**4. Electrical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 63                | 0.0                                    | 0.0      | 0.1  | 2.0                               | 0.20                 | 0.6                                                   |
| 125               | 0.0                                    | 0.1      | 0.1  | 1.5                               | 0.20                 | 0.6                                                   |
| 250               | 0.0                                    | 0.1      | 0.1  | 1.5                               | 0.20                 | 0.6                                                   |
| 500               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 1 000             | 0.0                                    | 0.0      | 0.0  | 1.0                               | 0.20                 | 0.6                                                   |
| 2 000             | 0.0                                    | 0.1      | 0.1  | 2.0                               | 0.20                 | 0.6                                                   |
| 4 000             | 0.0                                    | 0.1      | 0.1  | 3.0                               | 0.20                 | 0.6                                                   |
| 8 000             | 0.1                                    | 0.1      | 0.1  | 5.0                               | 0.20                 | 0.7                                                   |

Date of Calibration : 17-18 Feb. 2025

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**1. Absolute Sensitivity**

| Reference Acoustic<br>Signal (dB) | Measured value (dB) |              | Deviation<br>value (dB) | Acceptance limit<br>Class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-----------------------------------|---------------------|--------------|-------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
|                                   | Before adjust       | After adjust |                         |                                   |                      |                                                       |
| 93.95                             | 93.8                | 113.9        | 20.0                    | 1.0                               | 0.30                 | N/A                                                   |

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.0 dB.

**2. Self-generated noise**

**2.1 Normal test**

| Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|----------------------|-------------------------------------------------------|
| 17.9                   | 0.10                 | N/A                                                   |

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

| Frequency<br>Weighting | Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|----------------------|-------------------------------------------------------|
| A-Weight               | 14.3                   | 0.70                 | N/A                                                   |
| C-Weight               | 19.4                   | 0.70                 | N/A                                                   |
| Flat                   | 25.1                   | 0.30                 | N/A                                                   |

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**5. Long-term stability**

| Time  | Measured Value<br>(dB) | Deviated value<br>(dB) | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------|------------------------|------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
| Begin | 94.0                   | 0.0                    | 0.3                               | 0.10                 | 0.1                                                   |
| End   | 94.0                   |                        |                                   |                      |                                                       |

**6. Frequency and time weightings at 1 kHz**

**6.1 Frequency weightings at 1 kHz**

| Frequency<br>Weighting | Measured Value<br>(dB) | Deviated value<br>(dB) | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
| A-weight               | 94.0                   | 0.0                    | 0.2                               | 0.20                 | 0.2                                                   |
| C-weight               | 94.0                   | 0.0                    | 0.2                               | 0.20                 | 0.2                                                   |
| Flat                   | 94.1                   | 0.1                    | 0.2                               | 0.20                 | 0.2                                                   |

**6.2 Time weightings at 1 kHz**

| Frequency<br>Weighting | Measured Value<br>(dB) | Deviated value<br>(dB) | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
| Fast                   | 94.0                   | 0.0                    | 0.1                               | 0.20                 | 0.2                                                   |
| Slow                   | 94.0                   | 0.0                    | 0.1                               | 0.20                 | 0.2                                                   |
| Leq                    | 94.0                   | 0.0                    | 0.1                               | 0.20                 | 0.2                                                   |

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7. Level linearity on the reference level range

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 137                    | 137.1               | 0.1                 | 1.1                            | 0.64              | 0.3                                                |
| 136                    | 136.1               | 0.1                 | 1.1                            | 0.69              | 0.3                                                |
| 135                    | 135.0               | 0.0                 | 1.1                            | 0.58              | 0.3                                                |
| 133                    | 133.0               | 0.0                 | 1.1                            | 0.64              | 0.3                                                |
| 132                    | 132.0               | 0.0                 | 1.1                            | 0.64              | 0.3                                                |
| 131                    | 131.0               | 0.0                 | 1.1                            | 0.64              | 0.3                                                |
| 130                    | 130.0               | 0.0                 | 1.1                            | 0.64              | 0.3                                                |
| 129                    | 129.0               | 0.0                 | 1.1                            | 2.90              | 0.3                                                |
| 124                    | 124.0               | 0.0                 | 1.1                            | 2.90              | 0.3                                                |
| 119                    | 119.0               | 0.0                 | 1.1                            | 2.90              | 0.3                                                |
| 114                    | 114.0               | 0.0                 | 1.1                            | 2.90              | 0.3                                                |
| 109                    | 109.0               | 0.0                 | 1.1                            | 2.90              | 0.3                                                |
| 104                    | 104.0               | 0.0                 | 1.1                            | 2.90              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 89.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 79.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 69.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 64.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 58.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 30-130 | 25                     | 25.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

9. Tone burst response

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast           | 200                         | 126.0               | 0.0                 | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 108.9               | -0.1                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 100.0               | 0.0                 | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                         | 119.5               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 100.0               | 0.0                 | +1.0; -5.0                     | 0.20              | 0.3                                                |

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7. Level linearity on the reference level range (cont.)

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 54                     | 53.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 48.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 38.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 33.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 29                     | 29.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 28                     | 27.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 27                     | 26.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 26                     | 25.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 25                     | 24.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |

8. Level linearity including the level range control

At reference sound level on the reference level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 30-130 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

Date of Calibration : 17-18 Feb. 2025

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10. Peak C sound level

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.5               | 0.1                 | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.1               | -0.3                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.1               | -0.3                | 2.0                            | 0.20              | 0.35                                               |

11. Overload indication

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 135.4                   | 135.4                   | 0.0                 | 1.5                            | 0.55              | 0.25                                               |

12. High-level stability

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 129.0               |                     |                                |                   |                                                    |

Calibrated by :   
(Mr. Pannasit Phasingari)

Approved by :   
(Mr. Prasante Kloaypa)  
Director

Electrical and Electronic Standards Laboratory

Date of Calibration : 17-18 Feb. 2025

Industrial Metrology and Testing Service Centre

Date of Issue : 24 Feb. 2025

Ref : 2011268011400185010

End of Certificate

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**CALIBRATION CERTIFICATE**
**Submitted by :** Integrated Research Center Company Limited.

**Address :** 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi, 25140.

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

**Instrument Calibrated :**

Description : Sound Level Meter

Manufacturer : Rion

Model : NL-42

Serial No. : 00646442

Microphone : Type UC-52 No.142301

Preamplifier : Type NH-24 No.22410

**Ambient Environment**

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325±1.5) kPa

**Standards used :**

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Bruel&Kjaer 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt :** 14 Jan. 2025

**Date of Calibration :** 17-18 Feb. 2025

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**1. Absolute Sensitivity**

| Reference Acoustic<br>Signal (dB) | Measured value (dB) |              | Deviation<br>value (dB) | Acceptance limit<br>Class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-----------------------------------|---------------------|--------------|-------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
|                                   | Before adjust       | After adjust |                         |                                   |                      |                                                       |
| 93.95                             | 93.6                | 113.9        | 20.0                    | 1.0                               | 0.30                 | N/A                                                   |

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 124.3 dB.

**2. Self-generated noise**
**2.1 Normal test**

| Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|----------------------|-------------------------------------------------------|
| 16.9                   | 0.10                 | N/A                                                   |

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

| Frequency<br>Weighting | Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|----------------------|-------------------------------------------------------|
| A-Weight               | 13.1                   | 0.10                 | N/A                                                   |
| C-Weight               | 18.5                   | 0.10                 | N/A                                                   |
| Flat                   | 24.4                   | 0.10                 | N/A                                                   |

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

**Date of Calibration :** 17-18 Feb. 2025

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**3. Acoustical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 125               | 0.8                                    | 0.2      | 0.0  | 1.5                               | 0.45                 | 0.6                                                   |
| 1 000             | 0.0                                    | 0.0      | 0.0  | 1.0                               | 0.45                 | 0.6                                                   |
| 8 000             | -2.0                                   | -2.0     | -2.1 | 5.0                               | 0.45                 | 0.7                                                   |

**4. Electrical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 63                | -0.1                                   | 0.0      | 0.0  | 2.0                               | 0.20                 | 0.6                                                   |
| 125               | -0.1                                   | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 250               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 500               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 1 000             | 0.0                                    | 0.0      | 0.0  | 1.0                               | 0.20                 | 0.6                                                   |
| 2 000             | 0.0                                    | 0.0      | 0.0  | 2.0                               | 0.20                 | 0.6                                                   |
| 4 000             | 0.0                                    | 0.0      | 0.0  | 3.0                               | 0.20                 | 0.6                                                   |
| 8 000             | 0.0                                    | 0.0      | 0.0  | 5.0                               | 0.20                 | 0.7                                                   |

**Date of Calibration :** 17-18 Feb. 2025

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**5. Long-term stability**

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

**6. Frequency and time weightings at 1 kHz**
**6.1 Frequency weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.1                | 0.1                 | 0.2                            | 0.20              | 0.2                                                |

**6.2 Time weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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**7. Level linearity on the reference level range (cont.)**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 54                     | 54.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 48.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 43.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 38.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 34.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 29                     | 28.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 28                     | 27.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 27                     | 26.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 26                     | 25.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 25                     | 24.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |

**8. Level linearity including the level range control**

At reference sound level on the reference level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 30-130 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 137                    | 136.6               | -0.4                | 1.1                            | 0.30              | 0.3                                                |
| 136                    | 135.6               | -0.4                | 1.1                            | 0.30              | 0.3                                                |
| 135                    | 134.7               | -0.3                | 1.1                            | 0.30              | 0.3                                                |
| 133                    | 132.8               | -0.2                | 1.1                            | 0.30              | 0.3                                                |
| 132                    | 131.8               | -0.2                | 1.1                            | 0.30              | 0.3                                                |
| 131                    | 130.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 130                    | 129.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 129                    | 128.9               | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 124                    | 124.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 119.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 114.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 109.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 104.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 89.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 78.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 68.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 64.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 58.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |

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**8. Level linearity including the level range control**

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 30-130 | 25                     | 25.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast           | 200                         | 126.0               | 0.0                 | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 108.9               | -0.1                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 100.0               | 0.0                 | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                         | 119.5               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 100.0               | 0.0                 | +1.0; -5.0                     | 0.20              | 0.3                                                |

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**10. Peak C sound level**

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.5               | 0.1                 | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.1               | -0.3                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.1               | -0.3                | 2.0                            | 0.20              | 0.35                                               |

**11. Overload indication**

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 135.4                   | 135.4                   | 0.0                 | 1.5                            | 0.55              | 0.25                                               |

**12. High-level stability**

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 129.0               |                     |                                |                   |                                                    |

Calibrated by:   
(Mr. Pannasit Phasingsri)

Approved by:   
(Mr. Pravee Klusaypa)  
Director  
Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre  
Ref: 2011268011400185011

Date of Calibration : 17-18 Feb. 2025  
Date of Issue : 24 Feb. 2025

End of Certificate

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**CALIBRATION CERTIFICATE**

Submitted by : Integrated Research Center Company Limited.  
Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140.  
Calibrated at : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

Instrument Calibrated :  
Description : Sound Level Meter  
Manufacturer : ACO  
Model : 6236  
Serial No. : 192014  
Microphone : 7052NR No.73303  
Preamplifier : -

Ambient Environment  
Temperature : (23 ± 3) °C  
Relative Humidity : (50 ± 15) %  
Ambient Pressure : (101.325±1.5) kPa

- Standards used :
1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
  2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
  3. Decade Attenuator Ando AL-205 S/N 00464602.
  4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
  5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
  6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
  7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan.2025  
Date of Calibration : 24-27 Feb.2025

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 24-27 Feb.2025

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**1. Absolute Sensitivity**

| Reference Acoustic Signal (dB) | Measured value (dB) | Deviation value (dB) | Acceptance limit Class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------------------------------|---------------------|----------------------|--------------------------------|-------------------|----------------------------------------------------|
| 93.99                          | 94.0                | 0.0                  | 1.0                            | 0.48              | N/A                                                |

Note: No adjustment.

