

เอกสารแนบ ง
เอกสารสอบเทียบเครื่องมือ

บริษัท ยูไนเต็ด แอนนาลิสต์ แอนด์ เอ็นจิเนียริง
คอนซัลแตนท์ จำกัด

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	IRON	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	26/1/2026	25/1/2027
2	Mercury Analyzer	TOTAL MERCURY	NIC. Japan	RA-4500 / 17780278	Coax Group Corporation Ltd.	Preventive Maintenance Report	2/7/2025	1/7/2026
3	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	ALUMINIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY1803001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	3/11/2025	2/11/2026
4	UV-VIS Spectrophotometer	NITRATE NITROGEN	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP26-012	18/5/2026	17/5/2027
5	UV/VIS Spectrophotometer	AMMONIA-NITROGEN	Hitachi High-Tech Science Corporation Tokyo Japan	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP26-014	18/5/2026	17/5/2027
6	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	25CH1053	9/9/2025	7/9/2026

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
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2	DO Meter	DO	Horiba	LAQUA-DO210 / HE2L0016	Technology Promotion Association (Thailand-Japan)	26TW47	26/2/2026	26/2/2027
3	UV-VIS Spectrophotometer	NITRATE NITROGEN	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP26-012	18/5/2026	17/5/2027

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

Automatic Mercury Analyzer

Model : RA-4500

Preventive Maintenance Report

SERIAL No. RA-4500 : 11780278

Soft version : Ver 2.0.5

ROM version : Ver 2.0.2

DATE : 02 JULY 2025

DUE DATE : 02 JULY 2026

INSPECTED BY : *Natthaphong P.*
(Natthaphong P.)APPROVED BY : *Kitichai S.*
(Kitichai S.)

Kinetic Solutions Company Limited.

2, Soi Lat Krabang 1, Lat Krabang Subdistrict,

Lat Krabang District, Bangkok 10520

Tel. (+66) 062-789-5221

บริษัท คีเนติก โซลูชั่น จำกัด
KINETIC SOLUTIONS CO., LTD.

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Inspection

ITEMS	SPECIFICATIONS	RESULT	JUDGE
1. Quantity	-	Accessories are completed.	GOOD OK
2. Appearance	2.1 Overall Appearance	No visible damage.	GOOD
	2.2 Parts / Cables	Correctly placed and connected.	GOOD
3. Indication	Nameplate / Label	Plate and Label are indicated.	GOOD OK
4. Self check			
4.1 GLP Counter	Mercury Lamp	5000 hours	110 hr OK
	Membrane Filter	2000 hours or 1 year after replace	< 1 hr OK
	Main Pump Tube	750 hours or 1 year after replace	< 1 hr OK
	Absorbed Hg	1500 mg	< 1 hr OK
	P1 Tube	2000 hours or 1 year after replace	< 1 hr OK
	P2 Tube	2000 hours or 1 year after replace	< 1 hr OK
	P3 Tube	2000 hours or 1 year after replace	< 1 hr OK
	P4 Tube	2000 hours or 1 year after replace	< 1 hr OK
	P5 Tube	2000 hours or 1 year after replace	< 1 hr OK
	P6 Tube	2000 hours or 1 year after replace	< 1 hr OK
4.2 Check/Test	P7 Tube	2000 hours or 1 year after replace	< 1 hr OK
	Heater	2000 hours	42 hr OK
	Flow rate Adjustment	Flow rate 0.14 - 0.20 L/min	0.18 L/min OK
	Signals Detector	V.SIG is 3.5 - 4.5 V.	4.03 V. OK
		V.REF is 3.5 - 4.5 V.	4.03 V. OK
	Cooling Fan	Check the operation of cooling fan	PASS OK
	Color Sensor	signals (R,G,B) at least one nonzero	PASS OK
5. Heater	Radiation Thermometer	a positive valve form thermometer	PASS OK
	Heater	heater temp rises 4 °C within 5 min.	PASS OK
6. Calibration Curve	Temperature	At 95°C ± 2°C with 30 min.	94.7°C OK
7. Repeatability	no pretreatment	0-10ng : Max.Dev. 5.0%	0.90% OK
	100 µg/L (n=5)	Average: 100 ± 5 µg/L	101.4 µg/L OK
8. Blank		C.V. ≤ 5.0%	0.71% OK
	no pretreatment	Less than 0.5 (AREA)	0.103 AREA OK

Apparatus

NAME	Date Certified	Expiration
Mercury ICP Standard (1000 µg/mL) AccuStandard, Inc. Lot 223035027	March 10, 2023	March 10, 2028

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Inspection details

Remark

1. Cleaning Mercury Analyzer RA-4500

- Body case, Cell Detector, Table of Sample

2. Replace consumable one year set for RA-4500

3. Checking Mercury Analyzer RA-4500

- Mercury Lamp	- Outlet Activated Carbon Filter
- Membrane Filter	- Flow Sensor
- Main Pump Tube	- Valves
- Motor Pump	- Heater
- Motor Reagent pump	- Cooling Fan
- Motor of Arm	- Stirrer motor
- Motor of Table	- Color sensor
- Motor of Lift	- Instrument Performance

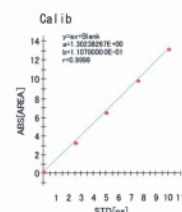
4. Adjust Optical system

5. Inspection Calibration curve and Repeatability of Mercury Analyzer RA-4500

หมายเหตุ Heater Box เริ่มเสื่อมสภาพ แนะนำให้เปลี่ยนในรอบ PM ถัดไป

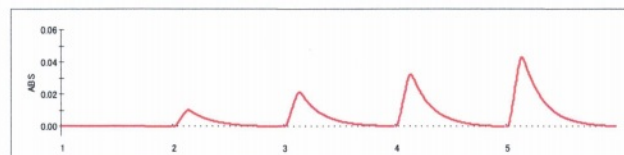
Title : Preventive Maintenance
Date : 02/07/2025
Name : Kinetic Solutions
Memo : Calibration curve 0-10ng

Method

Method1 (Pretreatment: without)
(1+1)H2SO4 : 0.5mL
10w/v% SnCl2 : 0.5mL
Measurement Time (sec) : 120sec

STD

No.	STD [µg/L]	SVOL [mL]	CVOL [mL]	DVOL [mL]	STD [ng]	AREA [ON]	MEAS [ng]	Dev [%]	Note
1	0.000	5.000	5.000	5.000	0.000	0.1107	0.0000	-	
2	100.000	0.025	5.000	5.000	2.500	3.2690	2.4250	3.0	
3	100.000	0.050	5.000	5.000	5.000	6.5434	4.9392	1.2	
4	100.000	0.075	5.000	5.000	7.500	9.8649	7.4895	0.1	
5	100.000	0.100	5.000	5.000	10.000	13.2088	10.0570	0.6	



SMP

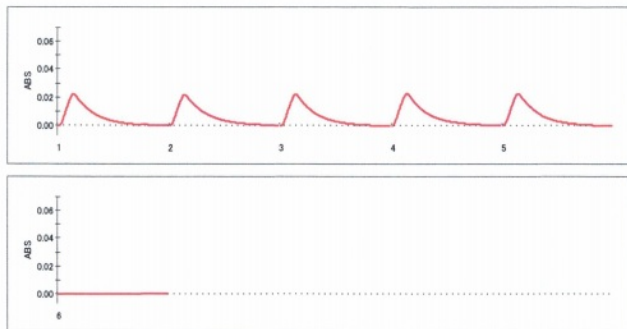
No.	NAME	SVOL [mL]	CVOL [mL]	DVOL [mL]	AREA [ON]	MEAS [ng]	CONC [µg/L]	Note
1	STD 100 ppb	0.050	5.000	5.000	6.7338	5.0854	101.708	
2	STD 100 ppb	0.050	5.000	5.000	6.7129	5.0693	101.386	
3	STD 100 ppb	0.050	5.000	5.000	6.6370	5.0110	100.220	
4	STD 100 ppb	0.050	5.000	5.000	6.7489	5.0970	101.940	
5	STD 100 ppb	0.050	5.000	5.000	6.7514	5.0989	101.978	
6	Blank	5.000	5.000	5.000	0.1035	-0.0055	0.000	

Statistics

No.	NAME	TRY	AV [µg/L]	SD [µg/L]	Cv [%]
1	STD 100 ppb	5	101.4464	0.724979	0.71

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Self Check
 Heat check: PASS!! (25.7degC[05:00] -> 29.7degC[02:29])
 Sensor check: PASS!! (253-15= 238)
 Leak check: PASS!! (0.18L/min)
 Sig/Ref check: PASS!! (Sig: 4.03V, Ref: 4.03V)
 Drift check: PASS!! (0.000037 - -0.000026 = 0.000063)

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NIPON INSTRUMENTS CORPORATION

1. Quality Standards:

ISO 17034:2016 – General Requirements for the Competence of Reference Material Producers
 ISO/IEC 17025:2017 – General Requirements for the Competence of Testing And Calibration Laboratories
 ISO 9001:2015 – Quality Management System – Requirements
 Eagle Registrations

2. **Intended Use:** The product covered by this certificate is designed for calibration or for use in quality control procedures for the specified chemical compounds listed on the reverse side. This product can be used for quantification and/or identification. This product can also be used as a reference material to validate analytical procedures, subject to the conditions under Section 7.

3. **Manufacturing:** All balances are calibrated daily using an in-house procedure with weights that are compared annually to master weights and traceable to NIST. The balances are also calibrated annually by an ISO/IEC 17025 accredited calibration laboratory. Please refer to the NIST test number listed on the front of this certificate. Class A glassware is used in the manufacture and quality control of all standards. Good Laboratory Practices have been used throughout the preparation of this Standard.

4. **Homogeneity:** This product is sufficiently homogeneous and any sample size would be within the uncertainty budget.

5. **Stability:** The manufacturer guarantees the stability of this solution through the expiration date stated on the label, when handled and stored according to the conditions stated on the label.

6. **Uncertainty:** The uncertainty values as stated on the face of this certificate have been determined using the EURACHEM/CITAC Guide. We report a combined expanded uncertainty equal to the positive square root of the total variance of the uncertainty of the components using the following formula: $u_c = \sqrt{(u(V))^2 + (u(m))^2 + (u(V))^2 + (u(RD))^2}$. This formula represents uncertainty components from the mass, volume, short-term stability, long-term stability and homogeneity factors associated with the production of this product. The expanded uncertainty, assumes a normal distribution and a coverage factor of k=2 is chosen using approximately a 95% confidence level.

7. **Legal Notice and Limit of Liability:** This product is for routine laboratory analysis and research purposes only. The company's liability will be limited to replacement of product or refund of purchase price. Notice of claims must be made within thirty (30) days from date of delivery.

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125 Market Street
 New Haven, CT 06513
 USA



AccuStandard®, Inc.
CERTIFICATE OF ANALYSIS

Tel (203)786-5290
 Fax (203)786-5287
 www.AccuStandard.com

AccuTrace™ Reference Standard

Catalog No: ICP-34N-1
 Description: Mercury ICP Standard
 Element: Mercury (Hg)
 SRM: 3133
 Lot: 223035027
 Matrix: 10% Nitric acid
 Hazards: Refer to SDS for complete safety information

Date Certified: Mar 10, 2023
 Expiration: Mar 10, 2028
 Density: 1.052 g/mL
 Sample Size: 100 mL
 Components: 1
 Storage Condition: Ambient (>5 °C)

Certified Reference Material



Signal Word: Danger



Certified Concentration: 1000 µg/mL

Trace Elements in µg/mL

Ag nd<0.02	Ce nd<0.2	Gd nd<0.02	Lu nd<0.02	Pb nd<0.2	Sc nd<0.02	Ti nd<0.02
Al nd<0.02	Co nd<0.02	Ge nd<0.2	Mg nd<0.02	Pd nd<0.2	Se nd<0.2	Tl nd<0.2
As nd<0.2	Cr nd<0.02	Hf nd<0.02	Mn nd<0.02	Pr nd<0.2	Si N/A	Tm nd<0.02
Au nd<0.02	Cs N/A	Hg *	Mo nd<0.02	Pt nd<0.2	Sm nd<0.2	U nd<0.2
B nd<0.2	Cu nd<0.02	Ho nd<0.02	Na nd<0.02	Rb N/A	Sr nd<0.02	V nd<0.2
Ba nd<0.02	Dy nd<0.02	In nd<0.2	Nb nd<0.2	Re nd<0.2	Sr nd<0.02	W nd<0.2
Be nd<0.02	Er nd<0.02	Ir nd<0.2	Nd nd<0.02	Rh nd<0.2	Ta nd<0.2	Y nd<0.02
Bi nd<0.2	Eu nd<0.02	K nd<0.2	Ni nd<0.02	Ru nd<0.02	Tb nd<0.02	Yb nd<0.02
Ca nd<0.02	Fe nd<0.02	La nd<0.02	Os N/A	S N/A	Te nd<0.2	Zn nd<0.02
Cd nd<0.02	Ga nd<0.02	Li nd<0.02	P N/A	Sb nd<0.2	Th nd<0.02	Zr nd<0.02

This Certified Reference Material was verified in accordance with ISO/IEC 17025 (AT-1339) and ISO 17034 (AR-1463). This solution was assayed gravimetrically, using a balance calibrated against weight sets, ID #86270, traceable to NIST. A product with a suffix (-1A, -2B, etc. or -01, -02, etc.) on its lot number has had its expiration date extended and is identical to the same lot number without the suffix. This product contains mercury and MUST be disposed of in accordance with all federal, state and local regulations. The gravimetric uncertainty for this product is ±0.24%. The CRM uncertainty is ±2.4%. In order to verify the concentration(s), the final solution was checked by plasma emission spectroscopy (ICP) against material traceable to the above listed NIST SRMs. We use the highest purity raw materials available to minimize impurity levels in the final solution. Typically 99.999%+ pure starting materials are used as well as high purity acids and ASTM Type 1 18 megohm deionized water. All trace level elemental impurities were determined via plasma emission spectroscopy on the concentrate. All weights are traceable through NIST, Test No. 684/291344-18 & 684/292805-19. All glassware used in preparation is Class A. All bottles are acid leached and triple rinsed with deionized water prior to use. Shake bottle prior to use and do not pipette directly out of the bottle. Use only cleaned Class A volumetric glassware. Keep bottle tightly capped.