**2. Self-generated noise**

**2.1 Normal test**

| Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|-------------------|----------------------------------------------------|
| 20.8                | 0.10              | N/A                                                |

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

| Frequency Weighting | Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|-------------------|----------------------------------------------------|
| A-Weight            | 13.3                | 0.10              | N/A                                                |
| C-Weight            | 18.4                | 0.10              | N/A                                                |
| Flat                | 22.4                | 0.10              | N/A                                                |

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## 3. Acoustical signal test of frequency weightings

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 125               | 0.2                                    | 0.3      | 0.2  | 1.5                               | 0.45                 | 0.6                                                   |
| 1 000             | 0.1                                    | 0.1      | 0.2  | 1.0                               | 0.45                 | 0.6                                                   |
| 8 000             | -1.6                                   | -1.5     | -1.1 | 5.0                               | 0.45                 | 0.7                                                   |

## 4. Electrical signal test of frequency weightings

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 63                | 0.0                                    | 0.0      | -0.1 | 2.0                               | 0.20                 | 0.6                                                   |
| 125               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 250               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 500               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 1 000             | 0.0                                    | 0.0      | 0.0  | 1.0                               | 0.20                 | 0.6                                                   |
| 2 000             | -0.1                                   | -0.1     | -0.1 | 2.0                               | 0.20                 | 0.6                                                   |
| 4 000             | -0.4                                   | -0.4     | -0.1 | 3.0                               | 0.20                 | 0.6                                                   |
| 8 000             | -0.6                                   | -0.7     | -0.2 | 5.0                               | 0.20                 | 0.7                                                   |

Date of Calibration : 24-27 Feb.2025

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## 7. Level linearity on the reference level range

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 122                    | 122.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 121                    | 121.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 120                    | 120.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 119.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 114.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 109.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 104.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 89.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 79.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 69.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 64.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 59.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 54                     | 54.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 49.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 39.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 34.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 33                     | 33.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |

Date of Calibration : 24-27 Feb.2025

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## 5. Long-term stability

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

## 6. Frequency and time weightings at 1 kHz

## 6.1 Frequency weightings at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.1                | 0.1                 | 0.2                            | 0.20              | 0.2                                                |

## 6.2 Time weightings at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

Date of Calibration : 24-27 Feb.2025

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## 7. Level linearity on the reference level range

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 32                     | 32.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 31                     | 31.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 30                     | 30.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |

## 8. Level linearity including the level range control

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

Date of Calibration : 24-27 Feb.2025

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**8. Level linearity including the level range control**

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 45.0                   | 45.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 35.0                   | 35.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 25.0                   | 25.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 25.0                   | 25.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 20-90  | 25.0                   | 25.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 20-80  | 25.0                   | 25.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, T <sub>b</sub> (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast           | 200                                     | 115.8               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                                       | 98.3                | -0.7                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                                    | 89.2                | -0.8                | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                                     | 109.5               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                                       | 89.7                | -0.3                | +1.0; -5.0                     | 0.20              | 0.3                                                |
| SEL            | 200                                     | 109.9               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                                       | 89.9                | -0.1                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                                    | 80.9                | -0.1                | +1.5; -5.0                     | 0.20              | 0.3                                                |

Date of Calibration : 24-27 Feb.2025

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**CALIBRATION CERTIFICATE**

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140.

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

Instrument Calibrated :

| Description       | Ambient Environment                  |
|-------------------|--------------------------------------|
| Sound Level Meter | Temperature : (23 ± 3) °C            |
| ACO               | Relative Humidity : (50 ± 15) %      |
| 6236              | Ambient Pressure : (101.325±1.5) kPa |
| 192015            |                                      |
| 7052NR No.73304   |                                      |
| -                 |                                      |

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
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7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan.2025

Date of Calibration : 24-27 Feb.2025

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**10. Peak C sound level**

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.7               | 0.3                 | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                            | 0.20              | 0.35                                               |

**11. Overload indication**

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 132.5                   | 132.5                   | 0.0                 | 1.5                            | 0.20              | 0.25                                               |

**12. High-level stability**

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 129.0               |                     |                                |                   |                                                    |

Calibrated by :

(Mr. Tawikiat Iamsamran)

Approved by :

(Mr. Prawate Klusaypa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

Ref : 2011268011400185003

End of Certificate

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Bangkok 10900, Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
(66) 08 1889 6827

8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 24-27 Feb.2025

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1. Absolute Sensitivity

| Reference Acoustic Signal (dB) | Measured value (dB) | Deviation value (dB) | Acceptance limit Class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------------------------------|---------------------|----------------------|--------------------------------|-------------------|----------------------------------------------------|
| 93.99                          | 93.9                | -0.1                 | 1.0                            | 0.48              | N/A                                                |

Note: No adjustment.

2. Self-generated noise

2.1 Normal test

| Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|-------------------|----------------------------------------------------|
| 22.0                | 0.10              | N/A                                                |

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

| Frequency Weighting | Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|-------------------|----------------------------------------------------|
| A-Weight            | 15.7                | 0.10              | N/A                                                |
| C-Weight            | 21.5                | 0.10              | N/A                                                |
| Flat                | 26.0                | 0.10              | N/A                                                |

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3. Acoustical signal test of frequency weightings

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 125            | 0.4                                    | 0.4      | 0.4  | 1.5                            | 0.45              | 0.6                                                |
| 1 000          | -0.4                                   | -0.4     | -0.4 | 1.0                            | 0.45              | 0.6                                                |
| 8 000          | -0.8                                   | -1.0     | -0.6 | 5.0                            | 0.45              | 0.7                                                |

4. Electrical signal test of frequency weightings

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 63             | 0.1                                    | 0.0      | -0.1 | 2.0                            | 0.20              | 0.6                                                |
| 125            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 250            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 500            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 1 000          | 0.0                                    | 0.0      | 0.0  | 1.0                            | 0.20              | 0.6                                                |
| 2 000          | -0.1                                   | 0.0      | -0.1 | 2.0                            | 0.20              | 0.6                                                |
| 4 000          | -0.4                                   | -0.4     | -0.1 | 3.0                            | 0.20              | 0.6                                                |
| 8 000          | -0.6                                   | -0.6     | -0.2 | 5.0                            | 0.20              | 0.7                                                |

Date of Calibration : 24-27 Feb.2025

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5. Long-term stability

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

6. Frequency and time weightings at 1 kHz

6.1 Frequency weightings at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |

6.2 Time weightings at 1 kHz

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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7. Level linearity on the reference level range

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 122                    | 122.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 121                    | 121.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 120                    | 120.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 119.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 114.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 109.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 104.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 89.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 79.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 69.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 64.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 59.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 54                     | 54.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 49.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 39.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 34.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 33                     | 33.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |

Date of Calibration : 24-27 Feb.2025

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 32                     | 32.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |
| 31                     | 31.4                | 0.4                 | 1.1                            | 0.30              | 0.3                                                |
| 30                     | 30.4                | 0.4                 | 1.1                            | 0.30              | 0.3                                                |

**8. Level linearity including the level range control**

At reference sound level on the reference level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

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**10. Peak C sound level**

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.5               | 0.1                 | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.3               | -0.1                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.3               | -0.1                | 2.0                            | 0.20              | 0.35                                               |

**11. Overload indication**

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 132.5                   | 132.5                   | 0.0                 | 1.5                            | 0.20              | 0.25                                               |

**12. High-level stability**

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 129.0               |                     |                                |                   |                                                    |

Calibrated by :

  
 (Mr. Tawikiat Iamsamran)

Approved by :

  
 (Mr. Prawate Klaiyapa)  
 Director

**Electrical and Electronic Standards Laboratory**  
**Industrial Metrology and Testing Service Centre**

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

Ref : 2011268011400185002

End of Certificate

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**8. Level linearity including the level range control**

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 45.0                   | 45.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 35.0                   | 35.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 25.0                   | 25.5                | 0.5                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 25.0                   | 25.4                | 0.4                 | 1.1                            | 0.30              | 0.3                                                |
| 20-90  | 25.0                   | 25.4                | 0.4                 | 1.1                            | 0.30              | 0.3                                                |
| 20-80  | 25.0                   | 25.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast           | 200                         | 115.8               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 98.6                | -0.4                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 89.0                | -1.0                | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                         | 109.4               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 89.8                | -0.2                | +1.0; -5.0                     | 0.20              | 0.3                                                |
| SEL            | 200                         | 109.9               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 90.0                | 0.0                 | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 80.9                | -0.1                | +1.5; -5.0                     | 0.20              | 0.3                                                |

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 (66) 08 1889 6827

**CALIBRATION CERTIFICATE**
**Submitted by** : Integrated Research Center Company Limited.

**Address** : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140.

**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.

Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., A.Muang, Samutprakan 10280.

**Instrument Calibrated :**

 Description : Sound Level Meter  
 Manufacturer : ACO  
 Model : 6236  
 Serial No. : 192016  
 Microphone : 7052NR No.73305  
 Preamplifier : -

**Ambient Environment**

 Temperature : (23 ± 3) °C  
 Relative Humidity : (50 ± 15) %  
 Ambient Pressure : (101.325±1.5) kPa

**Standards used :**

- Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
- Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
- Decade Attenuator Ando AL-205 S/N 00464602.
- Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
- Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
- Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
- Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt** : 14 Jan.2025

**Date of Calibration** : 24-27 Feb.2025

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 24-27 Feb.2025

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**1. Absolute Sensitivity**

| Reference Acoustic Signal (dB) | Measured value (dB) | Deviation value (dB) | Acceptance limit Class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------------------------------|---------------------|----------------------|--------------------------------|-------------------|----------------------------------------------------|
| 93.99                          | 93.3                | -0.7                 | 1.0                            | 0.48              | N/A                                                |

Note: No adjustment.

**2. Self-generated noise**
**2.1 Normal test**

| Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|-------------------|----------------------------------------------------|
| 23.6                | 0.10              | N/A                                                |

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

| Frequency Weighting | Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|-------------------|----------------------------------------------------|
| A-Weight            | 15.5                | 0.10              | N/A                                                |
| C-Weight            | 20.5                | 0.10              | N/A                                                |
| Flat                | 25.1                | 0.10              | N/A                                                |

Date of Calibration : 24-27 Feb.2025

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**3. Acoustical signal test of frequency weightings**

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 125            | 0.5                                    | 0.6      | 0.5  | 1.5                            | 0.45              | 0.6                                                |
| 1 000          | -0.9                                   | -0.9     | -0.8 | 1.0                            | 0.45              | 0.6                                                |
| 8 000          | -1.3                                   | -1.1     | -0.7 | 5.0                            | 0.45              | 0.7                                                |

**4. Electrical signal test of frequency weightings**

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 63             | 0.1                                    | 0.0      | -0.1 | 2.0                            | 0.20              | 0.6                                                |
| 125            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 250            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 500            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 1 000          | 0.0                                    | 0.0      | 0.0  | 1.0                            | 0.20              | 0.6                                                |
| 2 000          | -0.1                                   | -0.1     | 0.0  | 2.0                            | 0.20              | 0.6                                                |
| 4 000          | -0.4                                   | -0.4     | -0.1 | 3.0                            | 0.20              | 0.6                                                |
| 8 000          | -0.7                                   | -0.6     | -0.2 | 5.0                            | 0.20              | 0.7                                                |

Date of Calibration : 24-27 Feb.2025

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**5. Long-term stability**

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

**6. Frequency and time weightings at 1 kHz**
**6.1 Frequency weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.1                | 0.1                 | 0.2                            | 0.20              | 0.2                                                |

**6.2 Time weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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7. Level linearity on the reference level range

Table with 6 columns: Anticipated value (dB), Measured Value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows include values from 122 down to 33.

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8. Level linearity including the level range control

At reference level at 5 dB greater than the under-range on a level range

Table with 6 columns: Range, Anticipated value (dB), Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows include ranges from 40-130 down to 20-80.

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7. Level linearity on the reference level range

Table with 6 columns: Anticipated value (dB), Measured Value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows include values 32, 31, 30.

8. Level linearity including the level range control

At reference sound level on the reference level range

Table with 6 columns: Range, Anticipated value (dB), Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows include ranges 40-130, 30-120, 20-110, 20-100.

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10. Peak C sound level

Table with 6 columns: Number of cycles in test signal, Anticipated value (dB), Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows include Complete cycle, Positive half cycle, Negative half cycle.

11. Overload indication

Table with 5 columns: Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows include Positive one-half cycle, Negative one-half cycle.

12. High-level stability

Table with 6 columns: Time, Measured value (dB), Deviated value (dB), Acceptance limit class 2 (±dB), Uncertainty (±dB), Maximum-permitted uncertainty of measurement (±dB). Rows include Begin, End.

Calibrated by : (Mr. Tawikiat Iamsamran)

Approved by : (Mr. Prasart Klusapa) Director

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

Electrical and Electronic Standards Laboratory Industrial Metrology and Testing Service Centre

Ref : 2011268011400185001

End of Certificate

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**CALIBRATION CERTIFICATE**
**Submitted by** : Integrated Research Center Company Limited.

**Address** : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140.

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

**Instrument Calibrated :**

 Description : Sound Level Meter  
 Manufacturer : ACO  
 Model : 6236  
 Serial No. : 212014  
 Microphone : 7052NR No.76235  
 Preamplifier : -

**Ambient Environment**

 Temperature : (23 ± 3) °C  
 Relative Humidity : (50 ± 15) %  
 Ambient Pressure : (101.325±1.5) kPa

**Standards used :**

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

**Date of Receipt** : 14 Jan.2025

**Date of Calibration** : 24-27 Feb.2025

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**1. Absolute Sensitivity**

| Reference Acoustic<br>Signal (dB) | Measured value (dB) |              | Deviation<br>value (dB) | Acceptance limit<br>Class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-----------------------------------|---------------------|--------------|-------------------------|-----------------------------------|----------------------|-------------------------------------------------------|
|                                   | Before adjust       | After adjust |                         |                                   |                      |                                                       |
| 93.99                             | 94.2                | 94.0         | 0.0                     | 1.0                               | 0.48                 | N/A                                                   |

**Note:** The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 114.7 dB.

**2. Self-generated noise**
**2.1 Normal test**

| Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|----------------------|-------------------------------------------------------|
| 20.7                   | 0.10                 | N/A                                                   |

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

| Frequency<br>Weighting | Measured value<br>(dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|------------------------|------------------------|----------------------|-------------------------------------------------------|
| A-Weight               | 13.7                   | 0.10                 | N/A                                                   |
| C-Weight               | 19.0                   | 0.10                 | N/A                                                   |
| Flat                   | 23.9                   | 0.10                 | N/A                                                   |

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8. Power Amplifier Brüel&Kjær 2706 S/N 1517650.
9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.
10. Digital Multimeter Agilent 34401A S/N MY44005560.
11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

**Date of Calibration** : 24-27 Feb.2025

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**3. Acoustical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 125               | 0.5                                    | 0.5      | 0.3  | 1.5                               | 0.45                 | 0.6                                                   |
| 1 000             | -0.1                                   | -0.2     | 0.0  | 1.0                               | 0.45                 | 0.6                                                   |
| 8 000             | -1.3                                   | -1.1     | -0.8 | 5.0                               | 0.45                 | 0.7                                                   |

**4. Electrical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 63                | 0.2                                    | 0.0      | -0.1 | 2.0                               | 0.20                 | 0.6                                                   |
| 125               | 0.1                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 250               | 0.1                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 500               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 1 000             | 0.0                                    | 0.0      | 0.0  | 1.0                               | 0.20                 | 0.6                                                   |
| 2 000             | -0.1                                   | 0.0      | -0.1 | 2.0                               | 0.20                 | 0.6                                                   |
| 4 000             | -0.4                                   | -0.3     | -0.1 | 3.0                               | 0.20                 | 0.6                                                   |
| 8 000             | -0.6                                   | -0.6     | -0.2 | 5.0                               | 0.20                 | 0.7                                                   |

**Date of Calibration** : 24-27 Feb.2025

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**5. Long-term stability**

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

**6. Frequency and time weightings at 1 kHz**

**6.1 Frequency weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |

**6.2 Time weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 32                     | 32.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 31                     | 31.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |
| 30                     | 30.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |

**8. Level linearity including the level range control**

At reference sound level on the reference level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 122                    | 122.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 121                    | 121.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 120                    | 120.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 119.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 114.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 109.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 104.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 89.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 79.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 69.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 64.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 59.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 54                     | 54.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 49.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 39.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 34.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 33                     | 33.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |

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**8. Level linearity including the level range control**

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 45.0                   | 45.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 35.0                   | 35.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 25.0                   | 25.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 25.0                   | 25.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |
| 20-90  | 25.0                   | 25.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 20-80  | 25.0                   | 25.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
|                |                             |                     |                     |                                |                   |                                                    |
| Fast           | 200                         | 115.8               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 98.7                | -0.3                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 89.2                | -0.8                | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                         | 109.5               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 89.8                | -0.2                | +1.0; -5.0                     | 0.20              | 0.3                                                |
| SEL            | 200                         | 109.9               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 89.9                | -0.1                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 80.9                | -0.1                | +1.5; -5.0                     | 0.20              | 0.3                                                |

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**10. Peak C sound level**

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.0               | -0.4                | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.3               | -0.1                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.3               | -0.1                | 2.0                            | 0.20              | 0.35                                               |

**11. Overload indication**

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 132.5                   | 132.5                   | 0.0                 | 1.5                            | 0.20              | 0.25                                               |

**12. High-level stability**

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               |                     |                                |                   |                                                    |
| End   | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |

Calibrated by :

Approved by :

(Mr. Tawikiat Iamsamran)

(Mr. Prawate Khuyapa)

Electrical and Electronic Standards Laboratory  
Industrial Metrology and Testing Service Centre

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

Ref : 2011268011400185004

End of Certificate

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- Power Amplifier Brüel&Kjær 2706 S/N 1517650.
- Speaker Tannoy Limited, Great Britain British Patent No. 215300.
- Digital Multimeter Agilent 34401A S/N MY44005560.
- Programmable Attenuator Tamagawa TPA-303A S/N 2212.

**Calibration Procedure :**

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

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**CALIBRATION CERTIFICATE**

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140.

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

Instrument Calibrated :

Ambient Environment

Description : Sound Level Meter

Temperature : (23 ± 3) °C

Manufacturer : ACO

Relative Humidity : (50 ± 15) %

Model : 6236

Ambient Pressure : (101.325±1.5) kPa

Serial No. : 212015

Microphone : 7052NR No.76236

Preamplifier : -

Standards used :

- Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
- Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
- Decade Attenuator Ando AL-205 S/N 00464602.
- Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
- Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
- Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
- Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan.2025

Date of Calibration : 24-27 Feb.2025

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**1. Absolute Sensitivity**

| Reference Acoustic Signal (dB) | Measured value (dB) |              | Deviation value (dB) | Acceptance limit Class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------------------------------|---------------------|--------------|----------------------|--------------------------------|-------------------|----------------------------------------------------|
|                                | Before adjust       | After adjust |                      |                                |                   |                                                    |
| 93.99                          | 94.4                | 94.0         | 0.0                  | 1.0                            | 0.48              | N/A                                                |

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 115.0 dB.

**2. Self-generated noise**

**2.1 Normal test**

| Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|-------------------|----------------------------------------------------|
| 20.7                | 0.10              | N/A                                                |

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

| Frequency Weighting | Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|-------------------|----------------------------------------------------|
| A-Weight            | 15.1                | 0.10              | N/A                                                |
| C-Weight            | 19.9                | 0.10              | N/A                                                |
| Flat                | 24.7                | 0.10              | N/A                                                |

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**3. Acoustical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 125               | 0.4                                    | 0.6      | 0.4  | 1.5                               | 0.45                 | 0.6                                                   |
| 1 000             | -0.1                                   | -0.1     | 0.1  | 1.0                               | 0.45                 | 0.6                                                   |
| 8 000             | -0.7                                   | -0.7     | -0.2 | 5.0                               | 0.45                 | 0.7                                                   |

**4. Electrical signal test of frequency weightings**

| Frequency<br>(Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit<br>class 2 (±dB) | Uncertainty<br>(±dB) | Maximum-permitted uncertainty<br>of measurement (±dB) |
|-------------------|----------------------------------------|----------|------|-----------------------------------|----------------------|-------------------------------------------------------|
|                   | A-weight                               | C-weight | Flat |                                   |                      |                                                       |
| 63                | 0.0                                    | 0.0      | -0.1 | 2.0                               | 0.20                 | 0.6                                                   |
| 125               | -0.1                                   | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 250               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 500               | 0.0                                    | 0.0      | 0.0  | 1.5                               | 0.20                 | 0.6                                                   |
| 1 000             | 0.0                                    | 0.0      | 0.0  | 1.0                               | 0.20                 | 0.6                                                   |
| 2 000             | -0.1                                   | -0.1     | -0.1 | 2.0                               | 0.20                 | 0.6                                                   |
| 4 000             | -0.4                                   | -0.4     | -0.1 | 3.0                               | 0.20                 | 0.6                                                   |
| 8 000             | -0.6                                   | -0.6     | -0.2 | 5.0                               | 0.20                 | 0.7                                                   |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 122                    | 122.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 121                    | 121.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 120                    | 120.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 119.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 114.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 109.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 104.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 89.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 84.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 79.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 69.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 64.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 59.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 54                     | 54.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 49.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 39.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 34.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 33                     | 33.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |

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**5. Long-term stability**

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

**6. Frequency and time weightings at 1 kHz**
**6.1 Frequency weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |

**6.2 Time weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 32                     | 32.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 31                     | 31.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 30                     | 30.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |

**8. Level linearity including the level range control**

At reference sound level on the reference level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

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**8. Level linearity including the level range control**

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 45.0                   | 45.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 35.0                   | 35.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 25.0                   | 25.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 25.0                   | 25.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 20-90  | 25.0                   | 25.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 20-80  | 25.0                   | 24.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, Tb (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast           | 200                         | 115.8               | -0.2                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 98.9                | -0.1                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 89.0                | -1.0                | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                         | 109.3               | -0.3                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 89.8                | -0.2                | +1.0; -5.0                     | 0.20              | 0.3                                                |
| SEL            | 200                         | 109.9               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                           | 89.9                | -0.1                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                        | 80.9                | -0.1                | +1.5; -5.0                     | 0.20              | 0.3                                                |

Date of Calibration : 24-27 Feb.2025

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**CALIBRATION CERTIFICATE**

Submitted by : Integrated Research Center Company Limited.

Address : 122 Moo 2, T.Thatoom, A.Srimahaphote, Prachinburi 25140.

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

Instrument Calibrated :

Description : Sound Level Meter  
Manufacturer : ACO  
Model : 6236  
Serial No. : 212016  
Microphone : 7052NR No.76237  
Preamplifier : -

Ambient Environment

Temperature : (23 ± 3) °C  
Relative Humidity : (50 ± 15) %  
Ambient Pressure : (101.325 ± 1.5) kPa

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2889871.
3. Decade Attenuator Ando AL-205 S/N 00464602.
4. Function/Arbitrary Waveform Generator Agilent 33220A S/N MY44042668.
5. Digital Function Synthesizer NF Electronic Instruments DF-193A S/N 122037.
6. Sound Calibrator Brüel&Kjær 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjær 2636 S/N 1537484.

Date of Receipt : 14 Jan.2025

Date of Calibration : 24-27 Feb.2025

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**10. Peak C sound level**

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.5               | 0.1                 | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.3               | -0.1                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.3               | -0.1                | 2.0                            | 0.20              | 0.35                                               |

**11. Overload indication**

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 132.5                   | 132.5                   | 0.0                 | 1.5                            | 0.20              | 0.25                                               |

**12. High-level stability**

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 129.0               |                     |                                |                   |                                                    |

Calibrated by :

(Mr. Tawikiat Jamsamran)

Approved by :

(Mr. Pravee Klayyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

Ref: 2011268011400185005

End of Certificate

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8. Power Amplifier Brüel&amp;Kjær 2706 S/N 1517650.

9. Speaker Tannoy Limited, Great Britain British Patent No. 215300.

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

11. Programmable Attenuator Tamagawa TPA-303A S/N 2212.

Calibration Procedure :

This instrument was calibrated by using calibration procedures no CP-102-02 and CP-102-03, which were based on IEC 61672-3 Electroacoustics - Sound Level Meters - Part 3 : Periodic tests (2013). These calibration procedures were related to the electrical and acoustic signal tests. The electrical signal test was carried out with the direct measurement method. The acoustic signal test was performed in an anechoic room with the comparison measurement method.

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

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

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

Date of Calibration : 24-27 Feb.2025

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**1. Absolute Sensitivity**

| Reference Acoustic Signal (dB) | Measured value (dB) | Deviation value (dB) | Acceptance limit Class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------------------------------|---------------------|----------------------|--------------------------------|-------------------|----------------------------------------------------|
| 93.99                          | 94.0                | 0.0                  | 1.0                            | 0.48              | N/A                                                |

Note: No adjustment.

**2. Self-generated noise**

**2.1 Normal test**

| Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|-------------------|----------------------------------------------------|
| 21.3                | 0.10              | N/A                                                |

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

| Frequency Weighting | Measured value (dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|-------------------|----------------------------------------------------|
| A-Weight            | 14.4                | 0.10              | N/A                                                |
| C-Weight            | 19.1                | 0.10              | N/A                                                |
| Flat                | 23.5                | 0.10              | N/A                                                |

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**3. Acoustical signal test of frequency weightings**

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 125            | 0.5                                    | 0.5      | 0.4  | 1.5                            | 0.45              | 0.6                                                |
| 1 000          | -0.1                                   | -0.1     | 0.0  | 1.0                            | 0.45              | 0.6                                                |
| 8 000          | -1.5                                   | -1.7     | -1.1 | 5.0                            | 0.45              | 0.7                                                |

**4. Electrical signal test of frequency weightings**

| Frequency (Hz) | Deviation from frequency response (dB) |          |      | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|----------------------------------------|----------|------|--------------------------------|-------------------|----------------------------------------------------|
|                | A-weight                               | C-weight | Flat |                                |                   |                                                    |
| 63             | 0.1                                    | 0.0      | -0.1 | 2.0                            | 0.20              | 0.6                                                |
| 125            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 250            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 500            | 0.0                                    | 0.0      | 0.0  | 1.5                            | 0.20              | 0.6                                                |
| 1 000          | 0.0                                    | 0.0      | 0.0  | 1.0                            | 0.20              | 0.6                                                |
| 2 000          | -0.1                                   | 0.0      | -0.1 | 2.0                            | 0.20              | 0.6                                                |
| 4 000          | -0.4                                   | -0.3     | -0.1 | 3.0                            | 0.20              | 0.6                                                |
| 8 000          | -0.6                                   | -0.6     | -0.2 | 5.0                            | 0.20              | 0.7                                                |

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**5. Long-term stability**

| Time  | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 94.0                | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 94.0                |                     |                                |                   |                                                    |

**6. Frequency and time weightings at 1 kHz**

**6.1 Frequency weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| A-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| C-weight            | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |
| Flat                | 94.0                | 0.0                 | 0.2                            | 0.20              | 0.2                                                |