Certified By: *Michael J. O'Leary*
 Michael J. O'Leary, Inorganic QA Manager

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For use in routine laboratory analysis.

AccuStandard is accredited to ISO 17034, ISO/IEC 17025 and certified to ISO 9001:2015

Gen Certificate No. 074



Agilent AA Series Spectrometers

Preventative Maintenance Checklist

Foreword

Agilent Preventive Maintenance provides factory recommended service for your analytical systems to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the installation.

NOTE

While non-current production AA instrument and/or accessory models are not covered specifically in this document it can be used as a basic reference.

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.agilent.com/en-us/services>

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Customer information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

This information is subject to change without notice.

Other important Customer Web links

- How to get information on your product: Literature Library – <http://www.agilent.com/chem/library>
- Need to know more? www.agilent.com/chem/education
- Need technical support, FAQs? www.agilent.com/chem/techsupp
- Need supplies? www.agilent.com/chem/supplies

System information

- ☐ Check this box if an instrument configuration report is attached instead of completing this table.

Instrument system name and ID	240 FS AAS
Instrument system site and location	United Analyst and Engineering Consultant
List system component product numbers	List the serial numbers of each component
1 G 432 A	1 M1 13160001
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

Preparation, Safe operation and Initial performance checks

- ☐ Agilent AA safe operation flow chart inspections (to determine if the PM can be performed).

NOTE

If by following the flow chart the instrument is deemed to be unsafe for continued use you MUST NOT continue PM work. Inform the customer immediately of the Agilent recommendation that use of the instrument be discontinued.

- Discuss any specific questions or issues with the customer prior to starting.
- For HF application systems, if standard sample introduction system was not installed, ask the customer to install it.
- Review the instrument logbook for recorded problems and comments.
- Save instrument control settings before starting the procedure.
- Perform a general inspection of the system for cleanliness.
- Check for proper installation of parts, assemblies, sensors etc.
- Check system for required installation of components, settings as defined by current Service Notes

- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Use SVD to perform a Full Wavelength Scan for Cu HCL - "As found test_1"
- ☒ Perform a Basic Cu ABS test - "As found test_2"
- ☒ Print the Details page or screen captures of the test results and attach to the end of this checklist.

Preventative maintenance procedures

Flame systems

- ☐ Section NOT applicable.

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the SVD Power Supply diagnostic.
- ☒ For Dual Beam instruments - Confirm RBC frequency using the SVD RBC frequency diagnostic.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ Automatic Burner Adjuster

Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform Mono Wavelength Correction.
- ☒ Use SVD and perform Slit Calibration.
- ☒ Use SVD and perform Grating Squareness Diagnostic.
- ☒ Use SVD and perform Zero Order Offset/Mono Correction.
- ☒ Use SVD and perform Wavelength Repeatability.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

Sample introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring and lubricate with PFPE grease.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber and lubricate.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars and lubricate.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☒ Check and clean the igniter electrode.

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components using gasbox leak tester G8434-67013
- ☒ Check safety interlock status and operation using the SVD interlock monitoring diagnostic.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.

Furnace systems

- ☒ Section NOT applicable.

Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the SVD Power Supply diagnostic.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive

☐ Lamp selector**Optics components**

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform Mono Wavelength Correction.
- ☐ Use SVD and perform Slit Calibration.
- ☐ Use SVD and perform Grating Squareness Diagnostic.
- ☐ Use SVD and perform Zero Order Offset/Mono Correction.
- ☐ Use SVD and perform Wavelength Repeatability.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system, and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.
 - ☐ Tube
 - ☐ Electrodes
 - ☐ Shroud
- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☒ Section NOT applicable.
- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air leaks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Agilent AA Series Spectrometers Preventative Maintenance Checklist

Accessories

- ☐ Section NOT applicable.

Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable.
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.
- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

- ☒ Section NOT Applicable.

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

NOTE The autosampler requires no extra lubrication throughout its lifetime.

For further details refer to the SPS 4 service manual GB410-90050.

Agilent AA Series Spectrometers Preventative Maintenance Checklist

Vapor generation accessory VGA (hydride generator)

- ☐ Section NOT Applicable.
- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing.
- ☐ Check low gas pressure interlock setting – adjust if required.
- ☐ Check precision orifice gas flow setting – adjust if required.
- ☐ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltrAA Lamp Accessory (external)

- ☒ Section NOT Applicable.
- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☐ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Signature Page**Service Review**

- ☐ Attach available reports/printouts of all tests to this documentation.
- ☐ Record the Preventative Maintenance service activity in the customer's records/logbook.
- ☐ Update/reset instrument maintenance counters as appropriate.
- ☐ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☐ Complete the Service Engineer Comments section if there are additional comments.
- ☐ Review this service, parts replaced, and test results obtained with the customer.
- ☐ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.

Test Results

Test description	Expected test result	Actual test result
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	46 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.6331
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.7 %
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	-
Deuterium furnace performance test with 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.15	-
Zeeman furnace analytical performance: 25 ppb copper sample (324.8 nm)		
Precision %RSD	≤ 4.0%	-
Abs value	≥ 0.15	-
MSR% (327.4 nm)	≥ 70 %	-

AA consumable and parts list

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution - Cu 5ppm solution	6610030100	55 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	55 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	55 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	55 240 280	PM supplied	Flame
Organic Kit	9910093500	55 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	55 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	55 240 280	consumable	Flame
Capillary Tube Hivac Neb (3) (organics only)	9910044000	55 240 280	consumable	Flame
Glass Impact beads (5/pk)	9910025700	55 240 280	consumable	Flame

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Teflon impact beads (5/pk): (organics only)	9910053300	55 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	55 240 280	consumable	Flame
Window UV silica - round (right side)	2010082600	55 240 280	PM supplied	Common
Window UV silica - rectangular (left side)	2010082500	55 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	55 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	55 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310003400	GTA120	PM supplied	Furnace
Shroud (D2)	6310003100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310003500	GTA120	PM supplied	Furnace
Zeeman shroud	6310003600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM.

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write them in this box.

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Service Completion

Service Request Number:

6008059466

Service Engineer Name:

Kanyakorn S.

Service Engineer Signature:

Kanyakorn S.

Date of Service Completion:

26 Jan 2026

Customer Name:

David Hase

Customer Signature:

SVD Results Report



Report ID: 3	Diagnostic Start Time: 1/26/2026 8:39:56 AM	Diagnostic End Time: 1/26/2026 9:05:49 AM
Customer: UAE	Service Engineer: Kanyakorn S.	
Address:	Contact Details: 026376363#1	

Instrument Configuration

Configuration:

Serial Number: MY13160001	Turret Type: Automatic
Instrument Model: Varian AA140/240/280	Number Of Lamps: 4
Flame Instrument: True	Mono Type: Automatic
Furnace Instrument: True	Gasbox Type: 'Y' Gas Box
Zeeman Present: False	Auto Burner Adjuster: False
Internal Zeeman: False	Mains Frequency: 50
Internal UltraAA: False	Firmware Version: 2.11
Optics Type: Double Beam	Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True	PWB Version: 45
Boot Block Version: 1.09	

EEPROM Data:

Instrument Run Hours: 79270.602	D2 Run Hours: 58906.000
Zero Wavelength Offset: 30.095	D2 Serial Number: not set !
Mono Correction: 0.765	D2 Install Date: 1/1/1970
Flame Hours: 35125.582	D2 Original Intensity: 1.000
	D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0	
Datapoint Count: 20	
Upper Limit: 51.00	Highest Measured Frequency: 50.00
Average Frequency: 50.00	
Lower Limit: 49.00	Lowest Measured Frequency: 50.00

Result: **Passed**

Power Supply:

Averaging Period: 30.0
Datapoint Count: 20

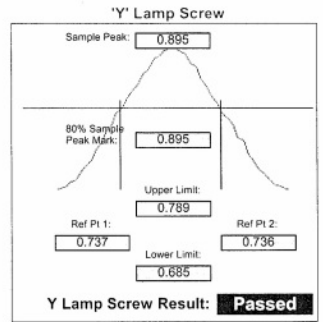
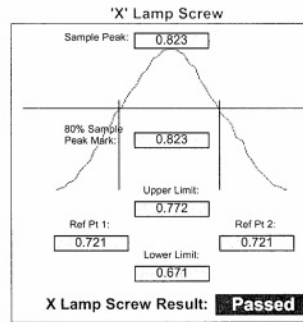
	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.20	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.02	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: Performed



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: Performed

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.74	325.15	Passed
Second Order	649.23	649.50	649.97	Passed

Report Generated At: 1/26/2026 9:06:40 AM

2

SVD Results Report



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Wavelength Repeatability:

Lamp Used: Copper
Peak Used(nm): 324.750
Connected to Socket: 3
Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment: Performed

Lower Limit(nm) 324.768 324.888 Upper Limit(nm)

(Approach from Zero Order) (Approach from end)
Sample 1: 324.828 Sample 2: 324.823
Sample 3: 324.823 Sample 4: 324.823
Sample 5: 324.823 Sample 6: 324.819
Sample 7: 324.823 Sample 8: 324.819
Sample 9: 324.819 Sample 10: 324.819

Mean: 324.823

Standard Deviation: 0.003

Result: Passed

Report Generated At: 1/26/2026 9:06:40 AM

3

SVD Results Report



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Mechanical

Wavelength Drive:

Passed

Slit Drive:

Passed

Turret Drive:

Passed

Auto Burner Adjuster Drive:

Untested

Miscellaneous

Signal Processing Linearity:

Calculate Mode: New Calc Mode

	Lower Limit	Actual	Upper Limit	Result:
S0	114	261	297	Passed
S1	156	165	191	Passed
S2	271	296	332	Passed
S3	474	508	579	Passed
S4	825	919	1008	Passed
S5	1435	1529	1754	Passed
S6	2498	2771	3053	Passed
S7	4347	4755	5313	Passed

Interlocks:

Burner Fitted: Working
N2O Burner Fitted: Untested
Flame Shield Closed: Working
Gas Control Fitted: Untested
Pressure Release Bung Fitted: Working
Liquid Trap Fitted: Working
Flame Detect: Working
GCU Active: Working
Oxidant Pressure: Working
Oxidant Changeover: Untested
Ignition: Working

Report Generated At: 1/26/2026 9:06:40 AM

4

SVD Results Report



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Report Generated At: 1/26/2026 9:06:40 AM

5

SVD Results Report



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Auto Lamp Recognition:

Lamp 1: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/C Lamp 5: Not Supported
Lamp 2: 68 - Zinc (Zn) Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu) Lamp 7: Not Supported
Lamp 4: Uncoded Lamp/Not Connected Lamp 8: Not Supported

Result: **Passed**

GTA Temperature Monitoring:

Not Performed

Notes:

Signatures:

Lamdo Hagi 26 Jan 21 Kanyakorn S. 26 Jan 2026
UAE Date Kanyakorn S. Date

Report Generated At: 1/26/2026 9:06:40 AM

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SVD Results Report SVD
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Sequential by time report

1/26/2026 10:15 AM
Page 1 of 1

SpectrAA

Analyst
Date Started 1/26/2026 9:07 AM GMT: 1/26/2026 2:07 AM
Worksheet Precision Test
Comment
Methods Cu
Computer name DESKTOP-R9UJFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
5 ppm Cu	0.618	0.7	0.6180
Readings			
0.6145	0.6187	0.6081	0.6168
0.6197	0.6195	0.6188	0.6189
1/26/2026			

Sequential by time report

1/26/2026 9:54 AM
Page 1 of 1

SpectrAA

Analyst
Date Started 1/26/2026 9:07 AM GMT: 1/26/2026 2:07 AM
Worksheet Sensitivity Test
Comment
Methods Cu
Computer name DESKTOP-R9UJFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
5 ppm Cu	0.633	1.4	0.6331
Readings			
0.6413	0.6340	0.6241	1/26/2026

เอกสารไม่ควบคุม

Agilent
CrossLab
From Insight to Outcome

Agilent CrossLab Start Up Services

Agilent 5100 5110 ICP-OES
Preventive Maintenance

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides what you need to reduce unplanned downtime and keep your systems operating at their peak performance.