**6.2 Time weightings at 1 kHz**

| Frequency Weighting | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Slow                | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |
| Leq                 | 94.0                | 0.0                 | 0.1                            | 0.20              | 0.2                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 122                    | 122.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 121                    | 121.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 120                    | 120.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 119                    | 119.1               | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 114                    | 114.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 109                    | 109.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 104                    | 104.0               | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 99                     | 99.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 94                     | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 89                     | 89.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 84                     | 83.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 79                     | 78.9                | -0.1                | 1.1                            | 0.30              | 0.3                                                |
| 74                     | 74.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 69                     | 69.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 64                     | 64.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 59                     | 59.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 54                     | 54.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 49                     | 49.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 44                     | 44.1                | 0.1                 | 1.1                            | 0.30              | 0.3                                                |
| 39                     | 39.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 34                     | 34.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 33                     | 33.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |

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**7. Level linearity on the reference level range**

| Anticipated value (dB) | Measured Value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 32                     | 32.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 31                     | 31.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |
| 30                     | 30.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |

**8. Level linearity including the level range control**

At reference sound level on the reference level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 94.0                   | 94.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |

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**10. Peak C sound level**

| Number of cycles in test signal | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|---------------------------------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Complete cycle                  | 125.4                  | 125.3               | -0.1                | 3.0                            | 0.20              | 0.35                                               |
| Positive half cycle             | 124.4                  | 124.3               | -0.1                | 2.0                            | 0.20              | 0.35                                               |
| Negative half cycle             | 124.4                  | 124.2               | -0.2                | 2.0                            | 0.20              | 0.35                                               |

**11. Overload indication**

| Measured value (dB)     |                         | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------------------------|-------------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Positive one-half cycle | Negative one-half cycle |                     |                                |                   |                                                    |
| 132.5                   | 132.5                   | 0.0                 | 1.5                            | 0.20              | 0.25                                               |

**12. High-level stability**

| Time  | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|-------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Begin | 129.0               | 0.0                 | 0.3                            | 0.10              | 0.1                                                |
| End   | 129.0               |                     |                                |                   |                                                    |

Calibrated by :

Approved by :

Date of Calibration : 24-27 Feb.2025

Date of Issue : 28 Feb.2025

**Electrical and Electronic Standards Laboratory**  
**Industrial Metrology and Testing Service Centre**

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**8. Level linearity including the level range control**

At reference level at 5 dB greater than the under-range on a level range

| Range  | Anticipated value (dB) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|--------|------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| 40-130 | 45.0                   | 45.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 30-120 | 35.0                   | 35.0                | 0.0                 | 1.1                            | 0.30              | 0.3                                                |
| 20-110 | 25.0                   | 25.5                | 0.5                 | 1.1                            | 0.30              | 0.3                                                |
| 20-100 | 25.0                   | 25.4                | 0.4                 | 1.1                            | 0.30              | 0.3                                                |
| 20-90  | 25.0                   | 25.3                | 0.3                 | 1.1                            | 0.30              | 0.3                                                |
| 20-80  | 25.0                   | 25.2                | 0.2                 | 1.1                            | 0.30              | 0.3                                                |

**9. Tone burst response**

| Time Weighting | Toneburst Duration, T <sub>b</sub> (ms) | Measured value (dB) | Deviated value (dB) | Acceptance limit class 2 (±dB) | Uncertainty (±dB) | Maximum-permitted uncertainty of measurement (±dB) |
|----------------|-----------------------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------------------------------------|
| Fast           | 200                                     | 115.9               | -0.1                | ±1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 2                                       | 98.1                | -0.9                | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                                    | 89.2                | -0.8                | +1.5; -5.0                     | 0.20              | 0.3                                                |
| Slow           | 200                                     | 109.5               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                                       | 89.8                | -0.2                | +1.0; -5.0                     | 0.20              | 0.3                                                |
| SEL            | 200                                     | 109.9               | -0.1                | ±1.0                           | 0.20              | 0.3                                                |
|                | 2                                       | 90.0                | 0.0                 | +1.0; -2.5                     | 0.20              | 0.3                                                |
|                | 0.25                                    | 80.9                | -0.1                | +1.5; -5.0                     | 0.20              | 0.3                                                |

Date of Calibration : 24-27 Feb.2025

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

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

FMBL.MTC.002 Rev.5

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**Airgas Specialty Gases**  
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600 Union Landing Road  
Cinnaminson, NJ 08077-0000  
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**CERTIFICATE OF ANALYSIS**  
**Grade of Product: EPA Protocol**

Part Number: E03N899E80A0020 Reference Number: 82-401285019-1  
Cylinder Number: LL193324 Cylinder Volume: 83.4 CF  
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2215 PSIG  
PGVP Number: B52018 Valve Outlet: 660  
Gas Code: NO, NOX, SO2, BALN Certification Date: Sep 05, 2018

Expiration Date: Sep 05, 2026

Certification performed in accordance with EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012) document EPA 600/R-12/021. Using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.  
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals

| Component      | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates            |
|----------------|-------------------------|----------------------|-----------------|----------------------------|------------------------|
| NOX            | 50.00 PPM               | 50.71 PPM            | G1              | ±1.4% NIST Traceable       | 08/27/2018, 09/05/2018 |
| NITRIC OXIDE   | 50.00 PPM               | 50.67 PPM            | G1              | ±1.4% NIST Traceable       | 08/27/2018, 09/05/2018 |
| SULFUR DIOXIDE | 50.00 PPM               | 50.54 PPM            | G1              | ±1.0% NIST Traceable       | 08/27/2018, 09/05/2018 |
| NITROGEN       | Balance                 |                      |                 |                            |                        |

| Type | Lot ID     | Cylinder No | Concentration                       | Uncertainty | Expiration Date |
|------|------------|-------------|-------------------------------------|-------------|-----------------|
| NTRM | 16060525   | CC442585    | 50.42 PPM NITRIC OXIDE/NITROGEN     | ±1.0%       | Jun 27, 2020    |
| PRM  | 12368      | 5604119     | 29.86 PPM NITROGEN DIOXIDE/AIR      | ±1.5%       | Jun 02, 2017    |
| GMIS | 7042010104 | CC503941    | 5.101 PPM NITROGEN DIOXIDE/NITROGEN | ±1.0%       | Jun 01, 2020    |
| NTRM | 14010327   | KAL004378   | 49.08 PPM SULFUR DIOXIDE/NITROGEN   | ±1.0%       | Apr 17, 2024    |

The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.

| Instrument/Make/Model       | Analytical Principle | Last Multipoint Calibration |
|-----------------------------|----------------------|-----------------------------|
| Nicoret 6700 APW1100391 NO  | FTIR                 | Aug 09, 2018                |
| Nicoret 6700 APW1100391 NO2 | FTIR                 | Aug 31, 2018                |
| Nicoret 6700 APW1100391 SO2 | FTIR                 | Aug 30, 2018                |

Triad Data Available Upon Request  
NOTES: PO# 5218003935

Net weight: 2736 grams  
Gross weight: 17393 grams

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol Document EPA-600/R-12/031. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2008 and relate only to items identified on this certificate. Values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 3082.05

Approved for Release

**CERTIFICATE OF ANALYSIS**  
**Grade of Product: EPA Protocol**

Part Number: E03N899E80A0020      Reference Number: 82-401285019-1  
 Cylinder Number: LL193324      Cylinder Volume: 83.4 CF  
 Laboratory: 124 - Rverton (SAP) - NJ      Cylinder Pressure: 2215 PSIG  
 PGVP Number: B52018      Valve Outlet: 660  
 Gas Code: NO,NOX,SO2,BALN      Certification Date: Sep 05, 2018  
 Expiration Date: **Sep 05, 2026**

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.  
 Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

**ANALYTICAL RESULTS**

| Component      | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates            |
|----------------|-------------------------|----------------------|-----------------|----------------------------|------------------------|
| NOX            | 50.00 PPM               | 50.71 PPM            | G1              | +/- 1.4% NIST Traceable    | 08/27/2018, 09/05/2018 |
| NITRIC OXIDE   | 50.00 PPM               | 50.67 PPM            | G1              | +/- 1.4% NIST Traceable    | 08/27/2018, 09/05/2018 |
| SULFUR DIOXIDE | 50.00 PPM               | 50.54 PPM            | G1              | +/- 1.0% NIST Traceable    | 08/27/2018, 09/05/2018 |
| NITROGEN       | Balance                 |                      |                 |                            |                        |

**CALIBRATION STANDARDS**

| Type | Lot ID     | Cylinder No | Concentration                       | Uncertainty | Expiration Date |
|------|------------|-------------|-------------------------------------|-------------|-----------------|
| NTRM | 16050525   | CC442585    | 50.42 PPM NITRIC OXIDE/NITROGEN     | +/- 0.8%    | Jun 27, 2020    |
| PRM  | 12368      | 5604119     | 29.86 PPM NITROGEN DIOXIDE/AIR      | +/- 1.5%    | Jun 02, 2017    |
| GMS  | 7042010104 | CC503941    | 5.101 PPM NITROGEN DIOXIDE/NITROGEN | +/- 2.0%    | Jun 01, 2020    |
| NTRM | 14010327   | KAL004378   | 49.08 PPM SULFUR DIOXIDE/NITROGEN   | +/- 1.0%    | Apr 17, 2024    |

The SRM, PRM or RGM noted above is only in reference to the GMS used in the assay and not part of the analysis.

**ANALYTICAL EQUIPMENT**

| Instrument/Make/Model       | Analytical Principle | Last Multipoint Calibration |
|-----------------------------|----------------------|-----------------------------|
| Nicodet 6700 APW1100391 NO  | FTIR                 | Aug 09, 2018                |
| Nicodet 6700 APW1100391 NO2 | FTIR                 | Aug 31, 2018                |
| Nicodet 6700 APW1100391 SO2 | FTIR                 | Aug 30, 2018                |

Triad Data Available Upon Request

NOTES: PO# 5218003935

Net weight: 2736 grams  
Gross weight: 17393 grams

This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol Document EPA-600/R-12/531. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2008 and relate only to items identified on this certificate. We are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT No. 3082.05

*[Signature]*  
Approved for Release

ภาคผนวก ฉ  
สำเนาหนังสืออนุญาตขึ้นทะเบียน  
ห้องปฏิบัติการวิเคราะห์เอกชน

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บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง  
คอนซัลแตนท์ จำกัด

ที่ อก ๐๓๑๐(๑)/ ๑๐๘๕



กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๖๐๐

๐๗ กุมภาพันธ์ ๒๕๖๕

เรื่อง ต่อยางหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงบุคลากร และขอใบสารมลพิษของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๓ ธันวาคม ๒๕๖๔

- สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๔๐ ราย
- ๒. รายชื่อเจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑๔๓ ราย
- ๓. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม

ตามคำขอที่อ้างถึง บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด ขอต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๔๕ สถานที่เลขที่ ๓ ซอยสุขุมสุข ๕๓ ถนนสุขุมวิท แขวงบางจาก เขตพระโขนง กรุงเทพมหานคร ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด ต่อยางหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

- ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๔๐ ราย ตามสิ่งที่ส่งมาด้วย ๑
- ข. เจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑๔๓ ราย ตามสิ่งที่ส่งมาด้วย ๒
- ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำ/น้ำเสีย น้ำใต้ดิน อากาศเสีย สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว และดิน ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะหมดอายุในวันที่ ๒ กุมภาพันธ์ ๒๕๖๖ หากประสงค์จะต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงานอุตสาหกรรมภายใน ๖๐ วัน ก่อนวันสิ้นสุดของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

จึงเรียนมาเพื่อทราบ



กองวิจัยและเคอเนกับมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบมลพิษและทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๐๓-๕

โทรสาร ๐ ๒๕๓๐ ๖๓๑๒ ต่อ ๒๑๓๕

ไปรษณีย์อิเล็กทรอนิกส์ sarabang@dlw.mail.go.th



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- ๓๖) นายนาเคนทร์ พันธุ์ชาติกุล
- ๓๗) นายกานต์พงษ์ บุญพวง
- ๓๘) นางสุธรรมา แก้วชื่อนอก
- ๓๙) นางสาวสรวิมล โยเซยชอุทัยพัฒกุล
- ๔๐) นางมานิตา เข้มมี

- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๕๐
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๕๑
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๕๒
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๕๓
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๕๔

๐๗/๒

เอกสารแนบท้ายหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕  
ที่ อก ๐๓๑๐(๑)/ ๑๐๘๕ ลงวันที่ ๐๗ กุมภาพันธ์ ๒๕๖๕

ก. ผู้ควบคุมห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๔๐ ราย

- ๑) นางสาวกฤตวรรณ กิทธิกรกุล
- ๒) นายณรงค์ นิรมิต
- ๓) นางสาวนันทิศา บุญไชย
- ๔) นางปิยะพัชร์ สุทธิธรรมสาร
- ๕) นางสาวเบญจวรรณ วีริโยทัย
- ๖) นายพนรัตน์ วงศ์บุญรักษาชัย
- ๗) นางสาวฉวีวรรณ บุญลา
- ๘) นายสุวิทย์ จอดนอก
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- ๒๘) นายกรวิทย์ เขียวศรีสกุล
- ๒๙) นายสุทธิเชิระ อรุณจันทร์
- ๓๐) นางสาวทัศนีย์ อ่อนคำ
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- ๓๓) นางสาวศศิภากร เหมือนเร่
- ๓๔) นางกวีลาดี ชำนิล
- ๓๕) นางสาวพรวิภา ธีระจินดา