This checklist is used as a guide for completing the preventive maintenance tasks. A signed copy of this checklist is provided for your records.

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เอกสารไม่ควบคุม

Introduction

Customer Information

- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures. Customers are responsible for regular maintenance and are encouraged to observe the service representative.
- Any parts not included in the Parts Lists section of this document are not part of the recommended Preventive Maintenance service nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.
- For customers using HF applications, the instrument should be returned to its standard sample introduction system.

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Important Customer Web Links

- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- To access the **Agilent Resource Center** web page, visit <https://www.agilent.com/en-us/agilentresources>. The following information topics are available:
 - Sample Prep and Containment
 - Chemical Standards
 - Analysis
 - Service and Support
 - Application Workflows
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>
- Videos about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>
- Need to place a service call?** Flexible Repair Options | Agilent

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Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Service not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance services in the most logical order relevant to the individual system service in the order of the tasks listed.
- Complete the **Service Review** section together with the customer.
- Complete the fields for page numbers at the foot of each selected page
- Add relevant page numbers to selected pages and complete the total number of pages field in the Service Completion section
- Ask the customer to sign the Service Verification section including the customer's and your signature.

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Instrument Maintenance

System Information

☐ Check this box if an instrument configuration report is attached instead of completing the table.

Instrument System Name and ID	5110 VDV ICP-OES
Instrument System Site and Location	UAE Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8015 A	NY 18030601
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type	SeaSpray OneNeb Conkal Other
Spray Chamber	Cyclonic Single Pass Cyclonic Double Pass Other
Torch	Radial Dual View Other
Torch Type	One Piece Semi Demountable Fully Demountable Other
Injector Diameter	2.4mm 1.8mm 1.4mm 0.8mm Other
Injector Material	Quartz Ceramic Other

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Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. *N/A*
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

เอกสารไม่ควบคุม

Preventive Maintenance Procedures

Record Pre-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table – Pre-PM.

Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. *N/A*
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

- ☐ Service not applicable
- ☒ Drain cooling fluid and remove any particles from the chiller reservoir
- ☒ Remove, clean and reinstall water inlet metal mesh filter if present.
- ☒ Re fill with Agilent Cool Clear cooling fluid.
- ☒ Clean the cooling system Air filter and the condenser.

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SPS 3 Auto Sampler

- ☒ Service not applicable
- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace is necessary.
- ☐ Clean X and Z axis slide shafts.
- ☐ Using customer's racks and the Agilent software move the sample probe to the 4 outermost corners and rinse port, ensure that the probe is approximately centered in the vial.

SPS 4 Auto sampler

- ☒ Service not applicable
- ☐ Clean the spill tray, rack location mat, end frames and chassis with a damp soft cloth and diluted mild detergent.
- ☐ Clean the auto sampler cover panels, if cover kit is installed, with domestic window cleaner.
- ☐ Check the X-axis and Z-axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X-axis, Theta-axis and Z-axis FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

- ☒ Service not applicable
- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

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ICP-OES adjustment

- ☒ Check position of Zn peak, adjust if required.
- ☒ Check Argon Ratio, adjust to specified value if required.
- ☒ Perform Detector Calibration.
- ☒ Perform Instrument Calibration.

Record Post-PM instrument performance

- ☒ Run Instrument Performance test.
- ☒ Record results in Instrument Performance Test Results Table - Post PM.
- ☒ For systems using ICP Expert version 7.3 and above, run the following Instrument tests

- ☒ Subsystem Communications Test
- ☒ Air Flow
- ☒ Water Flow
- ☒ Gas Flows
- ☒ RF Generator
- ☒ Camera Test
- ☒ Optics Test
- ☒ Nebulizer Test

- ☒ Record the result in the Instrument Test Results Table

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Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. N/A
- ☒ Leave system in an idle state: on and purging.
- ☒ Guidance: If the PM service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Record the PM event in the Smart Alerts logbook, if applicable.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review this service, parts replaced, and test results obtained with the customer.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box. Systems in a compliant environment may need additional documentation.
- ☒ Complete the Signature Page with both Service Engineer and Customer signatures.

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Test Results

Instrument Performance Test Results Table

Note: These measurements do not form part of any specification and are for reference only.

	Pre PM Sensitivity Check		Post PM Sensitivity Check	
	Radial	Axial *	Radial	Axial*
Zn 213.857 nm SRBR	1763.8	2579.2	2230.8	3962.9
Mn 257.610 nm SRBR	9470.5	19614.9	10863.0	17884.4
Al 396.152 nm SBR	5.2	8.0	7.0	7.4
K 766.491 nm SBR	3.0	14.6	3.4	8.7

* Axial result is not applicable for G8016AA, G8012AA Radial View instruments.

Instrument Test Results Table

Note: The Instrument Test results are for systems using ICP Expert version 7.3 and above only.

Instrument Test	Result
Subsystem Communications Test	Pass
Air Flow	Pass
Water Flow	Pass
Gas Flows	Pass
RF Generator	Pass
Camera Test	Pass
Optics Test	Pass
Nebulizer test	Pass

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ICP-OES Status Results Table

Note: These measurements do not form part of any specification and are for reference only.

Measurement	Standby Mode		Plasma On	
Mains Voltage	231.286	VAC	226.380	VAC
Mains Current	0.083	A	0.106	A
Instrument Temperature	21.1	°C	21.6	°C
RF Air Flow (sensor speed)	44.0	Hz	41.1	Hz
Plasma Exhaust Temperature	No measurement		47.1	°C
Water Flow Oscillator	No measurement		1.14	L/min
Water Flow Detector	0.92	L/min	0.90	L/min
Water Inlet Temperature	19.5	°C	18.5	°C
Polychromator Temperature	35.4	°C	36.4	°C
CCD Temperature	-40.1	°C	-39.9	°C
Thermal Stabilizer	35.0	°C	35.0	°C
Argon Supply Pressure	604.43	kPa	583.77	kPa
Purge Gas Supply Pressure*1	601.28	kPa	604.02	kPa
Option Gas Supply Pressure*1	-	kPa	-	kPa
Nebulizer Flow	No measurement		0.70	L/min
Nebulizer Back Pressure	No measurement		273.61	kPa
Plasma Gas Flow	No measurement		1196	L/min
Auxiliary Gas Flow	No measurement		1.00	L/min
RF Power	No measurement		1200.4	W
RF Supply Current	No measurement		8.228	A
RF Supply Voltage	No measurement		194.529	V

*1 If option installed

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Consumed PM Parts

Part Description	Part Number	Product or Model# where used	Quantity consumed
Axial Pre-Optic Window	G8010-68014	G8010A, G8011A, G8014A/G8015A	1
Radial Pre-Optic Window	G8010-68015	All	1
Agilent Cool Clear Coolant Fluid	5799-0037	Agilent Water Recirculator	1
Purge Gas Filter	G8010-60136	All	1
Air inlet filter	G8000-68002	All	1
High Capacity Air Filter	G8010-60189	Optional	-
Rotor seal for 6-7 port valve for AVS6/7	G8494-60002	G8494A/G8495	-
Rotor seal for 4 port valve for AVS4	G8493-60002	G8493A	-
Rinse solution to rinse station 2.5mm id x 1m	G8410-80123	SPS 4	-
Barb connector 2.5mm-1.5mm ID	G8410-80124	SPS 4	-
PVC waste tubing 8mm od x 5mm id, 2m	G8410-80122	SPS 4	-
Additional Parts may be required from engineer's stock:			
X axis drive belt	5410047500	SPS 3	-
Z axis drive belt	5410047400	SPS 3	-
Peristaltic pump tubing, PVC SolvaFlex, 3 bridged,	3710049000	SPS 4	-

Consumed Parts Reference
(Purchased by customer, not included as part of PM)☒ Section Not Applicable

Part Description	Part Number	Product or Model# where used	Quantity consumed
------------------	-------------	------------------------------	-------------------

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Signature Page

Service Engineer Comments (optional)

If there are any specific points you wish to note as part of performing the installation or other items of interest for the customer, please write in this box.

Service Verification

Service Request Number:
6008 006610

Service Engineer Name:
Worawit T.

Service Engineer Signature:
Worawit T.

Total number of pages in this document:
14

Date Service Completed:
3 Nov 2025

Customer Name:
Aphorn O.

Customer Signature:
Aphorn O.

Revision: A.02, Issued 21 January 2022
Document Number: G8014-90075
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เอกสารไม่ควบคุม



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.: 25CH1053
Page.: 1 of 2

Equipment : Turbidity Meter
Manufacturer : Oakton
Model : T100IR
Serial No. : 1120501017
ID. No. : UAE.WAT.056/2563
Condition As-Received: Used Item
Received Date : 05 September 2025
Calibration Date : 08 September 2025
Reference : 2509-0212DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (23 ± 3.0) °C
Relative Humidity : (50 ± 20) %
Calibration Procedure : In - house method : CP-CH11
Direct measurement by using Formazin standard solution
Calibrated by : Walalak Sirithean
Approved by : Sathip
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Sathip Meangmai
Issue Date : 9 September 2025

The Uncertainties are for a confidence probability of approximately 95%

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

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Cert.No.: 25CH1053
Page.: 2 of 2

Condition of this calibration result

1. Reference Standard Instruments :

Instruments	ID No.	Certificate No.	Due date
1) Data Logger	130EC012	24H2043	23 Sep 2025
2) Liquid-in Glass Thermometer	130RC003	251440	16 Apr 2026

- This measurement result is traceable to SI through Technology Promotion Association (Thailand - Japan)

2. Certified Reference Materials : Turbidity standard solution (Formazin)

- The measurement results are traceable to SI through CPA chem Ltd.,

Turbidity Solution	Manufacturer	Lot No.	Exp. date
20.0 NTU	CPA Chem	1088008	18 Mar 2026
100.0 NTU	CPA Chem	1088007	18 Mar 2026
400 NTU	CPA Chem	1088018	18 Mar 2026
800 NTU	CPA Chem	1088017	18 Mar 2026

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

Calibration result

Performing five - Formazin suspension standard curve by using 0, 20, 100, 400, 800 NTU
Turbidity Meter serial number : 1120501017

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
0	0.00	0.026	2.00
20.0	20.2	0.20	2.00
100.0	100	1.2	2.00
400	403	2.4	2.00
800	799	4.3	2.00

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

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

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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.: 26TW47
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE2L0016
ID No. : UAE.EFM.016/2566(EFM.DO.01/66)
Received Date : 24 February 2026
Test Date : 26 February 2026
Reference : 2602-0801WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Tested by : Walalak Sirithean
Approved by : Sathip
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Sathip Meangmai
Issue Date : 27 February 2026

เอกสารไม่ควบคุม



Cert.No.: 26TW47
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :
This measurement result is traceable to the International System of Unit through the reference standards laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).