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- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๖
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๗
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๘
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๙

เอกสารแนบท้ายหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท ยูโนเด็ค แอนนาลิสต์ แอนด์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๔๕  
ที่ อก ๐๓๑๐(๑)/ ๑๐๘๕ ลงวันที่ ๐๗ กุมภาพันธ์ ๒๕๖๕

ข. เจ้าหน้าที่ห้องปฏิบัติการวิเคราะห์เอกชน จำนวน ๑๔๓ ราย

- ๑) นายสุธนต์ พันสิงห์
- ๒) นายพีรณัฐ เจริญผล
- ๓) นางสาววิไลลักษณ์ เกโลสง
- ๔) นายสมชาติ อุทุมรัตน์
- ๕) นางสาวปรมภรณ์ ทองแก้ว
- ๖) นางสาวกัญญา สมพงษ์
- ๗) นางสาววรรณิ์ สายบุญเรือน
- ๘) นายกฤษณพงษ์ นามทิพย์
- ๙) นางสาวอาภากรณ์ อ่อนคง
- ๑๐) นายกิตติศักดิ์ ทรงจำรัส
- ๑๑) นางสาวอัชชินทร์ บุญคง
- ๑๒) นางสาวพรทิพย์ แว่นทอง
- ๑๓) นายอภิวิชญ์ ท่วงที
- ๑๔) นายมานิตย์ ปานโง้ง
- ๑๕) นายทศพร ธนะพิรุณท์
- ๑๖) นางสาวกัญญาณี โยธา
- ๑๗) นางสาวเกลิ สุธรี
- ๑๘) นางสาวชนอนัญ อภิพัทธ์ปภา
- ๑๙) นายศิริพัชร จงพวงเกียรติ
- ๒๐) นางสาวสุภาวดี อินยาศิริ
- ๒๑) นายพงศ์เทพ เหล่าขจร
- ๒๒) นายวิญชัย พันทุกษ์
- ๒๓) นางสาวพัชริภา คดีพิศาล
- ๒๔) นางสาวนงวิภา เสือคำจันทร์
- ๒๕) นายพีระพัฒน์ บัญญัติศิลป์
- ๒๖) นายชัชวาลย์ เลื่อนทอง
- ๒๗) นายณภินันท์ ฐนธรรมรัตน์
- ๒๘) นายกันนิกร รโยส
- ๒๙) นายปริญญา กมลเกษียา
- ๓๐) นายธีรวิวัฒน์ มาระโพธิ์ศรี
- ๓๑) นายบุญฤกษ์ ก้อนสิน
- ๓๒) นายพรชบุฒิ ไกรสกุล
- ๓๓) นายอภิเดช แสงจันทร์
- ๓๔) ว่าที่ร้อยตรีณัฐพงษ์ เมื่องชัย
- ๓๕) นายอนันต์ เลิศประเสริฐ

- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๑
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๒
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๓
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๔
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๕
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๖
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๗
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๘
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๑๙
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๐
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๑
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๒
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๓
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๔
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๕
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๖
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๗
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๘
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๒๙
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๐
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๑
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๒
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๓
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๔
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๕
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๖
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๗
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๘
- ทะเบียนเลขที่ ๖-๑๔๕-๙-๐๐๓๙

- ๓๖) นางสาวนิภาพร ชื่นทนต์
- ๓๗) นายรณภพ ภูตระกูลพัฒนา
- ๓๘) นายสมพงษ์ สกุลไทย
- ๓๙) นายสุวิวัฒน์ นิธิจิตพิบูลย์
- ๔๐) นายอัมรินทร์ อภิสิทธิ์
- ๔๑) นายเอกภูมิ เสนอใจ
- ๔๒) นายสุชสิทธิ์ บุญเลี้ยง
- ๔๓) นายอนันต์ หวานเสนาะ
- ๔๔) นายอภิสิทธิ์ ศรีวงแก้ว
- ๔๕) ว่าที่ร้อยตรีสุวิทย์ แก้ววาทิกุล
- ๔๖) นางสาวนารินทร์ สานนท์
- ๔๗) นายศุภกร รัตนวงศ์
- ๔๘) นางสาวจินตสุภา เปลี่ยนศรี
- ๔๙) นางสาวเนตรนภา กมลบุรินทร์
- ๕๐) นางสาวอรวิภา พรหมศรี
- ๕๑) นายจิรวัฒน์ สุขเกษม
- ๕๒) นายกิตติพงษ์ สอนชัยภูมิ
- ๕๓) นายจุมพล สวนเพชร
- ๕๔) นางสาวพัชรภรณ์ แสงฟ้า
- ๕๕) นายวิวัฒน์ เหล่างาม
- ๕๖) นายอิทธิพงษ์ ศรีวิเศษ
- ๕๗) นางสาวกรรณิการ์ ลำลีหา
- ๕๘) นางสาวณัฐชา พรหมศิริ
- ๕๙) นายณัฐสิทธิ์ ศรีพิมพ์
- ๖๐) นางสาวลลิตาภา ชื่นทรสุข
- ๖๑) นายศักดิ์ศศิธร นุ่มนัม
- ๖๒) นายวรพงษ์ นมทจันทร์
- ๖๓) นางสาวชนภา มาศมมาตร
- ๖๔) นายณัฐชัชพร พรหมอารักษ์
- ๖๕) นายชินนรินทร์ พานแก้ว
- ๖๖) นายปรีชาพล โสภาก
- ๖๗) นายวิวัฒน์ แสงงาม
- ๖๘) นายอาทิตย์ อุทุมผล
- ๖๙) นายอิทธิเดช ใจบุญ
- ๗๐) นายณวัฒน์ พงษ์ศรีราษฎร์
- ๗๑) นายเสฏฐวุฒิ เอมกลิ่นบัว
- ๗๒) นางสาวนาตยา หวานโนเมือง
- ๗๓) นางสาวทิมสุวรรณ ลิขมา

- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๘
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๒
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๓
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๘
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๐
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๒
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๓
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๘
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๖๙
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๐
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๒
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๓
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๘
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๗๙
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๐
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๒
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๓
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๘๘

- ๗๔) นายนิพนธ์วัฒน์ วงศ์คำ
- ๗๕) นายประพันธ์ฤทธิ์ เมื่อนาง
- ๗๖) นางสาวกัญญา ลำเลิศ
- ๗๗) นางสาวนภาพร ชื่นกลุ่ม
- ๗๘) นางสาวบุญญา นอมฤตกุล
- ๗๙) นายอมรพล อรรถลักษณ์
- ๘๐) นางสาวศรित्रพร ทองขาว
- ๘๑) นางสาวณิชากร คุณชาติภิรสร
- ๘๒) นางสาววิมลวรรณ คำตัน
- ๘๓) นายคุณานนท์ ฤทธาคนานนท์
- ๘๔) นายชาญณรงค์ อ่ำลอย
- ๘๕) นางสาวจิตมาศ ศรีวรรณ
- ๘๖) นายสุจิต โปษนิเงิน
- ๘๗) นายเจษฎา ช่างทวี
- ๘๘) นายยศ เหมชอุสิน
- ๘๙) นายสุเชษฐ์ หล้าโท
- ๙๐) นายชัย บัวคุด
- ๙๑) นางสาวอรอุภา ประสานศรี
- ๙๒) นายพนพล เนียมเมือง
- ๙๓) นายศุภกร สวนศรี
- ๙๔) นายคณพล ศิลานนท์
- ๙๕) นายโชคชัย ทุมโล
- ๙๖) นายวิวัฒน์ อรรณสุวรรณ
- ๙๗) นายนิพนธ์พงศ์ ชะชุมทศ
- ๙๘) นางสาวณัฐชญา พลนิกรกิจ
- ๙๙) นางสาวนภาพร ทองบุรินทร์
- ๑๐๐) นางสาวพรชญา ชัยธรรมดิษฐ์
- ๑๐๑) นางสาวเพ็ญพิชชา รอดทอง
- ๑๐๒) นางสาวณัฐชา แสงสว่าง
- ๑๐๓) นายกรติ สีอาจ
- ๑๐๔) นายศุภพร ศรีศรี
- ๑๐๕) นางสาวสุวิมลลา เปลี่ยนเงิน
- ๑๐๖) นางสาวพรหมทิพา อะโนนาม
- ๑๐๗) นายอนันต์ มุดอ
- ๑๐๘) นางสาวพรพิมล ประชาพันธุ์
- ๑๐๙) นายวิวัฒน์ บุญฤทธิ
- ๑๑๐) นางสาวณัฐชา แก้วภาพ
- ๑๑๑) นายสิทธิพล พร้อมพองษ์บุญ
- ๑๑๒) นางสาวนันทิชา กลิ่นหนู

- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๒
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๓
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๘
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๙
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๐
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๒
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๓
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๘
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๙
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๐
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๒
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๓
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๘
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๓๙
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๐
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๒
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๓
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๘
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๔๙
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๐
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๑
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๒
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- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๔
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๕
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๖
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๗
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๕๘

- ๑๑๓) นางสาวปิยดา พูเจ็ทเชื้อ
- ๑๑๔) นางสาวลลิตาวัลย์ โพธิ์พันธ์
- ๑๑๕) นายอาทิตย์ ตาภา
- ๑๑๖) นางสาวบุญชยา บุญอนนศรี
- ๑๑๗) นางสาวพัชรารัตน์ ชื่นอุบล
- ๑๑๘) นางสาวนฤกร ใต้น้ำกวย
- ๑๑๙) นางสาวปวีณา แคนชบ
- ๑๒๐) นางสาวนันทิชา พรหมกัญญา
- ๑๒๑) นางสาวกมลชนก ปูนคำ
- ๑๒๒) นางสาวปวีณิดา ทองใบ
- ๑๒๓) นายชัยวัฒน์ ชื่นชนะ
- ๑๒๔) นางสาวกัญญา สิงห์แก้ว
- ๑๒๕) นางสาวอารีนา มณีเชีย
- ๑๒๖) นายสุภาพกรณ์ อุบล
- ๑๒๗) นางสาวชามันตา กิมาคม
- ๑๒๘) นายอนันต์นรินทร์ ยาเหลือ
- ๑๒๙) นายวิเศษพงษ์ แสงทำนง
- ๑๓๐) นางสาวปิยะณัฐชญา สำนภาพงษ์
- ๑๓๑) นางสาวนันทิสร ศรีสถาน
- ๑๓๒) นางสาวจุริวัณน์ โสแทน
- ๑๓๓) นายวิวัฒน์ ทรวงลา
- ๑๓๔) นายอนันต์พงษ์ ปลั่งกลาง
- ๑๓๕) นายณภัทร เต็มบุตร
- ๑๓๖) นางสาวจิตภา กุษา
- ๑๓๗) นางสาวณัฐชญาทิพย์ สังข์ทอง
- ๑๓๘) นางสาวชาธิสา บัญญู
- ๑๓๙) นายภูวณัฐ เหมมา
- ๑๔๐) ว่าที่ร้อยตรีวิมลพร ประทุมเขตต์
- ๑๔๑) นายอนุทร พลสำโรง

- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๖๐
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๖๑
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- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๑๙๙
- ทะเบียนเลขที่ ๖-๑๕๕-๖-๐๐๒๐๐