Instruments	ID No.	Certificate No.	Due Date
1. Burette	130BU10	25CG1126	18 Mar 2027
2. Balance	110RC001	25MM316	02 July 2026

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate 5-Hydrate AR	KEMAUS	2203162447	99.6%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 9K2J0004

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.22	8.22	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.: 26LM34
Page.: 1 of 2

Equipment : DO Meter with Sensor
Manufacturer : Horiba
Model : LAQUA-DO210
Serial No. : HE2L0016
ID No. : UAE.EFM.016/2566(EFM.DO.01/66)
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 : 24 February 2026
Calibrated Date : 26 February 2026
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Warakorn Lernagatrakul
Approved by :
() Chakrit Waewwanjua
() Suwit Imjai
(✓) Kunchit Promprat
Issue Date : 05 March 2026

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2602-0801WSC-2

Cert. No.: 26LM34
Page.: 2 of 2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with
Industrial Platinum Resistance Thermometer (IPT) into Temperature Bath.
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Digital Thermometer	2188080	25I953	TPA	05 Sep 2026

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

3. This measurement result is traceable to the International System of Unit maintained through :

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 9K2J0004

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
15.0	80	15.002	15.0	-0.002	0.16	2.00
30.0	80	30.005	29.9	-0.105	0.16	2.00
45.0	80	45.002	44.9	-0.102	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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DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



CERTIFICATE OF CALIBRATION

Certificate No. : SP26-012

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 18 May 2026

Calibration Date : 18 May 2026

Issue Date : 21 May 2026

Condition Instrument : Good

Calibrated by :
(Mr.Pacit Mathavorn)
Calibration Engineer

Approved by :
(Ms.Chonticha Sangnern)
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding
national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.
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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



REPORT OF CALIBRATION

Certificate No. : SP26-012Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	136858	5 November 2027
Absorbance Standard set	25757	136848	5 November 2027
Wavelength Standard set	25806	136824	5 November 2027
Wavelength Standard set	25758	136827	5 November 2027

Traceability : This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

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REPORT OF CALIBRATION

Certificate No. : SP26-012Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5772	0.575	0.0022	0.0031	2.00
	1.0478	1.043	0.0048	0.0029	2.00
	2.1879	2.197	-0.0091	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5581	0.558	0.0001	0.0034	2.00
	1.0224	1.022	0.0004	0.0035	2.00
	2.1227	2.131	-0.0083	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5225	0.518	0.0045	0.0029	2.00
	0.9628	0.961	0.0018	0.0028	2.00
	1.9744	1.981	-0.0066	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5174	0.515	0.0024	0.0031	2.00
	0.9990	0.997	0.0020	0.0033	2.00
	1.9953	1.995	0.0003	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5508	0.549	0.0018	0.0030	2.00
	1.0801	1.079	0.0011	0.0029	2.00
	2.0356	2.036	-0.0004	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5579	0.558	-0.0001	0.0031	2.00
	1.0512	1.050	0.0012	0.0029	2.00
	1.9257	1.928	-0.0023	0.0079	2.00

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REPORT OF CALIBRATION

Certificate No. : SP26-012Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7455	0.742	0.0035	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8656	0.860	0.0056	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2910	0.288	0.0030	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6414	0.635	0.0064	0.0055	2.00

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REPORT OF CALIBRATION

Certificate No. : SP26-012Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.3	0.42	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.5	0.16	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.3	0.17	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

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MSC-1701-1705 17025
CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP26-014

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-5100

Serial No. : 23A4-008

ID No. : UAE.WAS.010/2567

Received Date : 18 May 2026

Calibration Date : 18 May 2026

Issue Date : 21 May 2026

Condition Instrument : Good

Calibrated by : 
(Mr.Pacit Mathavorn)
Calibration Engineer

Approved by : 
(Ms.Chonticha Sangngern)
Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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MSC-1701-1705 17025
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP26-014

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	136858	5 November 2027
Absorbance Standard set	25757	136848	5 November 2027
Wavelength Standard set	25806	136824	5 November 2027
Wavelength Standard set	25758	136827	5 November 2027

Traceability : This certification is traceable to the International System of Unit maintained at National -
Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 5.0 nm.

Scan Speed of UUC : 40

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.
Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

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MSC-1701-1705 17025
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP26-014

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5772	0.574	0.0032	0.0031	2.00
	1.0478	1.043	0.0048	0.0029	2.00
	2.1879	2.182	0.0059	0.0082	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5581	0.556	0.0021	0.0034	2.00
	1.0224	1.020	0.0024	0.0035	2.00
	2.1227	2.121	0.0017	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5225	0.518	0.0045	0.0029	2.00
	0.9628	0.961	0.0018	0.0028	2.00
	1.9744	1.974	0.0004	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5174	0.514	0.0034	0.0031	2.00
	0.9990	0.996	0.0030	0.0033	2.00
	1.9953	1.995	0.0003	0.0087	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5508	0.549	0.0018	0.0030	2.00
	1.0801	1.078	0.0021	0.0029	2.00
	2.0356	2.028	0.0076	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5579	0.558	-0.0001	0.0031	2.00
	1.0512	1.050	0.0012	0.0029	2.00
	1.9257	1.923	0.0027	0.0083	2.00

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MSC-1701-1705 17025
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP26-014

Page 4 of 5

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7455	0.744	0.0015	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8656	0.863	0.0026	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2910	0.290	0.0010	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6414	0.640	0.0014	0.0055	2.00

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



MSC-1701-TIS 17025

CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP26-014

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.00	240.3	0.70	0.18	2.00
279.30	278.9	0.40	0.18	2.00
288.90	288.2	0.70	0.18	2.00
334.50	333.8	0.70	0.18	2.00
361.40	360.7	0.70	0.18	2.00
418.40	417.9	0.50	0.18	2.00
447.20	446.6	0.60	0.18	2.00
459.30	459.4	-0.10	0.18	2.00
537.00	536.5	0.50	0.18	2.00
638.00	637.3	0.70	0.18	2.00
441.29	440.6	0.69	0.18	2.00
479.88	479.2	0.68	0.18	2.00
513.75	513.0	0.75	0.18	2.00
528.59	528.1	0.49	0.18	2.00
575.10	574.5	0.60	0.18	2.00
585.56	585.0	0.56	0.20	2.00
684.70	684.2	0.50	0.18	2.00
740.51	739.9	0.61	0.20	2.00
747.61	747.0	0.61	0.18	2.00
807.04	806.5	0.54	0.18	2.00
879.68	879.0	0.68	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k.

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

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FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

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Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



MSC-1701-TIS 17025

CALIBRATION DATA

CERTIFICATE OF CALIBRATION

Certificate No. : SP26-012

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co.,Ltd. (Head Office)

Address : 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Location of calibration : Instrument room (207)

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 18 May 2026

Calibration Date : 18 May 2026

Issue Date : 21 May 2026

Condition Instrument : Good

Calibrated by : 

(Mr.Pacit Mathavorn)

Calibration Engineer

Approved by : 

(Ms.Chonticha Sangnangern)

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.

The measurement capability of the laboratory and its traceability to recognized national standards and to the unit of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the DQE Services Co., Ltd.

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DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



MSC-1701-TIS 17025

CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP26-012

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	136858	5 November 2027
Absorbance Standard set	25757	136848	5 November 2027
Wavelength Standard set	25806	136824	5 November 2027
Wavelength Standard set	25758	136827	5 November 2027

Traceability : This certification is traceable to the International System of Unit maintained at National - Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

DQE Services Co.,Ltd.

DQE Services

32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



MSC-1701-TIS 17025

CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP26-012

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5772	0.575	0.0022	0.0031	2.00
	1.0478	1.043	0.0048	0.0029	2.00
	2.1879	2.197	-0.0091	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5581	0.558	0.0001	0.0034	2.00
	1.0224	1.022	0.0004	0.0035	2.00
	2.1227	2.131	-0.0083	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5225	0.518	0.0045	0.0029	2.00
	0.9628	0.961	0.0018	0.0028	2.00
	1.9744	1.981	-0.0066	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5174	0.515	0.0024	0.0031	2.00
	0.9990	0.997	0.0020	0.0033	2.00
	1.9953	1.995	0.0003	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5508	0.549	0.0018	0.0030	2.00
	1.0801	1.079	0.0011	0.0029	2.00
	2.0356	2.036	-0.0004	0.0079	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5579	0.558	-0.0001	0.0031	2.00
	1.0512	1.050	0.0012	0.0029	2.00
	1.9257	1.928	-0.0023	0.0079	2.00

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

REPORT OF CALIBRATION

Certificate No. : SP26-012

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7455	0.742	0.0035	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8656	0.860	0.0056	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2910	0.288	0.0030	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6414	0.635	0.0064	0.0055	2.00

REPORT OF CALIBRATION

Certificate No. : SP26-012

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Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.3	0.42	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.0	0.59	0.18	2.00
445.94	445.5	0.44	0.18	2.00
453.66	453.5	0.16	0.18	2.00
460.02	459.5	0.52	0.18	2.00
536.59	536.5	0.09	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.0	0.38	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.3	0.17	0.18	2.00
528.88	528.5	0.38	0.18	2.00
573.17	573.0	0.17	0.18	2.00
585.35	585.0	0.35	0.20	2.00
684.40	684.0	0.40	0.18	2.00
740.72	740.5	0.22	0.20	2.00
748.55	748.5	0.05	0.18	2.00
807.03	807.0	0.03	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,
which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

เอกสารไม่ควบคุม

FM-708-02 R01 1/11/2021

บริษัท อินทิเกรตเต็ด รีเสิร์ช เซ็นเตอร์ จำกัด

CERTIFICATE OF CALIBRATION

Certificate No. : COF-022-68

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : TISCH
MODEL/TYPE : TE-5028A
SERIAL NUMBER : 2926
ID NUMBER : -
CONDITION AS-RECEIVED : Used item
CUSTOMER : Integrated Research Center Company Limited,
122 Moo 2, Thathom, Srirachaphote,
Prachinburi 25140, Thailand.

RECEIVED DATE : 05 Jun 2025
MEASUREMENT DATE : 12 Jun 2025
ISSUE DATE : 13 Jun 2025

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 22.7 °C and 52.1 %RH.

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

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G55/MNO/MS-2p. The MW-CL-004 was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: NMW-0016-25.

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".

Table 1: The results of Q Standard calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.698	752.986	22.65	22.05	60.043	1.071	1.034	0.643
2	1.003	752.904	22.57	21.90	44.794	2.326	1.524	0.944
3	1.120	752.767	22.83	22.21	39.589	2.939	1.712	1.061
4	1.167	752.907	22.91	22.32	37.026	3.231	1.795	1.109
5	1.417	752.831	23.13	22.57	25.460	4.930	2.217	1.368

Slope (w): 1.63233
Intercept (i): -0.01636
Correlation coefficient (r): 0.99980
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [T _a] °C	Temperature [T _m] °C	Ap_meter mmHg	Ap_Orifice inH ₂ O	γ	Standard Flow [Q _s] m ³ /min
1	0.698	752.986	22.65	22.05	60.043	1.071	0.649	0.644
2	1.003	752.904	22.57	21.90	44.794	2.326	0.956	0.945
3	1.120	752.767	22.83	22.21	39.589	2.939	1.075	1.063
4	1.167	752.907	22.91	22.32	37.026	3.231	1.127	1.112
5	1.417	752.831	23.13	22.57	25.460	4.930	1.393	1.372

Slope (w): 1.02238
Intercept (i): -0.01025
Correlation coefficient (r): 0.99981
Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration

Calibrated by:
☐ Mr. Sorwet Thachalad
☐ Miss Jitraporn Lertsomphol



Approved signatory:
Mr. Parinya Booncharoen
Calibration Department Manager

THIS CERTIFICATE OF CALIBRATION MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03N199E80A0020
Cylinder Number: LL193324
Laboratory: 124 - Riverton (SAP) - NJ
PGVP Number: B52018
Gas Code: NO,NOX,SO2,BALN
Reference Number: 82-401285019-1
Cylinder Volume: 83.4 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
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.

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	+/- 0.8%	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	+/- 2.0%	Jun 01, 2020
NTRM	14010327	KAL004376	49.08 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Apr 17, 2024

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 APW1100391 NO	FTIR	Aug 09, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Aug 31, 2018
Nicolet 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. 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.

ACCREDITED

TESTING CERT No. 3082.05

Approved for Release

Page 1 of 82-401285019-1

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
600 Union Landing Road
Cinnaminson, NJ 08077-0000
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03N199E80A0020
Cylinder Number: LL193324
Laboratory: 124 - Riverton (SAP) - NJ
PGVP Number: B52018
Gas Code: NO,NOX,SO2,BALN
Reference Number: 82-401285019-1
Cylinder Volume: 83.4 CF
Cylinder Pressure: 2215 PSIG
Valve Outlet: 660
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.

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	+/- 0.8%	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	+/- 2.0%	Jun 01, 2020
NTRM	14010327	KAL004376	49.08 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Apr 17, 2024

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 APW1100391 NO	FTIR	Aug 09, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Aug 31, 2018
Nicolet 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. 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.

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TESTING CERT No. 3082.05

Approved for Release

Page 1 of 82-401285019-1

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E03NI99E80A0020 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-12/531, 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.

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	1605025	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
GMIS	7042010104	CC503941	5.101 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Jun 01, 2020
NTRM	14010327	KAL004376	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
Nicolet 6700 APW1100391 NO	FTIR	Aug 09, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Aug 31, 2018
Nicolet 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. 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

Page 1 of 82-401285019-1



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

Request No.23-69/0168

MTC.No.23-69/0168

Number of page(s) 2

CALIBRATION CERTIFICATE

Nomenclature : PERSONAL AIR PUMP SAMPLING PUMP CALIBRATION

Manufacturer : MesaLabs

Serial No.: 210155

Model : Defender 510

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

Subdivision : (0.00001, 0.0001) l/min

Submitted by : INTEGRATED RESEARCH CENTER COMPANY LIMITED.

122 T.Thatoom A.Srimahaphote,

Prachinburi 25140, Thailand.

Received date : 9 January 2026

Condition of measured item : Normal

Calibration date : 19 January 2026

Standard	Standard	Certificate No.	Date due	Traceability
RTD Thermometer	PSL-T 0811/67	3-Jul-26	TISTR	
Molbox/Pressure Transducer/UpStream	MP-0178-25	29-Jun-27	NIMT	
Primary Flow Calibrator S/N 117982	MW-0045-25	2-Jul-27	NIMT	
Primary Flow Calibrator S/N 119521	MW-0046-25	14-Jul-27	NIMT	

Calibrated by : Terasak Panna
(Mr.Terasak Panna)

Approved by : (Ms.Kirana Luanghirun)
Director
Mechanical Engineering Standards Laboratory
Ref. 2013269010900101001
Issued Date 22 January 2026

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

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

FM.BLMTC.002 Rev.5

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E03NI99E80A0020 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-12/531, 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.

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	1605025	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
GMIS	7042010104	CC503941	5.101 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Jun 01, 2020
NTRM	14010327	KAL004376	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
Nicolet 6700 APW1100391 NO	FTIR	Aug 09, 2018
Nicolet 6700 APW1100391 NO2	FTIR	Aug 31, 2018
Nicolet 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. 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

Page 1 of 82-401285019-1



THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

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

Request No.23-69/0168

2/2

MTC.No.23-69/0168

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

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

Atmospheric pressure (1010±13) hPa

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

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

Measurement data :

UUC Value (l/min)	Standard Value (l/min)	Temperature (°C)	Pressure (hPa)	Deviation (%)	Uncertainty (%)
0.05246	0.052521	24.480	1009.62	-0.12	0.93
0.49901	0.49904	24.466	1009.80	-0.01	0.93
1.0071	1.0072	24.432	1009.92	-0.01	0.89
1.5010	1.5006	24.421	1010.14	+0.02	0.89
2.0022	2.0039	24.412	1010.32	-0.08	0.90

The reported expanded uncertainties are based on standard uncertainties multiplied by a coverage factor k=2, which provides a level of confidence of approximately 95%.

The end of calibration certificate.

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

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

FM.BLMTC.002 Rev.5

Request No. 21-69/0163

MTC No. EEL. BP. 73/0169

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., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Rion

Model : 2127

Serial No. : 100012

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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 : 9 Jan. 2026

Date of Calibration : 20 Jan. 2026

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FMBL.MTC.002 Rev.5

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

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

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

Request No. 21-69/0163

MTC No. EEL. BP. 75/0169

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., Muang, Samutprakan 10280.

Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : Delta Ohm

Model : HD1902

Serial No. : 10038483

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

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

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

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

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.500) kPa

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 : 9 Jan. 2026

Date of Calibration : 20 Jan. 2026

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Fax. (66) 0 2577 9009

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Request No. 21-69/0163

MTC No. EEL. BP. 73/0169

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	93.94	-0.06	± 0.10	±0.40 dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	999.9	-0.1	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Bruel&Kjaer 4180	1.60	± 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.Weerachai Deechaiyae)

Approved by :



(Mr.Pasade Kludaya)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 20 Jan. 2026

Date of Issue : 21 Jan. 2026

Ref : 2011269010900096001

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

Office/Laboratory
668 Mu 2 Tambon Bangpooaim, Amphoe Muang Samutprakan,
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Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

Request No. 21-69/0163

MTC No. EEL. BP. 75/0169

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	93.92	-0.08	± 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	1.30	± 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 : 20 Jan. 2026

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

Office/Laboratory
668 Mu 2 Tambon Bangpooaim, Amphoe Muang Samutprakan,
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196 Phahonyothin Road, Ladyao, Chatuchak,
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Request No. 21-69/0163

MTC No. EEL. BP. 75/0169

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

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	113.90	-0.10	± 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 Brüel&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 Brüel&Kjaer 4180	0.19	± 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 Deechaiyae)

Approved by:

(Mr. Prawit Kluyapa)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration: 20 Jan. 2026

Date of Issue: 21 Jan. 2026

Ref: 2011269010900096003

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

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

Office
196 Phahonyothin Road, Ladysao, Chatuchak,
Bangkok 10900, Thailand
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(66) 08 1889 6827

FMBL.MTC.002 Rev.5

Request No. 21-69/0163

MTC No. EEL. BP. 74/1169

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 Brüel&Kjaer 4180	93.94	-0.06	± 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 Brüel&Kjaer 4180	1001.6	1.6	± 1.5	±1.0%

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 1
1/2 inch Brüel&Kjaer 4180	1.45	± 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 Deechaiyae)

Approved by:

(Mr. Prawit Kluyapa)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration: 20 Jan. 2026

Date of Issue: 21 Jan. 2026

Ref: 2011269010900096002

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

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

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

FMBL.MTC.002 Rev.5

Request No. 21-69/0163

MTC No. EEL. BP. 74/1169

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., Muang, Samutprakan 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 Brüel&Kjaer 2636 S/N 1537484.

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

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

5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.

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

7. Condenser Microphone Brüel&Kjaer 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: 9 Jan. 2026

Date of Calibration: 20 Jan. 2026

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

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

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

Request No. 21-69/0162

MTC No. EEL. BP. 63/0169

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.: 100142

Microphone: Type 7052 No.79842

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&Kjaer 4180 S/N 2633526.

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&Kjaer 4231 S/N 3015154.

7. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.

Date of Receipt: 9 Jan. 2026

Date of Calibration: 13-17 Feb. 2026

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

Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
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196 Phahonyothin Road, Ladysao, Chatuchak,
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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 : 13-17 Feb. 2026

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Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoornai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
	A-weight	C-weight	Flat			
125	0.2	0.4	0.2	1.5	0.45	0.6
1 000	0.0	0.0	0.0	1.0	0.45	0.6
8 000	-3.6	-3.5	-3.7	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

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

Date of Calibration : 13-17 Feb. 2026

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Office/Laboratory
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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
	Before adjust	After adjust				
93.99	93.3	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 115.6 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
20.1	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 ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
A-Weight	18.3	0.10	N/A
C-Weight	27.9	0.10	N/A
Flat	32.1	0.10	N/A

Date of Calibration : 13-17 Feb. 2026

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5. Long-term 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	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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 : 13-17 Feb. 2026

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

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

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

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	118.9	-0.1	1.1	0.30	0.3
114	113.9	-0.1	1.1	0.30	0.3
109	108.8	-0.2	1.1	0.30	0.3
104	103.8	-0.2	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	78.9	-0.1	1.1	0.30	0.3
74	73.8	-0.2	1.1	0.30	0.3
69	68.8	-0.2	1.1	0.30	0.3
64	63.8	-0.2	1.1	0.30	0.3
59	58.8	-0.2	1.1	0.30	0.3
54	53.8	-0.2	1.1	0.30	0.3
49	48.8	-0.2	1.1	0.30	0.3
44	43.8	-0.2	1.1	0.30	0.3
39	38.8	-0.2	1.1	0.30	0.3
34	33.1	-0.9	1.1	0.30	0.3
33	33.0	0.0	1.1	0.30	0.3

Date of Calibration : 13-17 Feb. 2026

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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	25.9	0.9	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	115.2	-0.8	±1.0	0.20	0.3
	2	98.8	-0.2	+1.0; -2.5	0.20	0.3
	0.25	89.1	-0.9	+1.5; -5.0	0.20	0.3
Slow	200	109.6	0.0	±1.0	0.20	0.3
	2	89.9	-0.1	+1.0; -5.0	0.20	0.3
SEL	200	109.2	-0.8	±1.0	0.20	0.3
	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	81.2	0.2	+1.5; -5.0	0.20	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	32.1	0.1	1.1	0.30	0.3
31	31.2	0.2	1.1	0.30	0.3
30	30.2	0.2	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	125.8	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	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. Prawat Klauyapa)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Feb. 2026

Date of Issue : 17 Feb. 2026

Ref : 2011269010900095005

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. : 100143

Microphone : Type 7052 No.57063

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 2633526.
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 : 9 Jan. 2026

Date of Calibration : 29-30 Jan. 2026

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Fax. (66) 0 2577 9009

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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	93.1	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)
16.9	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	15.2	0.10	N/A
C-Weight	24.2	0.10	N/A
Flat	27.1	0.10	N/A

Date of Calibration : 29-30 Jan. 2026

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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 : 29-30 Jan. 2026

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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	0.6	0.6	0.5	1.5	0.45	0.6
1 000	-0.2	-0.3	-0.2	1.0	0.45	0.6
8 000	-2.7	-2.5	-2.5	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	0.2	0.0	0.0	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	-0.1	0.0	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

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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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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory
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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	32.1	0.1	1.1	0.30	0.3
31	31.1	0.1	1.1	0.30	0.3
30	30.2	0.2	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	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	118.9	-0.1	1.1	0.30	0.3
114	113.9	-0.1	1.1	0.30	0.3
109	108.8	-0.2	1.1	0.30	0.3
104	103.8	-0.2	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	78.9	-0.1	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	33.0	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	25.7	0.7	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	25.3	0.3	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	115.2	-0.8	±1.0	0.20	0.3
	2	98.8	-0.2	+1.0; -2.5	0.20	0.3
	0.25	89.1	-0.9	+1.5; -5.0	0.20	0.3
Slow	200	109.6	0.0	±1.0	0.20	0.3
	2	89.9	-0.1	+1.0; -5.0	0.20	0.3
	200	109.2	-0.8	±1.0	0.20	0.3
SEL	2	90.0	0.0	+1.0; -2.5	0.20	0.3
	0.25	81.2	0.2	+1.5; -5.0	0.20	0.3

Date of Calibration : 29-30 Jan. 2026

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

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

Office
196 Phahonyothin Road, Ladao, Chatchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 521
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10. Peak C sound level

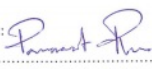
Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.8	0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20	0.35
Negative half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

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 Phasingri)

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

Date of Calibration : 29-30 Jan. 2026

Date of Issue : 2 Feb. 2026

Ref : 2011269010900095006

End of Certificate

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

Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
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E-mail : mtctr@tistr.or.th Website : www.tistr.or.th

Office
196 Phahonyothin Road, Ladyao, Chatchak,
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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%.

Date of Calibration : 29-30 Jan. 2026

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Changwat Pathumthani 12120, Thailand
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Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 8827

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. : 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 :

- Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
- Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
- 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 : 9 Jan. 2026

Date of Calibration : 29-30 Jan. 2026

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Fax. (66) 0 2577 9009

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668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
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196 Phahonyothin Road, Ladyao, Chatchak,
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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit Class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
	Before adjust	After adjust			
93.99	93.7	94.0	0.0	1.0	0.30

Note: The external calibration adjustment was firstly performed. The internal calibration adjustment was then completed at the display of 95.5 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
18.4	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	15.9	0.10	N/A
C-Weight	24.8	0.10	N/A
Flat	27.8	0.10	N/A

Date of Calibration : 29-30 Jan. 2026

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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	0.1	0.2	1.5	0.45	0.6
1 000	-0.1	-0.1	-0.1	1.0	0.45	0.6
8 000	-4.5	-4.4	-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	0.2	0.1	0.0	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	0.0	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

Date of Calibration : 29-30 Jan. 2026

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Fax. (66) 0 2577 9009

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

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	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	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	39.1	0.1	1.1	0.30	0.3
34	34.5	0.5	1.1	0.30	0.3
33	33.1	0.1	1.1	0.30	0.3

Date of Calibration : 29-30 Jan. 2026

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

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

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

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 : 29-30 Jan. 2026

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

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

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

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	32.1	0.1	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

Date of Calibration : 29-30 Jan. 2026

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

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

Office
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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	44.8	-0.2	1.1	0.30	0.3
30-120	35	34.8	-0.2	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	25.7	0.7	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 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Fast	200	115.6	-0.4	±1.0	0.20	0.3
	2	98.8	-0.2	+1.0; -2.5	0.20	0.3
	0.25	89.1	-0.9	+1.5; -5.0	0.20	0.3
Slow	200	109.6	0.0	±1.0	0.20	0.3
	2	89.9	-0.1	+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 : 29-30 Jan. 2026

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

Office/Laboratory
668 Mu 2 Tambon Bangpoornai, Amphoe Muang Samutprakan,
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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 : Delta OHM

Model : HD 2010UC

Serial No. : 11040842480

Microphone : Type UC-52 No.121411

Preamplifier : Delta Type HD2010PNE2 No.11001019

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.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Date of Receipt : 9 Jan. 2026

Date of Calibration : 13-17 Feb. 2026

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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. Prawtee Klauyapa)
Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 29-30 Jan. 2026

Date of Issue : 2 Feb. 2026

Ref : 2011269010900095007

End of Certificate

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FMLBL.MTC.002 Rev.5

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

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

Office
196 Phahonyothin Road, Ladysao, Chatchuak,
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 : 13-17 Feb. 2026

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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	93.7	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	18.7	0.10	N/A
C-Weight	25.1	0.10	N/A
Flat	27.2	0.10	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