เอกสารแนบท้ายหนังสือต่ออายุรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท ยูโนเด็ค แอแนลลิติก แอนด์ เอ็นจิเนียริ่ง คอนซัลแตนท์ จำกัด เลขทะเบียน ๖-๑๕๕  
ที่ อก ๐๓๑๐(๑) ๖ ๐ ๘ ๕ ลงวันที่ ๐๗ กุมภาพันธ์ ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๑๗ รายการ

| ลำดับ | สารมลพิษ                  | วิธีวิเคราะห์                                                                                                                                                    |
|-------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Aldrin                    | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 2     | Arsenic                   | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>         |
| 3     | Barium                    | Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                                                      |
| 4     | α-BHC                     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 5     | β-BHC                     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 6     | δ-BHC                     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 7     | γ-BHC                     | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 8     | Biochemical Oxygen Demand | 1) 5-Day BOD Test, Azide Modification Method <sup>(4)</sup><br>2) 5-Day BOD Test, Membrane Electrode Method <sup>(4)</sup>                                       |
| 9     | Cadmium                   | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                 |
| 10    | Chemical Oxygen Demand    | 1) Closed Reflux, Titrimetric Method <sup>(4)</sup><br>2) Closed Reflux, Colorimetric Method <sup>(4)</sup><br>3) Open Reflux, Titrimetric Method <sup>(4)</sup> |
| 11    | Chlordane                 | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 12    | Chromium                  | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                 |
| 13    | Color                     | ADMI Weighted-Ordinate Spectrophotometric Method <sup>(4)</sup>                                                                                                  |
| 14    | Copper                    | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                 |
| 15    | Cyanide                   | 1) Distillation, Colorimetric Method <sup>(4)</sup><br>2) Total Cyanide after Distillation, by Flow Injection Analysis Method <sup>(4)</sup>                     |
| 16    | o,p'-DDT                  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 17    | 4,4'-DDD                  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 18    | 4,4'-DDE                  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 19    | 4,4'-DDT                  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 20    | Dieldrin                  | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 21    | Endosulfan I              | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 22    | Endosulfan II             | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 23    | Endosulfan sulfate        | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 24    | Endrin                    | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |

| ลำดับ | สารมลพิษ                | วิธีวิเคราะห์                                                                                                                                                                                        |
|-------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 25    | Endrin aldehyde         | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                                                                  |
| 26    | Formaldehyde            | Distillation, Colorimetric Method <sup>(2)</sup>                                                                                                                                                     |
| 27    | Free Chlorine           | 1) Iodometric Method <sup>(4)</sup><br>2) DPD Ferrous Titrimetric Method <sup>(4)</sup>                                                                                                              |
| 28    | Heptachlor              | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                                                                  |
| 29    | Heptachlor Epoxide      | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                                                                  |
| 30    | Hexavalent Chromium     | Colorimetric Method <sup>(4)</sup>                                                                                                                                                                   |
| 31    | Lead                    | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                     |
| 32    | Manganese               | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                     |
| 33    | Mercury                 | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup>                                                                                                                          |
| 34    | Methoxychlor            | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                                                                  |
| 35    | Nickel                  | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                     |
| 36    | Oil & Grease            | 1) Liquid-Liquid, Partition-Gravimetric Method <sup>(4)</sup><br>2) Soxhlet Extraction Method <sup>(4)</sup>                                                                                         |
| 37    | pH                      | Electrometric Method <sup>(4)</sup>                                                                                                                                                                  |
| 38    | Phenols                 | 1) Distillation, Chloroform Extraction Method <sup>(4)</sup><br>2) Distillation, Direct Photometric Method <sup>(4)</sup>                                                                            |
| 39    | Selenium                | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                             |
| 40    | Sulfide                 | 1) Iodometric Method <sup>(4)</sup><br>2) Methylene Blue Method <sup>(4)</sup>                                                                                                                       |
| 41    | Temperature             | Laboratory and Field Methods <sup>(4)</sup>                                                                                                                                                          |
| 42    | Total Dissolved Solids  | Dried at 180 °C <sup>(4)</sup>                                                                                                                                                                       |
| 43    | Total Kjeldahl Nitrogen | Semi-Micro-Kjeldahl Method <sup>(4)</sup>                                                                                                                                                            |
| 44    | Total Suspended Solids  | Dried from 103 to 105 °C <sup>(4)</sup>                                                                                                                                                              |
| 45    | Trivalent Chromium      | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> |
| 46    | Zinc                    | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                     |

| ลำดับ | สารมลพิษ             | วิธีวิเคราะห์                                                                                                                                                       |
|-------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Acenaphthene         | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                              |
| 2     | Acetone              | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 3     | Aldrin               | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 4     | Anthracene           | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 5     | Antimony             | Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                                                         |
| 6     | Arsenic              | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>            |
| 7     | Atrazine             | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 8     | Barium               | Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                                                         |
| 9     | Benz(a)anthracene    | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 10    | Benzene              | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 11    | Benzo(b)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 12    | Benzo(k)fluoranthene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 13    | Benzoic acid         | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |

14 Benzo(a)pyrene...

| ลำดับ | สารมลพิษ                   | วิธีวิเคราะห์                                                                                                                                                                                                          |
|-------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14    | Benzo(a)pyrene             | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                    |
| 15    | Benzo(g,h,i)perylene       | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                    |
| 16    | Beryllium                  | Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                                                                                                            |
| 17    | Bis(2-chloroethyl)ether    | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                 |
| 18    | Bis(2-ethylhexyl)phthalate | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                 |
| 19    | Bromodichloromethane       | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                            |
| 20    | Bromoform                  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                            |
| 21    | Butanol                    | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                            |
| 22    | Butyl benzyl phthalate     | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                 |
| 23    | Cadmium                    | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>(4)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> |
| 24    | Carbazole                  | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                 |
| 25    | Carbon disulfide           | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                            |
| 26    | Carbon tetrachloride       | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                            |
| 27    | Chlordane                  | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                    |
| 28    | p-Chloroaniline            | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                 |

| ลำดับ | สารมลพิษ              | วิธีวิเคราะห์                                                                                                                                                                                        |
|-------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 29    | Chlorobenzene         | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                          |
| 30    | Chlorodibromomethane  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                          |
| 31    | Chloroform            | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                          |
| 32    | 2-Chlorophenol        | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                               |
| 33    | Chromium              | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                     |
| 34    | Chromium (III)        | 1) Digestion, Direct Air-Acetylene Flame Method; Colorimetric Method; Calculation <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation <sup>(4)</sup> |
| 35    | Chromium (VI)         | Colorimetric Method <sup>(4)</sup>                                                                                                                                                                   |
| 36    | Chrysene              | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                  |
| 37    | Cyanide               | Distillation, Colorimetric Method <sup>(4)</sup>                                                                                                                                                     |
| 38    | 2,4-D                 | Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup>                                                                                                                                  |
| 39    | DDD                   | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                  |
| 40    | DDE                   | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                  |
| 41    | DDT                   | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                  |
| 42    | Dibenz(a,h)anthracene | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                  |

| ลำดับ | สารมลพิษ                   | วิธีวิเคราะห์                                                                                                                                                       |
|-------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 43    | Di-n-butyl phthalate       | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 44    | 1,2-Dichlorobenzene        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 45    | 1,3-Dichlorobenzene        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 46    | 1,4-Dichlorobenzene        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 47    | 3,3'-Dichlorobenzidine     | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 48    | 1,1-Dichloroethane         | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 49    | 1,2-Dichloroethane         | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 50    | 1,1-Dichloroethylene       | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 51    | cis-1,2-Dichloroethylene   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 52    | trans-1,2-Dichloroethylene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 53    | 2,4-Dichlorophenol         | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 54    | 1,2-Dichloropropane        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 55    | 1,3-Dichloropropane        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 56    | 1,3-Dichloropropene        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 57    | Dieldrin                   | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 58    | Diethyl phthalate          | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 59    | 2,4-Dimethylphenol         | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 60    | 2,4-Dinitrophenol          | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |

| ลำดับ | สารมลพิษ                 | วิธีวิเคราะห์                                                                                                                                                       |
|-------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 61    | 2,4-Dinitrotoluene       | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 62    | 2,6-Dinitrotoluene       | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 63    | Di-n-Octyl phthalate     | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 64    | Endosulfan               | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 65    | Endrin                   | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 66    | Ethylbenzene             | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 67    | Fluoranthene             | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 68    | Fluorene                 | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 69    | Heptachlor               | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 70    | Heptachlor epoxide       | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 71    | Hexachlorobenzene        | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 72    | Hexachloro-1,3-butadiene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 73    | n-Hexane                 | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |

| ลำดับ | สารมลพิษ                  | วิธีวิเคราะห์                                                                                                                                                                                                          |
|-------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 74    | α-HCH                     | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                    |
| 75    | β-HCH                     | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                    |
| 76    | γ-HCH                     | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                    |
| 77    | Hexachlorocyclopentadiene | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                 |
| 78    | Hexachloroethane          | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                 |
| 79    | Indeno(1,2,3-cd)pyrene    | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                    |
| 80    | Isophorone                | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                 |
| 81    | Lead                      | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Electrothermal Atomic Absorption Spectrometric Method <sup>(4)</sup><br>3) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> |
| 82    | Manganese                 | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                                       |
| 83    | Mercury                   | Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(4)</sup>                                                                                                                                            |
| 84    | Methanol                  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                            |
| 85    | Methoxychlor              | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                    |
| 86    | Methyl bromide            | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                                                                            |

| ลำดับ | สารมลพิษ                                                                                                                    | วิธีวิเคราะห์                                                                                                                                                       |
|-------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 87    | Methylene chloride                                                                                                          | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 88    | 2-Methylphenol                                                                                                              | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 89    | 2-Methylnaphthalene                                                                                                         | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 90    | Methyl tert-butyl ether                                                                                                     | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 91    | Naphthalene                                                                                                                 | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 92    | Nickel                                                                                                                      | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                    |
| 93    | Nitrobenzene                                                                                                                | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 94    | N-Nitrosodiphenylamine                                                                                                      | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 95    | N-Nitrosodi-n-propylamine                                                                                                   | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 96    | Polychlorinated Biphenyls<br>- PCB 1016<br>- PCB 1221<br>- PCB 1232<br>- PCB-1242<br>- PCB-1248<br>- PCB-1254<br>- PCB-1260 | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 97    | Pentachlorophenol                                                                                                           | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                              |
| 98    | pH                                                                                                                          | Electrometric Method <sup>(4)</sup>                                                                                                                                 |
| 99    | Phenanthrene                                                                                                                | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |

| ลำดับ | สารมลพิษ                                 | วิธีวิเคราะห์                                                                                                                                                       |
|-------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 100   | Phenol                                   | 1) Distillation, Chloroform Extraction Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>           |
| 101   | Pyrene                                   | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 102   | Selenium                                 | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>            |
| 103   | Silver                                   | Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                                                         |
| 104   | Styrene                                  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 105   | 1,1,2,2-Tetrachloroethane                | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 106   | Tetrachloroethylene                      | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 107   | Toluene                                  | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 108   | Toxaphene                                | 1) Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(4)</sup><br>2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup> |
| 109   | TPH (C <sub>3</sub> - C <sub>6</sub> )   | 1) Purge and Trap, Gas Chromatographic Method <sup>(12,22)</sup><br>2) Purge and Trap, Gas Chromatographic/Mass spectrometric Method <sup>(12,27)</sup>             |
| 110   | TPH (C <sub>8</sub> - C <sub>16</sub> )  | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(9,22)</sup>                                                                            |
| 111   | TPH (C <sub>16</sub> - C <sub>35</sub> ) | Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(9,22)</sup>                                                                            |
| 112   | 1,2,4-Trichlorobenzene                   | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 113   | 1,1,1-Trichloroethane                    | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 114   | 1,1,2-Trichloroethane                    | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |
| 115   | Trichloroethylene                        | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                                                         |

| ลำดับ | สารมลพิษ               | วิธีวิเคราะห์                                                                                                                    |
|-------|------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 116   | 2,4,5-Trichlorophenol  | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                           |
| 117   | 2,4,6-Trichlorophenol  | Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                           |
| 118   | 1,3,5-Trimethylbenzene | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                      |
| 119   | Vanadium               | Digestion, Inductively Coupled Plasma Method <sup>(4)</sup>                                                                      |
| 120   | Vinyl acetate          | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                      |
| 121   | Vinyl chloride         | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                      |
| 122   | m-Xylene               | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                      |
| 123   | o-Xylene               | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                      |
| 124   | p-Xylene               | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                      |
| 125   | Xylene (Total)         | Purge and Trap Gas Chromatographic/Mass Spectrometric Method <sup>(4)</sup>                                                      |
| 126   | Zinc                   | 1) Digestion, Direct Air-Acetylene Flame Method <sup>(4)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(4)</sup> |

ตารางสืบ (ปดองระบอบ) จำนวน 25 รายการ

| ลำดับ | สารมลพิษ        | วิธีวิเคราะห์                                                                                                                                                                                      |
|-------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Antimony        | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                                                                                                                   |
| 2     | Arsenic         | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(5)</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> |
| 3     | Cadmium         | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>(5)</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                         |
| 4     | Carbon Monoxide | Instrumental Analyzer Method <sup>(5)</sup>                                                                                                                                                        |
| 5     | Chlorine        | Isokinetic Sampling, Ion Chromatographic Method <sup>(5)</sup>                                                                                                                                     |
| 6     | Chromium        | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>(5)</sup>                                                                                                                |

| ลำดับ | สารมลพิษ           | วิธีวิเคราะห์                                                                                                                                                                                      |
|-------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6     | Chromium (ต้อ)     | 2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                                                                                                                |
| 7     | Cobalt             | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                                                                                                                   |
| 8     | Copper             | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>(5)</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                         |
| 9     | Cresol             | Absorption Sampling, Gas Chromatographic Method <sup>(5)</sup>                                                                                                                                     |
| 10    | Dioxins/Furans     | Isokinetic Sampling <sup>(5)</sup>                                                                                                                                                                 |
| 11    | Hydrogen Chloride  | Isokinetic Sampling, Ion Chromatographic Method <sup>(5)</sup>                                                                                                                                     |
| 12    | Hydrogen Fluoride  | Isokinetic Sampling, Ion Chromatographic Method <sup>(5)</sup>                                                                                                                                     |
| 13    | Hydrogen Sulfide   | Absorption Sampling, Iodometric Method <sup>(5)</sup>                                                                                                                                              |
| 14    | Lead               | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>(5)</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                         |
| 15    | Manganese          | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>(5)</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                         |
| 16    | Mercury            | Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(5)</sup>                                                                                                   |
| 17    | Nickel             | 1) Isokinetic Sampling, Digestion, Direct Air-Acetylene Flame Method <sup>(5)</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                         |
| 18    | Opacity            | Ringelmann's Method <sup>(1)</sup>                                                                                                                                                                 |
| 19    | Oxides of Nitrogen | 1) Absorption Sampling, Phenoldisulfonic acid Method <sup>(5)</sup><br>2) Instrumental Analyzer Method <sup>(5)</sup>                                                                              |
| 20    | Selenium           | 1) Isokinetic Sampling, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(5)</sup><br>2) Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup> |
| 21    | Sulfur Dioxide     | 1) Absorption Sampling, Barium-Thorin Titrimetric Method <sup>(5)</sup><br>2) Instrumental Analyzer Method <sup>(5)</sup>                                                                          |
| 22    | Sulfuric Acid      | Isokinetic Sampling, Barium-Thorin Titrimetric Method <sup>(5)</sup>                                                                                                                               |

| ลำดับ | สารมลพิษ                    | วิธีวิเคราะห์                                                                                                                   |
|-------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 23    | Total Suspended Particulate | Isokinetic Sampling, Gravimetric Method <sup>(5)</sup>                                                                          |
| 24    | Vanadium                    | Isokinetic Sampling, Digestion, Inductively Coupled Plasma Method <sup>(5)</sup>                                                |
| 25    | Xylene                      | 1) Bag Sampling, Gas Chromatographic Method <sup>(5)</sup><br>2) Adsorption Sampling, Gas Chromatographic Method <sup>(5)</sup> |