Date of Calibration : 13-17 Feb. 2026

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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	0.3	0.3	0.2	1.5	0.45	0.6
1 000	-0.3	-0.3	-0.3	1.0	0.45	0.6
8 000	-5.3	-5.1	-5.3	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	0.0	-0.1	-0.3	2.0	0.20	0.6
125	0.0	0.0	-0.1	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	0.1	0.0	2.0	0.20	0.6
4 000	0.0	0.1	0.0	3.0	0.20	0.6
8 000	0.0	0.1	0.0	5.0	0.20	0.7

Date of Calibration : 13-17 Feb. 2026

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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 : 13-17 Feb. 2026

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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)
41	41.1	0.1	1.1	0.30	0.3
40	40.1	0.1	1.1	0.30	0.3
39	39.1	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)
60-140	94.0	94.0	0.0	1.1	0.30	0.3
50-130	94.0	94.0	0.0	1.1	0.30	0.3
40-120	94.0	94.0	0.0	1.1	0.30	0.3
30-110	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 : 13-17 Feb. 2026

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10. Peak C sound level

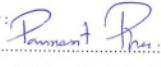
Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	135.4	135.3	-0.1	3.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	2.0	0.20	0.35
Negative half cycle	134.4	134.2	-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			
140.5	140.5	0.0	1.5	0.20

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	139.0	0.0	0.3	0.10	0.1
End	139.0				

Calibrated by : 
(Mr. Pannasit Phasingsri)

Approved by : 
(Mr. Prawate Khuaypa)
Director

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Feb. 2026

Date of Issue : 17 Feb. 2026

Ref : 2011269010900095010

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)
60-140	65	65.0	0.0	1.1	0.30	0.3
50-130	55	55.0	0.0	1.1	0.30	0.3
40-120	45	45.0	0.0	1.1	0.30	0.3
30-110	35	35.2	0.2	1.1	0.30	0.3
20-100	25	25.3	0.3	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
	0.25	80.9	-0.1	+1.5; -5.0	0.20	0.3

Date of Calibration : 13-17 Feb. 2026

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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 :

- Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
- Condenser Microphone Brüel&Kjaer 4180 S/N 2633526.
- 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&Kjaer 4231 S/N 3015154.
- Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Date of Receipt : 9 Jan. 2026

Date of Calibration : 13-17 Feb. 2026

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

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

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Date of Calibration : 13-17 Feb. 2026

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
	A-weight	C-weight	Flat			
125	0.4	0.2	0.1	1.5	0.45	0.6
1 000	-0.3	-0.3	-0.3	1.0	0.45	0.6
8 000	-5.2	-5.2	-5.3	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
	A-weight	C-weight	Flat			
63	-0.1	-0.3	-0.3	2.0	0.20	0.6
125	0.0	-0.1	-0.1	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	0.2	0.1	2.0	0.20	0.6
4 000	0.1	0.2	0.2	3.0	0.20	0.6
8 000	0.1	0.2	0.1	5.0	0.20	0.7

Date of Calibration : 13-17 Feb. 2026

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

FMBL.MTC.002 Rev.5

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
	Before adjust	After adjust				
93.95	93.1	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 ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
19.8	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 ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
A-Weight	18.2	0.10	N/A
C-Weight	24.2	0.10	N/A
Flat	27.0	0.10	N/A

Date of Calibration : 13-17 Feb. 2026

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

Office/Laboratory
668 Mu 2 Tambon Bangpoornai, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
Tel. (66) 0 2323 1672-80 ext. 115, 116
(66) 08 3219 9440
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5. Long-term 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	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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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)
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

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196 Phahonyothin Road, Ladysao, Chatuchak,
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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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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)
60-140	65	65.0	0.0	1.1	0.30	0.3
50-130	55	55.0	0.0	1.1	0.30	0.3
40-120	45	45.0	0.0	1.1	0.30	0.3
30-110	35	35.2	0.2	1.1	0.30	0.3
20-100	25	25.3	0.3	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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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)
41	41.1	0.1	1.1	0.30	0.3
40	40.1	0.1	1.1	0.30	0.3
39	39.1	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)
60-140	94.0	94.0	0.0	1.1	0.30	0.3
50-130	94.0	94.0	0.0	1.1	0.30	0.3
40-120	94.0	94.0	0.0	1.1	0.30	0.3
30-110	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 : 13-17 Feb. 2026

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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	135.4	135.3	-0.1	3.0	0.20	0.35
Positive half cycle	134.4	134.2	-0.2	2.0	0.20	0.35
Negative half cycle	134.4	134.2	-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				
140.5	140.5	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	139.0	0.0	0.3	0.10	0.1
End	139.0				

Calibrated by 
(Mr. Pannasit Phasingiri)

Approved by : 
(Mr. Pravee Khuyap)

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Feb. 2026

Date of Issue : 17 Feb. 2026

Ref : 2011269010900095009

End of Certificate

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Changwat Pathumthani 12120, Thailand
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FM.BLMTC.002 Rev.5

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. : 01022362

Microphone : Type UC-52 No.142301

Preamplifier : Type NH-24 No.22410

Ambient Environment

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

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

Ambient Pressure : $(101.325 \pm 1.5) \text{ kPa}$

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjær 4180 S/N 2633526.
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 : 9 Jun. 2026

Date of Calibration : 29-30 Jan. 2026

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

Office/Laboratory
668 Mu 2 Tambon Bangpoo, Amphoe Muang Samutprakan,
Changwat Samutprakan 10280, Thailand
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FM.BLMTC.002 Rev.5

1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB) Before adjust After adjust	Deviation value (dB)	Acceptance limit Class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
93.70	94.2 93.9	0.2	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 114.4 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
17.9	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 ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
A-Weight	13.2	0.10	N/A
C-Weight	18.8	0.10	N/A
Flat	24.4	0.10	N/A

Date of Calibration : 29-30 Jan. 2026

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Changwat Samutprakan 10280, Thailand
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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 : 29-30 Jan. 2026

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB) A-weight C-weight Flat	Acceptance limit class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
125	0.5 0.5 0.3	1.5	0.45	0.6
1 000	-0.1 -0.1 -0.1	1.0	0.45	0.6
8 000	-5.0 -5.0 -5.0	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB) A-weight C-weight Flat	Acceptance limit class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
63	-1.1 0.0 0.0	2.0	0.20	0.6
125	-1.1 0.0 0.0	1.5	0.20	0.6
250	-1.1 0.0 0.0	1.5	0.20	0.6
500	-1.0 1.0 1.0	1.5	0.20	0.6
1 000	0.0 1.0 1.0	1.0	0.20	0.6
2 000	-1.0 0.0 0.0	2.0	0.20	0.6
4 000	-1.0 0.0 0.0	3.0	0.20	0.6
8 000	-1.0 0.0 -1.0	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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 : 29-30 Jan. 2026

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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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
59	59.0	0.0	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	39.0	0.0	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	25.8	-0.2	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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
137	137.0	0.0	1.1	0.30	0.3
136	136.0	0.0	1.1	0.30	0.3
135	135.0	0.0	1.1	0.30	0.3
134	134.1	0.1	1.1	0.30	0.3
133	133.0	0.0	1.1	0.30	0.3
132	132.0	0.0	1.1	0.30	0.3
131	131.0	0.0	1.1	0.30	0.3
130	130.0	0.0	1.1	0.30	0.3
129	129.0	0.0	1.1	0.30	0.3
124	123.9	-0.1	1.1	0.30	0.3
119	119.0	0.0	1.1	0.30	0.3
114	114.1	0.1	1.1	0.30	0.3
109	109.1	0.1	1.1	0.30	0.3
104	104.1	0.1	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	84.0	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

Date of Calibration : 29-30 Jan. 2026

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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)
30-130	35	35.0	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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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

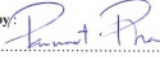
Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125.3	-0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.1	-0.3	2.0	0.20	0.35
Negative 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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Positive one-half cycle	Negative one-half cycle				
136.6	136.6	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	139.0	0.0	0.3	0.10	0.1
End	139.0				

Calibrated by: 
(Mr. Pannasit Phasingsri)

Approved by: 
(Mr. Prawate Klauayon)
Director
Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre
Ref: 2011269010900095008

Date of Calibration : 29-30 Jan. 2026

Date of Issue : 2 Feb. 2026

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 : 6236

Serial No. : 192015

Microphone : Type 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 2633526.
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 : 9 Jan. 2026

Date of Calibration : 13-17 Feb. 2026

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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 : 13-17 Feb. 2026

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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				
93.96	94.2	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 114.2 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
23.3	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	13.6	0.10	N/A
C-Weight	19.6	0.10	N/A
Flat	23.7	0.10	N/A

Date of Calibration : 13-17 Feb. 2026

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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	0.2	0.2	0.0	1.5	0.45	0.6
1 000	0.2	0.2	0.2	1.0	0.45	0.6
8 000	-5.0	-5.0	-5.1	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	0.1	0.0	2.0	0.20	0.6
125	0.0	0.1	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	-0.2	0.0	0.0	2.0	0.20	0.6
4 000	-0.4	-0.3	0.0	3.0	0.20	0.6
8 000	-0.6	-0.6	-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	122.0	0.0	1.1	0.30	0.3
121	121.0	0.0	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	114.0	0.0	1.1	0.30	0.3
109	109.0	0.0	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	79.1	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	54.1	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	39.0	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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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

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

Office
196 Phahonyothin Road, Ladyao, Chatuchak,
Bangkok 10900, Thailand
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
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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	119.9	-0.1	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	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	79.1	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	54.1	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	39.0	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

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	44.6	-0.4	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.3	0.3	1.1	0.30	0.3
20-100	25	25.3	0.3	1.1	0.30	0.3
20-90	25	25.2	0.2	1.1	0.30	0.3
20-80	25	25.1	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	98.6	-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

Date of Calibration : 13-17 Feb. 2026

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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. Pannasit Phasingsri)

Approved by : 
(Mr. Prawate Khuapra)

Electrical and Electronic Standards Laboratory
Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Feb. 2026

Date of Issue : 17 Feb. 2026

Ref : 201126901090095001

End of Certificate

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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
Changwat Pathumthani 12120, Thailand
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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 : 6236

Serial No. : 212014

Microphone : Type 7052NR No.76235

Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjaer 4180 S/N 2633526.
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&Kjaer 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.

Date of Receipt : 9 Jan. 2026

Date of Calibration : 13-17 Feb. 2026

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8 Power Amplifier Brüel&Kjaer 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 : 13-17 Feb. 2026

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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,
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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				
93.96	93.9	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 114.8 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
21.2	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	15.0	0.10	N/A
C-Weight	19.5	0.10	N/A
Flat	24.3	0.10	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	0.1	0.2	1.5	0.45	0.6
1 000	0.1	0.1	0.0	1.0	0.45	0.6
8 000	-3.8	-3.8	-3.9	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	0.2	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	0.0	1.5	0.20	0.6
500	0.0	0.1	0.0	1.5	0.20	0.6
1 000	0.0	0.1	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	0.0	3.0	0.20	0.6
8 000	-0.7	-0.5	-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	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	78.9	-0.1	1.1	0.30	0.3
74	74.0	0.0	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	49.3	0.3	1.1	0.30	0.3
44	44.3	0.3	1.1	0.30	0.3
39	39.1	0.1	1.1	0.30	0.3
34	34.4	0.4	1.1	0.30	0.3
33	33.4	0.4	1.1	0.30	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)
32	32.3	0.3	1.1	0.30	0.3
31	31.3	0.3	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

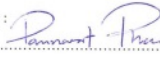
Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 (±dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
Complete cycle	125.4	125	-0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half 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

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. Prawate Khuaypa)

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

Date of Calibration : 13-17 Feb. 2026

Date of Issue : 17 Feb. 2026

Ref: 2011269010900095002

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	44.6	-0.4	1.1	0.30	0.3
30-120	35	35.0	0.0	1.1	0.30	0.3
20-110	25	25.3	0.3	1.1	0.30	0.3
20-100	25	25.3	0.3	1.1	0.30	0.3
20-90	25	25.3	0.3	1.1	0.30	0.3
20-80	25	25.3	0.3	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	89.6	-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

Date of Calibration : 13-17 Feb. 2026

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

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

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

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 : 6236

Serial No. : 212015

Microphone : Type 7052NR No.76236

Preamplifier : -

Standards used :

1. Band Pass Filter Stanford Research Systems SR 650 S/N 28712.
2. Condenser Microphone Brüel&Kjaer 4180 S/N 2633526.
3. Decade Attenuator Ando AL-205 S/N 0046602.
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&Kjaer 4231 S/N 3015154.
7. Measuring Amplifier Brüel&Kjaer 2636 S/N 1537484.

Ambient Environment

Temperature : (23 ± 3) °C

Relative Humidity : (50 ± 15) %

Ambient Pressure : (101.325 ± 1.5) kPa

Date of Receipt : 9 Jan. 2026

Date of Calibration : 13-17 Feb. 2026

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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 : 13-17 Feb. 2026

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3. Acoustical signal test of frequency weightings

Frequency (Hz)	Deviation from frequency response (dB)			Acceptance limit class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
	A-weight	C-weight	Flat			
125	0.2	0.2	0.0	1.5	0.45	0.6
1 000	0.2	0.2	0.2	1.0	0.45	0.6
8 000	-5.0	-5.0	-5.1	5.0	0.45	0.7

4. Electrical signal test of frequency weightings

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

Date of Calibration : 13-17 Feb. 2026

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1. Absolute Sensitivity

Reference Acoustic Signal (dB)	Measured value (dB)		Deviation value (dB)	Acceptance limit Class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
	Before adjust	After adjust				
93.96	93.5	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 94.9 dB.

2. Self-generated noise

2.1 Normal test

Measured value (dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
A-Weight	14.6	0.10	N/A
C-Weight	19.7	0.10	N/A
Flat	24.3	0.10	N/A

Date of Calibration : 13-17 Feb. 2026

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5. Long-term 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	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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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 : 13-17 Feb. 2026

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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	121.0	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	113.9	-0.1	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	88.9	-0.1	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	63.8	-0.2	1.1	0.30	0.3
59	58.9	-0.1	1.1	0.30	0.3
54	53.8	-0.2	1.1	0.33	0.3
49	48.8	-0.2	1.1	0.33	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	34.4	0.4	1.1	0.32	0.3
33	33.3	0.3	1.1	0.30	0.3

Date of Calibration : 13-17 Feb. 2026

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Changwat Pathumthani 12120, Thailand
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Office
196 Phahonyothin Road, Ladysao, Chatchuk,
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Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217
(66) 08 1889 6827

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	25.3	0.3	1.1	0.30	0.3
20-100	25	25.2	0.2	1.1	0.30	0.3
20-90	25	25.1	0.1	1.1	0.30	0.3
20-80	25	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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ 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	109.4	-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

Date of Calibration : 13-17 Feb. 2026

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Changwat Pathumthani 12120, Thailand
Tel. (66) 0 2577 9036
Fax. (66) 0 2577 9009

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Changwat Samutprakan 10280, Thailand
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196 Phahonyothin Road, Ladysao, Chatchuk,
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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 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
32	32.5	0.5	1.1	0.30	0.3
31	31.8	0.8	1.1	0.32	0.3
30	30.9	0.9	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

Date of Calibration : 13-17 Feb. 2026

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10. Peak C sound level

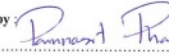
Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Complete cycle	125.4	125.8	0.4	3.0	0.20	0.35
Positive half cycle	124.4	124.2	-0.2	2.0	0.20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

11. Overload indication

Measured value (dB)		Deviated	Acceptance limit	Uncertainty	Maximum-permitted uncertainty
Positive one-half cycle	Negative one-half cycle	value (dB)	class 2 ($\pm$ dB)	($\pm$ dB)	of measurement ($\pm$ dB)
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 ($\pm$ 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 Phasingsri)

Approved by : 
(Mr. Prawate Klauyapa)

Director

Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 13-17 Feb. 2026

Date of Issue : 17 Feb. 2026

Ref : 2011269010900095003

End of Certificate

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(66) 08 1889 6827

CALIBRATION CERTIFICATE

Submitted by : INTEGRATED RESEARCH CENTER COMPANY LIMITED
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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 : 6236
Serial No. : 121016
Microphone : Type 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 2633526.
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 : 9 Jan. 2026

Date of Calibration : 13-17 Feb. 2026

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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				
93.96	93.4	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 (dB)	Uncertainty (±dB)	Maximum-permitted uncertainty of measurement (±dB)
21.4	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	14.5	0.10	N/A
C-Weight	19.4	0.10	N/A
Flat	24.5	0.10	N/A

Date of Calibration : 13-17 Feb. 2026

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FM.BLMTC.002 Rev.5

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

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

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

- 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 : 13-17 Feb. 2026

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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	0.2	0.2	0.0	1.5	0.45	0.6
1 000	0.5	0.5	0.3	1.0	0.45	0.6
8 000	-4.3	-4.2	-4.3	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	0.0	0.1	0.1	2.0	0.20	0.6
125	0.0	0.1	0.1	1.5	0.20	0.6
250	0.0	0.0	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	-0.5	-0.3	0.0	3.0	0.20	0.6
8 000	-0.6	-0.6	-0.1	5.0	0.20	0.7

Date of Calibration : 13-17 Feb. 2026

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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	0.1	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 : 13-17 Feb. 2026

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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)
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

Date of Calibration : 13-17 Feb. 2026

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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	99.1	0.1	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	78.9	-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	64.1	0.1	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	44.2	0.2	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 : 13-17 Feb. 2026

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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	25.2	0.2	1.1	0.30	0.3
20-100	25	25.2	0.2	1.1	0.30	0.3
20-90	25	25.1	0.1	1.1	0.30	0.3
20-80	25	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	89.6	-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
	0.25	80.9	-0.1	+1.5; -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 : 13-17 Feb. 2026

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Changwat Pathumthani 12120, Thailand
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Bangkok 10900, Thailand
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10. Peak C sound level

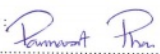
Number of cycles in test signal	Anticipated value (dB)	Measured value (dB)	Deviated value (dB)	Acceptance limit class 2 ($\pm$ dB)	Uncertainty ($\pm$ dB)	Maximum-permitted uncertainty of measurement ($\pm$ dB)
Complete cycle	125.4	125.3	-0.1	3.0	0.20	0.35
Positive half cycle	124.4	124.3	-0.1	2.0	0.20	0.35
Negative half cycle	124.4	124.3	-0.1	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			
132.5	132.5	0.0	1.5	0.20

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 Phasingsri)

Approved by : 
(Mr. Prawate Kluaypa)

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

Date of Calibration : 13-17 Feb. 2026

Date of Issue : 17 Feb. 2026

Ref : 2011269010900095004

End of Certificate

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Changwat Pathumthani 12120, Thailand
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Certificate of Calibration

Cert No. 5523631032284174

Date: Oct 28, 2025

Customer:
DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Work Order #: THAI-PT-01409

MPC Control #: EV3704
Asset ID: WL-WTB/01
Gage Type: WATER BATH
Manufacturer: MEMMERT
Model Number: WNB22
Size: 10 to 95 °C
Temp/RH: 23.8 °C / 54.0%
Location: Calibration performed at Customer's facility

Serial Number: L508.0973
Department: WATER LAB
Performed By: KRITSANAPHON THONGBAI
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: October 27, 2025
Cal. Interval: 12 MONTHS
Cal. Due Date: October 27, 2026

Calibration Notes:
Please refer to the attached Calibration Report (2 pages)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
CA2368	DATA ACQUISITION / THERMOCOUPLE SENSOR	34970A	MY41019078	AGILENT	Jan 7, 2026	5523631032227613 / MP-TH

Procedures Used in This Event

Procedure Name	Description
MPC-TCE-001 Rev. 03	Temperature Controlled Enclosures, General, Rev.03, Jun-13-2024

Calibrating Technician: *Kritsanaphon Th.*

QC Approval: *Taweesak Ariyachad*

KRITSANAPHON THONGBAI

TAWEESAK ARIYACHAD

STATEMENTS OF PASS OR FAIL CONFORMANCE: The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO/IEC 17025:2017.

THE CALIBRATION REPORT STATES:
PASS: Test used when compliance is met, and the measurement result is PASS.
FAIL: Test used when compliance is not met, and the measurement result is FAIL.
PASS: Test used when compliance is met, and the measurement result is PASS.
FAIL: Test used when compliance is not met, and the measurement result is FAIL.
REPORT OF VALUE: Test used when required measurement is not meeting compliance tolerance is noted.
ADJUSTED: When measurements are made in an adjusted state, change the value of measurement from what was measured as found to true value as set.
LIMITED: When an instrument has exceeded its use and is not functioning in a limited manner.

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

This calibration report complies with ISO/IEC 17025:2017, ANSI/ISO/IEC 17025:2017 and ISO/IEC 17025:2017. Calibration dates and testing data were submitted to the customer. Any number of future may cause an adjustment to shift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and accuracy of calibration. Accuracy is indicated by the number of significant figures and the tolerance (1991) and/or significant figures in international standards. Services rendered include proper maintenance of service equipment and are warranted for no less than 120 days. This information on this report pertains only to the equipment identified, the use may not be warranted in part or in a whole without the prior written approval of the issuing MP Calibration Laboratory.

Page 1 of 1

(CERT. Rev 9)

Calibration Report of Memmert WNB22 Water Bath

MPC Control #: EV3704
Asset ID: WL-WTB/01

Serial Number: L508.0973
Calibration Date: October 27, 2025

Measurement Results

Section 1 : Temperature Distribution

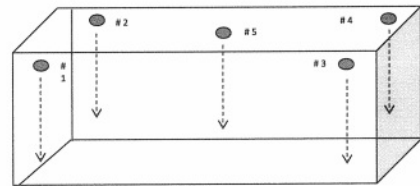
Temperature @ 85 °C

Sensor No.	UUC Setting (°C)	Lower Limit (°C)	STD Reading (°C)	Upper Limit (°C)	Result	Uncertainty (°C)
Sensor#1	85	84.00	84.65	84.65	PASS	± 0.45
Sensor#2	85	84.00	84.68	84.68	PASS	± 0.45
Sensor#3	85	84.00	84.66	84.66	PASS	± 0.45
Sensor#4	85	84.00	84.63	84.63	PASS	± 0.45
Sensor#5	85	84.00	84.64	84.64	PASS	± 0.45

Section 2 : Chamber Performance

Setting Temp (°C)	Indicating Temp (°C)	Measured Uniformity (°C)	Measured Stability (°C)	Overall Variation (°C)
85	85	0.32	0.24	0.57

Accuracy By : Customer Specification ± 1 °C



Page 1 of 2

Calibration Report of Memmert WNB22 Water Bath

MPC Control #: EV3704
Asset ID: WL-WTB/01

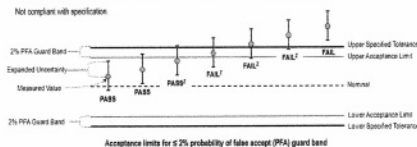
Serial Number: L508.0973
Calibration Date: October 27, 2025

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO/IEC 17025:2017.

The status of compliance with the acceptance criteria is reported as:

- PASS** - Compliant with specification.
- PASS** - The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
- FAIL** - The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
- FAIL** - Not compliant with specification.



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

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO/IEC 17025:2017, Method 6 - Guard Bands Based on Test Uncertainty Ratio.

End of Calibration Report

Page 2 of 2

Certificate of Calibration

Cert No. 5523631032284117

Date: Oct 28, 2025

Customer:
DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Work Order #: THAI-PT-01409

MPC Control #: EV3703
Asset ID: WL-WTB/02
Gage Type: WATER BATH
Manufacturer: MEMMERT
Model Number: WNB22
Size: 10 to 95 °C
Temp/RH: 23.8 °C / 54.0%
Location: Calibration performed at Customer's facility

Serial Number: L518.0690
Department: WATER LAB
Performed By: KRITSANAPHON THONGBAI
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: October 27, 2025
Cal. Interval: 12 MONTHS
Cal. Due Date: October 27, 2026

Calibration Notes:
Please refer to the attached Calibration Report (2 pages)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
CA2368	DATA ACQUISITION / THERMOCOUPLE SENSOR	34970A	MY41019078	AGILENT	Jan 7, 2026	5523631032227613 / MP-TH

Procedures Used in This Event

Procedure Name	Description
MPC-TCE-001 Rev. 03	Temperature Controlled Enclosures, General, Rev.03, Jun-13-2024

Calibrating Technician: *Kritsanaphon Th.*

QC Approval: *Taweesak Ariyachad*

KRITSANAPHON THONGBAI

TAWEESAK ARIYACHAD

STATEMENTS OF PASS OR FAIL CONFORMANCE: The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO/IEC 17025:2017.

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This calibration report complies with ISO/IEC 17025:2017, ANSI/ISO/IEC 17025:2017 and ISO/IEC 17025:2017. Calibration dates and testing data were submitted to the customer. Any number of future may cause an adjustment to shift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and accuracy of calibration. Accuracy is indicated by the number of significant figures and the tolerance (1991) and/or significant figures in international standards. Services rendered include proper maintenance of service equipment and are warranted for no less than 120 days. This information on this report pertains only to the equipment identified, the use may not be warranted in part or in a whole without the prior written approval of the issuing MP Calibration Laboratory.

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(CERT. Rev 9)



Calibration Report of Dixell XR06CX-5N0C2 Cool Room

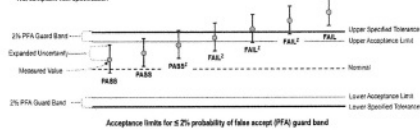
MPC Control #:	EV3706	Serial Number:	LIOGBXB500
Asset ID:	DARC-TE15028	Calibration Date:	October 27, 2025

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 17025:2017.