สืบปฏิภนหรือวัตถุที่ไม่ใช่แล้ว จำนวน 35 รายการ

| ลำดับ | สารมลพิษ  | วิธีวิเคราะห์                                                                                                                                                                                                                                                                                                                                                            |
|-------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Aldrin    | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                                               |
| 2     | Antimony  | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                                               |
| 3     | Arsenic   | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(3,6,14)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(7,14)</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> |
| 4     | Barium    | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                                               |
| 5     | Beryllium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                                               |
| 6     | Cadmium   | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>(3,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                           |
| 7     | Chlordane | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                                               |

| ลำดับ | สารมลพิษ       | วิธีวิเคราะห์                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8     | Chromium       | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>(3,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                                                                     |
| 9     | Chromium (III) | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation <sup>(3,6,15,17)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation <sup>(3,6,14,17)</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>(7,8,15,17)</sup><br>4) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>(7,8,14,17)</sup> |
| 10    | Chromium (VI)  | 1) Waste Extraction, Colorimetric Method <sup>(3,17)</sup><br>2) Alkaline Digestion, Colorimetric Method <sup>(8,17)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 11    | Cobalt         | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 12    | Copper         | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>(3,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                                                                     |
| 13    | 2,4-D          | 1) Waste Extraction, Gas Chromatographic Method <sup>(3,26)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(26)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 14    | DDD            | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                                                                                                                                                                                                                                                         |

| ลำดับ | สารมลพิษ   | วิธีวิเคราะห์                                                                                                                                                                                                                                                                                                                                  |
|-------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15    | DDE        | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                     |
| 16    | DDT        | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                     |
| 17    | Dieldrin   | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                     |
| 18    | Endrin     | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                     |
| 19    | Heptachlor | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                     |
| 20    | Lead       | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>(3,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> |
| 21    | Lindane    | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                     |
| 22    | Mercury    | 1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(3,19)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(9)</sup><br>4) Digestion, Inductively Coupled P                          |

| ลำดับ | สารมลพิษ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | วิธีวิเคราะห์                                                                                                                                                                                                                                                                                                                                  |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22    | Mercury (ดีไอ)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(20)</sup>                                                                                                                                                                                                                                               |
| 23    | Methoxychlor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                     |
| 24    | Molybdenum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                     |
| 25    | Nickel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>(3,6,13)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> |
| 26    | Polychlorinated Biphenyls<br>- Aroclor 1016<br>- Aroclor 1221<br>- Aroclor 1232<br>- Aroclor 1242<br>- Aroclor 1248<br>- Aroclor 1254<br>- Aroclor 1260<br>- 2-Chlorobiphenyl<br>- 2,3-Dichlorobiphenyl<br>- 2,2',5'-Trichlorobiphenyl<br>- 2,4',5'-Trichlorobiphenyl<br>- 2,2',3,5'-Tetrachlorobiphenyl<br>- 2,2',5,5'-Tetrachlorobiphenyl<br>- 2,3',4,4'-Tetrachlorobiphenyl<br>- 2,2',3,4,5'-<br>Pentachlorobiphenyl<br>- 2,2',4,5,5'-<br>Pentachlorobiphenyl<br>- 2,3,3',4,6-<br>Pentachlorobiphenyl | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,24)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,26)</sup>                                                                                                                                                     |

| ลำดับ | สารมลพิษ                                                                                                                                                                                                                                                                                                                                                                                               | วิธีวิเคราะห์                                                                                                                                                                                                                                                                                                                                                            |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | Polychlorinated Biphenyls(ดีไอ)<br>- 2,2',3,4,4',5'-<br>Hexachlorobiphenyl<br>- 2,2',3,4,5,5'-<br>Hexachlorobiphenyl<br>- 2,2',3,5,5',6-<br>Hexachlorobiphenyl<br>- 2,2',4,4',5,5'-<br>Hexachlorobiphenyl<br>- 2,2',3,3',4,4',5'-<br>Heptachlorobiphenyl<br>- 2,2',3,4,4',5,5'-<br>Heptachlorobiphenyl<br>- 2,2',3,4',5,5',6-<br>Heptachlorobiphenyl<br>- 2,2',3,3',4,4',5,5',6-<br>Nonachlorobiphenyl |                                                                                                                                                                                                                                                                                                                                                                          |
| 27    | Pentachlorophenol                                                                                                                                                                                                                                                                                                                                                                                      | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(3,9,28)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                                                                         |
| 28    | pH                                                                                                                                                                                                                                                                                                                                                                                                     | Electrometric Method <sup>(31,32)</sup>                                                                                                                                                                                                                                                                                                                                  |
| 29    | Selenium                                                                                                                                                                                                                                                                                                                                                                                               | 1) Waste Extraction, Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(3,6,21)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(7,21)</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> |
| 30    | Silver                                                                                                                                                                                                                                                                                                                                                                                                 | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                                               |
| 31    | Thallium                                                                                                                                                                                                                                                                                                                                                                                               | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>2) Digestion, Inductively Coupled                                                                                                                                                                                                                                               |

| ลำดับ | สารมลพิษ          | วิธีวิเคราะห์                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 32    | Toxaphene         | 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method <sup>(3,9,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                                                                                                                                     |
| 33    | Trichloroethylene | 1) Waste Extraction, Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(3,11,27)</sup><br>2) Waste Extraction, Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(3,11,27)</sup><br>3) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>4) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 34    | Vanadium          | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                                                                                                                                                     |
| 35    | Zinc              | 1) Waste Extraction, Digestion, Flame Atomic Absorption Spectrometric Method <sup>(3,6,15)</sup><br>2) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>(3,6,14)</sup><br>3) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>4) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                 |

สิ้น จำนวน 125 รายการ

| ลำดับ | สารมลพิษ     | วิธีวิเคราะห์                                                                                                                                                         |
|-------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Acenaphthene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> |
| 2     | Acetone      | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                      |
| 3     | Aldrin       | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> |
| 4     | Anthracene   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup>                                                                                               |

| ลำดับ | สารมลพิษ             | วิธีวิเคราะห์                                                                                                                                                                     |
|-------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4     | Anthracene (คัส)     | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                        |
| 5     | Antimony             | Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                    |
| 6     | Arsenic              | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(7,14)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                    |
| 7     | Atrazine             | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 8     | Barium               | Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                    |
| 9     | Benz(a)anthracene    | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 10    | Benzene              | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 11    | Benzo(b)fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 12    | Benzo(k)fluoranthene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 13    | Benzoic acid         | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 14    | Benzo(a)pyrene       | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 15    | Benzo(g,h,i)perylene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 16    | Beryllium            | Digestion, Inductively                                                                                                                                                            |

| ลำดับ | สารมลพิษ                   | วิธีวิเคราะห์                                                                                                                                                                     |
|-------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17    | Bis(2-chloroethyl)ether    | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 18    | Bis(2-ethylhexyl)phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 19    | Bromodichloromethane       | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 20    | Bromoform                  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 21    | Butanol                    | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 22    | Butyl benzyl phthalate     | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 23    | Cadmium                    | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                 |
| 24    | Carbazole                  | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 25    | Carbon disulfide           | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 26    | Carbon tetrachloride       | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 27    | Chlordane                  | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 28    | p-Chloroaniline            | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 29    | Chlorobenzene              | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 30    | Chlorodibromomethane       | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 31    | Chloroform                 | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 32    | 2-Chlorophenol             | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |

| ลำดับ | สารมลพิษ              | วิธีวิเคราะห์                                                                                                                                                                                                                                                           |
|-------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 33    | Chromium              | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                       |
| 34    | Chromium (III)        | 1) Digestion, Flame Atomic Absorption Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>(7,8,15,17)</sup><br>2) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation <sup>(7,8,14,17)</sup> |
| 35    | Chromium (VI)         | Alkaline Digestion, Colorimetric Method <sup>(8,17)</sup>                                                                                                                                                                                                               |
| 36    | Chrysene              | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                                   |
| 37    | Cyanide               | Extraction, Distillation, Colorimetric Method <sup>(29,30)</sup>                                                                                                                                                                                                        |
| 38    | 2,4-D                 | Ultrasonic Extraction, Gas Chromatographic Method <sup>(24)</sup>                                                                                                                                                                                                       |
| 39    | DDD                   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                                   |
| 40    | DOE                   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                                   |
| 41    | DDT                   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                                   |
| 42    | Dibenz(a,h)anthracene | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                                   |
| 43    | Di-n-butyl phthalate  | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                                                                                                                 |
| 44    | 1,2-Dichlorobenzene   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                                                                                                        |

| ลำดับ | สารมลพิษ                   | วิธีวิเคราะห์                                                                                                                                                                     |
|-------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 45    | 1,3-Dichlorobenzene        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 46    | 1,4-Dichlorobenzene        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 47    | 3,3'-Dichlorobenzidine     | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 48    | 1,1-Dichloroethane         | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 49    | 1,2-Dichloroethane         | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 50    | 1,1-Dichloroethylene       | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 51    | cis-1,2-Dichloroethylene   | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 52    | trans-1,2-Dichloroethylene | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 53    | 2,4-Dichlorophenol         | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 54    | 1,2-Dichloropropane        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 55    | 1,3-Dichloropropane        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 56    | 1,3-Dichloropropene        | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 57    | Dieldrin                   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |

| ลำดับ | สารมลพิษ             | วิธีวิเคราะห์                                                                                                                                                                     |
|-------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 58    | Diethyl phthalate    | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 59    | 2,4-Dimethylphenol   | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 60    | 2,4-Dinitrophenol    | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 61    | 2,4-Dinitrotoluene   | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 62    | 2,6-Dinitrotoluene   | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 63    | Di-n-Octyl phthalate | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 64    | Endosulfan           | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 65    | Endrin               | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 66    | Ethylbenzene         | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 67    | Fluoranthene         | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 68    | Fluorene             | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 69    | Heptachlor           | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 70    | Heptachlor epoxide   | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup>                                                                                                           |

| ลำดับ | สารมลพิษ                  | วิธีวิเคราะห์                                                                                                                                                         |
|-------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 70    | Heptachlor epoxide (หีบ)  | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                            |
| 71    | Hexachlorobenzene         | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> |
| 72    | Hexachloro-1,3-butadiene  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                      |
| 73    | n-Hexane                  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                      |
| 74    | α-HCH                     | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> |
| 75    | β-HCH                     | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> |
| 76    | γ-HCH                     | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> |
| 77    | Hexachlorocyclopentadiene | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                               |
| 78    | Hexachloroethane          | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                               |
| 79    | Indeno(1,2,3-cd)pyrene    | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup> |
| 80    | Isophorone                | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                               |
| 81    | Lead                      | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                     |
| 82    | Manganese                 | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>2) Digestion, Inductively                                                             |

| ลำดับ | สารมลพิษ                                 | วิธีวิเคราะห์                                                                                                                                                                      |
|-------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 83    | Mercury                                  | 1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method <sup>(9)</sup><br>2) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method <sup>(20)</sup> |
| 84    | Methanol                                 | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                   |
| 85    | Methoxychlor                             | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>              |
| 86    | Methyl bromide                           | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                   |
| 87    | Methylene chloride                       | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup>  |
| 88    | 2-Methylphenol                           | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                            |
| 89    | 2-Methylnaphthalene                      | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                            |
| 90    | Methyl tert-butyl ether                  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                   |
| 91    | Naphthalene                              | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>              |
| 92    | Nickel                                   | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                  |
| 93    | Nitrobenzene                             | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                            |
| 94    | N-Nitrosodiphenylamine                   | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                            |
| 95    | N-Nitrosodi-n-propylamine                | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                            |
| 96    | Polychlorinated Biphenyls - Aroclor 1016 | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup>                                                                                                            |

| ลำดับ | สารมลพิษ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | วิธีวิเคราะห์                                                                                                                                                          |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 96    | Polychlorinated Biphenyls(คปบ)<br>- Aroclor 1221<br>- Aroclor 1232<br>- Aroclor 1242<br>- Aroclor 1248<br>- Aroclor 1254<br>- Aroclor 1260<br>Polychlorinated Biphenyls<br>- 2-Chlorobiphenyl<br>- 2,3-Dichlorobiphenyl<br>- 2,2',5-Trichlorobiphenyl<br>- 2,4',5-Trichlorobiphenyl<br>- 2,2',3,5'-Tetrachlorobiphenyl<br>- 2,2',5,5'-Tetrachlorobiphenyl<br>- 2,3',4,4'-Tetrachlorobiphenyl<br>- 2,2',3,4,5'-<br>Pentachlorobiphenyl<br>- 2,2',4,5,5'-<br>Pentachlorobiphenyl<br>- 2,3,3',4',6-<br>Pentachlorobiphenyl<br>- 2,2',3,4,4',5'-<br>Hexachlorobiphenyl<br>- 2,2',3,4,5,5'-<br>Hexachlorobiphenyl<br>- 2,2',3,5,5',6-<br>Hexachlorobiphenyl<br>- 2,2',4,4',5,5'-<br>Hexachlorobiphenyl<br>- 2,2',3,3',4,4',5-<br>Heptachlorobiphenyl<br>- 2,2',3,4,4',5,5'-<br>Heptachlorobiphenyl<br>- 2,2',3,4,4',5,6-<br>Heptachlorobiphenyl<br>- 2,2',3,4',5,5',6-<br>Heptachlorobiphenyl<br>- 2,2',3,3',4,4',5,5',6-<br>Nonachlorobiphenyl | 2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup><br><br>Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,28)</sup> |

| ลำดับ | สารมลพิษ                                    | วิธีวิเคราะห์                                                                                                                                                                     |
|-------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 97    | Pentachlorophenol                           | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 98    | Phenanthrene                                | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 99    | Phenol                                      | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 100   | Pyrene                                      | 1) Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,25)</sup><br>2) Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>             |
| 101   | Selenium                                    | 1) Digestion, Hydride Generation/Atomic Absorption Spectrometric Method <sup>(7,21)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                    |
| 102   | Silver                                      | Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                    |
| 103   | Styrene                                     | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup> |
| 104   | 1,1,2,2-Tetrachloroethane                   | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 105   | Tetrachloroethylene                         | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup> |
| 106   | Toluene                                     | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup> |
| 107   | Toxaphene                                   | Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,23)</sup>                                                                                                              |
| 108   | TPH (C <sub>8</sub> -C <sub>6</sub> )       | 1) Purge and Trap, Gas Chromatographic Method <sup>(13,27)</sup><br>2) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                           |
| 109   | TPH (C <sub>8</sub> -C <sub>16</sub> )      | Ultrasonic Extraction, Gas Chromatographic Method <sup>(10,22)</sup>                                                                                                              |
| 110   | TPH (C <sub>&gt;16</sub> -C <sub>35</sub> ) | Ultrasonic Extraction                                                                                                                                                             |

| ลำดับ | สารมลพิษ               | วิธีวิเคราะห์                                                                                                                                                                     |
|-------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 111   | 1,2,4-Trichlorobenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 112   | 1,1,1-Trichloroethane  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 113   | 1,1,2-Trichloroethane  | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 114   | Trichloroethylene      | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 115   | 2,4,5-Trichlorophenol  | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 116   | 2,4,6-Trichlorophenol  | Ultrasonic Extraction, Gas Chromatographic/Mass Spectrometric Method <sup>(10,28)</sup>                                                                                           |
| 117   | 1,3,5-Trimethylbenzene | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 118   | Vanadium               | Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup>                                                                                                                    |
| 119   | Vinyl acetate          | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 120   | Vinyl chloride         | Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup>                                                                                                  |
| 121   | m-Xylene               | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 122   | o-Xylene               | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 123   | p-Xylene               | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |
| 124   | Xylene (Total)         | 1) Purge and Trap, Gas Chromatographic/Mass Spectrometric Method <sup>(13,27)</sup><br>2) Equilibrium Headspace, Gas Chromatographic/Mass Spectrometric Method <sup>(11,27)</sup> |

| ลำดับ | สารมลพิษ | วิธีวิเคราะห์                                                                                                                                     |
|-------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 125   | Zinc     | 1) Digestion, Flame Atomic Absorption Spectrometric Method <sup>(7,15)</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>(7,14)</sup> |

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บริษัท อินทิเกรทเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด



ที่ อก ๐๓๒๐/๑๗๐๓๒

กรมโรงงานอุตสาหกรรม  
ถนนพระรามที่ ๖ แขวงทุ่งพญาไท  
เขตราชเทวี กรุงเทพฯ ๑๐๔๐๐

๒๒ พฤศจิกายน ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

อ้างถึง คำขอต่ออายุของห้องปฏิบัติการวิเคราะห์เอกชน ลงวันที่ ๕ ตุลาคม ๒๕๖๕

สิ่งที่ส่งมาด้วย เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน  
บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด จำนวน ๓ แผ่น

ตามหนังสือที่อ้างถึง บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด ขอต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๑๙๙ สถานที่ตั้งเลขที่ ๑๒๒ หมู่ที่ ๒ ตำบลท่าตูม  
อำเภอศรีมหาโพธิ จังหวัดปราจีนบุรี ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด  
ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์

- |                                  |                            |
|----------------------------------|----------------------------|
| ๑) นางสาววิไลรัตน์ เกียรติธนะชัย | ทะเบียนเลขที่ ๖-๑๙๙-ค-๐๐๐๑ |
| ๒) นางสาวทิติยา นันหมื่น         | ทะเบียนเลขที่ ๖-๑๙๙-ค-๐๐๐๒ |
| ๓) นางวีราภรณ์ ผลเจริญ           | ทะเบียนเลขที่ ๖-๑๙๙-ค-๐๐๐๓ |

ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์

- |                              |                            |
|------------------------------|----------------------------|
| ๑) นายไกรวิชญ์ แสงแก้ว       | ทะเบียนเลขที่ ๖-๑๙๙-จ-๐๐๐๑ |
| ๒) นางสาวณัฐนันท์ สังกาลวงษ์ | ทะเบียนเลขที่ ๖-๑๙๙-จ-๐๐๐๒ |
| ๓) นางสาวอนันตพร งามสง่า     | ทะเบียนเลขที่ ๖-๑๙๙-จ-๐๐๐๓ |
| ๔) นางสาวหนึ่งฤทัย ออบมาลี   | ทะเบียนเลขที่ ๖-๑๙๙-จ-๐๐๐๔ |
| ๕) นางสาวแววตา คำสา          | ทะเบียนเลขที่ ๖-๑๙๙-จ-๐๐๐๕ |
| ๖) นายจักรีชัย อินติะ        | ทะเบียนเลขที่ ๖-๑๙๙-จ-๐๐๐๖ |
| ๗) นางสาวชนนิกานต์ แสนสุข    | ทะเบียนเลขที่ ๖-๑๙๙-จ-๐๐๐๗ |

ค. ขอบข่ายสารมลพิษที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๒๓ รายการ น้ำใต้ดิน  
จำนวน ๑๒ รายการ และสิ่งปฏิกูลหรือวัสดุที่ไม่ใช่แล้ว จำนวน ๑๐ รายการ รวมทั้งสิ้นจำนวน ๔๕ รายการ  
ตามสิ่งที่ส่งมาด้วย

หนังสือฉบับนี้จะหมดอายุในวันที่ ๑๘ พฤศจิกายน ๒๕๖๘ หากประสงค์จะต่ออายุหนังสือ  
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอต่อกรมโรงงาน  
อุตสาหกรรมภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ซึ่งคำขอ  
ต่ออายุดังกล่าวขอรับได้ที่กรมโรงงานอุตสาหกรรม ทั้งนี้ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์ได้ที่หน้า  
เว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ท้ายหนังสือนี้

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ



(นายทวี อำพาพันธ์)

ผู้อำนวยการศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก  
ปฏิบัติราชการแทนอธิบดีกรมโรงงานอุตสาหกรรม

ศูนย์วิจัยและเตือนภัยมลพิษโรงงานภาคตะวันออก  
โทร. ๐ ๓๓๑๓ ๖๐๕๕ ต่อ ๕๐๐๑-๒  
ไปรษณีย์อิเล็กทรอนิกส์ eirw@diw.mail.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์



เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

บริษัท อินทิเกรทเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

เลขทะเบียน ว-๑๙๙

ที่ อก ๐๓๒๐/๑๗๐๓๒

ลงวันที่ ๒๒ พฤศจิกายน ๒๕๖๕

ขอขยายสารมลพิษที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๔๕ รายการ  
น้ำเสีย จำนวน 23 รายการ

| ลำดับที่ | สารมลพิษ                  | วิธีวิเคราะห์                                                                                                              |
|----------|---------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1        | Arsenic                   | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 2        | Barium                    | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 3        | Biochemical Oxygen Demand | 1) 5-Day BOD Test, Azide Modification Method <sup>[1]</sup><br>2) 5-Day BOD Test, Membrane Electrode Method <sup>[1]</sup> |
| 4        | Cadmium                   | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 5        | Chemical Oxygen Demand    | Closed Reflux, Colorimetric Method <sup>[1]</sup>                                                                          |
| 6        | Color                     | ADMI Weighted – Ordinate Spectrophotometric Method <sup>[1]</sup>                                                          |
| 7        | Copper                    | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 8        | Free Chlorine             | Iodometric Method <sup>[1]</sup>                                                                                           |
| 9        | Hexavalent Chromium       | Filtration, Colorimetric Method <sup>[1]</sup>                                                                             |
| 10       | Lead                      | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 11       | Manganese                 | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 12       | Nickle                    | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 13       | Oil and Grease            | Liquid-Liquid, Partition-Gravimetric Method <sup>[1]</sup>                                                                 |
| 14       | pH                        | Electrometric Method <sup>[1]</sup>                                                                                        |
| 15       | Selenium                  | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 16       | Sulfide                   | ZnS Precipitation, Iodometric Method <sup>[1]</sup>                                                                        |
| 17       | Temperature               | Field Method <sup>[1]</sup>                                                                                                |
| 18       | Total Chromium            | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |
| 19       | Total Dissolved Solids    | Dried at 180 °C <sup>[1]</sup>                                                                                             |
| 20       | Total Kjeldahl Nitrogen   | Macro Kjeldahl Method <sup>[1]</sup>                                                                                       |
| 21       | Total Suspended Solids    | Dried at 103-105 °C <sup>[1]</sup>                                                                                         |
| 22       | Trivalent Chromium        | Digestion, Inductively Coupled Plasma Method<br>Filtration, Colorimetric Method, Calculation <sup>[1]</sup>                |
| 23       | Zinc                      | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                                                |

น้ำใต้ดิน จำนวน 12 รายการ

| ลำดับที่ | สารมลพิษ            | วิธีวิเคราะห์                                                                                  |
|----------|---------------------|------------------------------------------------------------------------------------------------|
| 1        | Arsenic             | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |
| 2        | Barium              | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |
| 3        | Cadmium             | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |
| 4        | Chromium            | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |
| 5        | Hexavalent Chromium | Filtration, Colorimetric Method <sup>[1]</sup>                                                 |
| 6        | Lead                | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |
| 7        | Manganese           | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |
| 8        | Nickel              | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |
| 9        | pH                  | Electrometric Method <sup>[1]</sup>                                                            |
| 10       | Selenium            | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |
| 11       | Trivalent Chromium  | Inductively Coupled Plasma Method; Filtration, Colorimetric Method; Calculation <sup>[1]</sup> |
| 12       | Zinc                | Digestion, Inductively Coupled Plasma Method <sup>[1]</sup>                                    |

สิ่งปฏิกูลหรือวัสดุที่ไม่ใช้แล้ว จำนวน 10 รายการ

| ลำดับที่ | สารมลพิษ  | วิธีวิเคราะห์                                                                        |
|----------|-----------|--------------------------------------------------------------------------------------|
| 1        | Arsenic   | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,4,5]</sup> |
| 2        | Barium    | 2) Digestion, Inductively Coupled Plasma Method <sup>[3,5]</sup>                     |
| 3        | Cadmium   | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,4,5]</sup> |
| 4        | Chromium  | 2) Digestion, Inductively Coupled Plasma Method <sup>[3,5]</sup>                     |
| 5        | Lead      | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,4,5]</sup> |
| 6        | Manganese | 2) Digestion, Inductively Coupled Plasma Method <sup>[3,5]</sup>                     |
|          |           | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,4,5]</sup> |
|          |           | 2) Digestion, Inductively Coupled Plasma Method <sup>[3,5]</sup>                     |
|          |           | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,4,5]</sup> |
|          |           | 2) Digestion, Inductively Coupled Plasma Method <sup>[3,5]</sup>                     |

| ลำดับที่ | สารมลพิษ | วิธีวิเคราะห์                                                                                                                                            |
|----------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7        | Nickel   | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,4,5]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[3,5]</sup> |
| 8        | pH       | Electrometric Method <sup>[6]</sup>                                                                                                                      |
| 9        | Selenium | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,4,5]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[3,5]</sup> |
| 10       | Zinc     | 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method <sup>[2,4,5]</sup><br>2) Digestion, Inductively Coupled Plasma Method <sup>[3,5]</sup> |

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