The status of compliance with the acceptance criteria is reported as:

- PASS — Compliant with specification.
- PASS? — The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
- FAIL? — The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
- FAIL — Not compliant with specification.



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

The calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017, Method 6 — Guard Bands Based on Test Uncertainty Ratio.

End of Calibration Report

Page 2 of 2



MICRO PRECISION CALIBRATION LABORATORY (THAILAND) CO., LTD.
413 Borden Road, Bangsue Subdistrict, Bangkok 10810, Thailand
Tel: 02-583 9834



Certificate of Calibration

Cert No. 5523631032284091

Date: Oct 28, 2025

Customer:

DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Work Order #: THAI-PT-01409

MPC Control #: EV3701
Asset ID: WL-058/11
Gage Type: CONDUCTIVITY METER
Manufacturer: METTLER TOLEDO
Model Number: SEVEN EASY
Size: 1413 $\mu\text{S}/\text{cm}$
Temp/RH: 23.8°C / 54.0%
Location: Calibration performed at Customer's facility

Serial Number: 1232025828
Department: WATER LAB
Performed By: KRITSANAPHON THONGBAI
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: October 27, 2025
Cal. Interval: 12 MONTHS
Cal. Due Date: October 27, 2026

Calibration Notes:

Please refer to the attached Calibration Report (1 page)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
EP5091	CONDUCTIVITY STANDARD SOLUTION	1413	H17031L	HANNA INSTRUMENTS	Oct 5, 2027	8207 / HANNA

Procedures Used in This Event

Procedure Name	Description
MPC-CON-001 Rev. 03	Conductivity and Resistivity Meters, General, Rev.03, Jul-15-2024

Calibrating Technician:

Kritsanaphon Th.

QC Approval:

Taweesak Ariyachad

KRITSANAPHON THONGBAI

TAWEEESAK ARYACHAD

STATEMENTS OF PASS OR FAIL CONFORMANCE: The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 17025:2017.

THE CALIBRATION REPORT STATES:
PASS? — Test used when compliance statement is given, and the measurement result is PASS?
PASS? — Test used when compliance statement is given, and the measurement result is PASS?
FAIL? — Test used when compliance statement is given, and the measurement result is FAIL?
FAIL? — Test used when compliance statement is given, and the measurement result is FAIL?
REPORT OF MEASUREMENT: — Test used when compliance statement is given, and the measurement result is PASS?
LIMITED: — Other or untested test conditions but a full functional in a normal manner.

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

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017, Method 6 — Guard Bands Based on Test Uncertainty Ratio.

The calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017, Method 6 — Guard Bands Based on Test Uncertainty Ratio.

Page 1 of 1

(CERT, Rev 9)



Calibration Report of Mettler Toledo SEVEN EASY Conductivity Meter

MPC Control #:	EV3701	Serial Number:	1232025828
Asset ID:	WL-058/11	Calibration Date:	October 27, 2025

Measurement Results

Nominal	Unit	Temp.	STD. Test Point @ Temp	Lower Limit	UUC Reading		Upper Limit	Result	Uncertainty (±)
					As Found	As Left			
1413	$\mu\text{S}/\text{cm}$	25.0°C	1413	1403	1413	1413	1423	PASS?	16

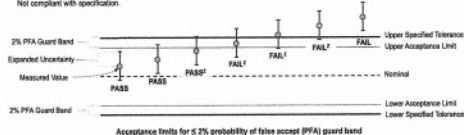
Note : Accuracy by Customer : $\pm 0.5\%$

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 17025:2017.

The status of compliance with the acceptance criteria is reported as:

- PASS — Compliant with specification.
- PASS? — The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
- FAIL? — The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
- FAIL — Not compliant with specification.



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

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017, Method 6 — Guard Bands Based on Test Uncertainty Ratio.

End of Calibration Report



MICRO PRECISION CALIBRATION LABORATORY (THAILAND) CO., LTD.
413 Borden Road, Bangsue Subdistrict, Bangkok 10810, Thailand
Tel: 02-583 9834



Certificate of Calibration

Cert No. 5523631032284084

Date: Oct 28, 2025

Customer:

DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Work Order #: THAI-PT-01409

MPC Control #: EV3700
Asset ID: WL-056/11
Gage Type: PH METER
Manufacturer: METTLER TOLEDO
Model Number: SEVEN EASY
Size: 0.00 to 14.00 pH
Temp/RH: 23.8°C / 54.0%
Location: Calibration performed at Customer's facility

Serial Number: 1232025225
Department: WATER LAB
Performed By: KRITSANAPHON THONGBAI
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: October 27, 2025
Cal. Interval: 12 MONTHS
Cal. Due Date: October 27, 2026

Calibration Notes:

Please refer to the attached Calibration Report (1 page)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
EP5088	PH BUFFER SOLUTION	PH 4.00	H17004L	HANNA INSTRUMENTS	Oct 14, 2029	0697 / HANNA
EP5089	PH BUFFER SOLUTION	PH 7.00	H17007L	HANNA INSTRUMENTS	Oct 14, 2029	0695 / HANNA
EY9977	PH BUFFER SOLUTION	PH 10.00	H17010L	HANNA INSTRUMENTS	Jul 9, 2026	0376 / HANNA

Procedures Used in This Event

Procedure Name	Description
MPC-PHM-001 Rev. 06	pH Meters, General, Rev.06, May-24-2024

Calibrating Technician:

Kritsanaphon Th.

QC Approval:

Taweesak Ariyachad

KRITSANAPHON THONGBAI

TAWEEESAK ARYACHAD

STATEMENTS OF PASS OR FAIL CONFORMANCE: The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 17025:2017.

THE CALIBRATION REPORT STATES:
PASS? — Test used when compliance statement is given, and the measurement result is PASS?
PASS? — Test used when compliance statement is given, and the measurement result is PASS?
FAIL? — Test used when compliance statement is given, and the measurement result is FAIL?
FAIL? — Test used when compliance statement is given, and the measurement result is FAIL?
REPORT OF MEASUREMENT: — Test used when compliance statement is given, and the measurement result is PASS?
LIMITED: — Other or untested test conditions but a full functional in a normal manner.

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

This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017, Method 6 — Guard Bands Based on Test Uncertainty Ratio.

The calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 17025:2017, Method 6 — Guard Bands Based on Test Uncertainty Ratio.

Page 1 of 1

(CERT, Rev 9)

Calibration Report of Digital Hygro - Thermometer

MPC Control #: EV3396 Serial Number: N/A
Asset ID: WL-DTH/02 Calibration Date: October 31, 2025

Measurement Results

Section 1 - Temperature Measurement

STD Reading (°C)	Lower Limit (°C)	UUC Reading (°C)		Upper Limit (°C)	Result	Uncertainty (°C)
		As Found	As Left			
20.00	19.00	20.1	20.1	21.00	PASS	± 0.051
25.00	24.00	25.3	25.3	26.00	PASS	± 0.055

Section 2 - Humidity Measurement

STD Reading (%RH)	Lower Limit (%RH)	UUC Reading (%RH)		Upper Limit (%RH)	Result	Uncertainty (%RH)
		As Found	As Left			
30.2	28.2	30	30	32.2	PASS	± 0.75
50.4	48.4	49	49	52.4	PASS	± 1.2
70.3	68.3	70	70	72.3	PASS	± 1.3

UUC : Unit Under Calibration , Reference Temperature @ 25°C

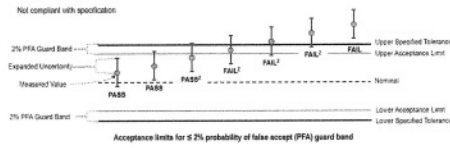
Accuracy By Manufacturer Specification , Temperature : ± 1 °C, Humidity : ± 2 %RH

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 2540 3:2006

The status of compliance with the acceptance criteria is reported as:

- PASS - Compliant with specification.
- PASS^U - The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
- FAIL^L - The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
- FAIL - Not compliant with specification.



The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated. This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 2540 3:2006, Method 6 - Guard Bands Based on Test Uncertainty Ratio.

End of Calibration Report

Certificate of Calibration

Cert No. 5523631032300196

Date: Nov 3, 2025

Customer:

DOUBLE A (1991) PUBLIC COMPANY LIMITED
1 MOO2 KLONGRUNG-PRACHINBURI ROAD
THATOOM, SRIMAHAPHOT
PRACHINBURI PRACHINBURI 25140

Work Order #: THAI-32289565

MPC Control #: EV3397
Asset ID: WL-DTH/03
Gage Type: DIGITAL HYGRO - THERMOMETER
Manufacturer: ELITECH
Model Number: BT-3
Size: N/A
Temp/RH: 23.3°C / 53.0%
Location: Calibration performed at MPC facility

Serial Number: N/A
Department: N/A
Performed By: PIMPHORN SAKKHAM
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: October 31, 2025
Cal. Interval: 12 MONTHS
Cal. Due Date: October 31, 2026

Calibration Notes:

Please refer to the attached Calibration Report (1 page)

Standards Used to Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
AS9541	PLATINUM RESISTANCE THERMOMETER	162C	957	ROSEMOUNT ANALYTICAL INC	Jun 20, 2027	TT-1027-25/NIMT
DP5188	HUMIDITY AND TEMPERATURE TRANSMITTER	HMT338	C5130088	VAISALA	Oct 9, 2026	TH-0126-24 / NIMT

Procedures Used in this Event

Procedure Name	Description
MPC-THD-001 Rev. 03	Temperature, Humidity and Dew Point Devices, General, Rev.03, Jul-15-2024

Calibrating Technician:

Pimphorn S.

QC Approval:

Taweek Ariyachad

STATEMENTS OF PASS OR FAIL CONFORMANCE: The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 2540 3:2006.

THE CALIBRATION REPORT STATUS: PASS: Test and other compliance statement is given, and the measurement result is within the specified tolerance. PASS^U: Test and other compliance statement is given, and the measurement result is within the specified tolerance. FAIL^L: Test and other compliance statement is given, and the measurement result is within the specified tolerance. FAIL: Test and other compliance statement is given, and the measurement result is outside the specified tolerance.

REPORT OF VALUE: Test and other compliance statement is given, and the measurement result is within the specified tolerance. The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

Calibration Report of Elitech BT-3 Digital Hygro - Thermometer

MPC Control #: EV3397 Serial Number: N/A
Asset ID: WL-DTH/03 Calibration Date: October 31, 2025

Measurement Results

Section 1 - Temperature Measurement

STD Reading (°C)	Lower Limit (°C)	UUC Reading (°C)		Upper Limit (°C)	Result	Uncertainty (°C)
		As Found	As Left			
20.00	19.50	19.6	19.6	20.50	PASS	± 0.051
25.00	24.50	24.9	24.9	25.50	PASS	± 0.055

Section 2 - Humidity Measurement

STD Reading (%RH)	Lower Limit (%RH)	UUC Reading (%RH)		Upper Limit (%RH)	Result	Uncertainty (%RH)
		As Found	As Left			
30.2	27.2	30	30	33.2	PASS	± 0.75
50.4	47.4	50	50	53.4	PASS	± 1.2
70.3	67.3	71	71	73.3	PASS	± 1.3

UUC : Unit Under Calibration , Reference Temperature @ 25°C

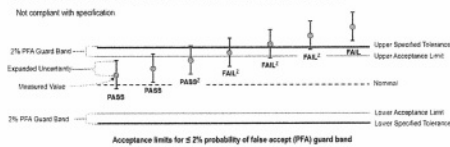
Accuracy By Manufacturer Specification , Temperature : ± 0.5 °C, Humidity : ± 3 %RH

Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/ISO 2540 3:2006

The status of compliance with the acceptance criteria is reported as:

- PASS - Compliant with specification.
- PASS^U - The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.
- FAIL^L - The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
- FAIL - Not compliant with specification.



The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated. This calibration report complies with ISO/IEC 17025:2017 and ANSI/ISO 2540 3:2006, Method 6 - Guard Bands Based on Test Uncertainty Ratio.

End of Calibration Report

Certificate of Calibration

Equipment: Standard Weight
Manufacturer: LS
Model: 1 g
Serial No.: Weight 001
ID No.: -
Condition of the item: Normal

Certificate No.: C02251945
Job No.: WO-00091492
Issued Date: 04 November 2025
Page: 1 of 2
Class: -

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Sriramahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature 22 °C ± 2 °C
Relative Humidity 50 % ± 10 %
Atmospheric Pressure 1005 mbar ± 25 mbar

Calibration Place: Mass Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Nopparat Suriyapong

Calibration Date: 04 November 2025

The Method Used: In house method, CAL-WI-48, base on OIML R111-1

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited, Certificate No. C02251804.

(Mr. Nopparat Suriyapong)

Person in charge

(Mr. Adisai Maknoi)

Authorized signatory

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).

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

Calibration Results:

Nominal Value	Marking	Conventional Mass	Uncertainty ($\pm$ mg)	MPE Class ($\pm$ mg)
1 g	None	1 g + 0.043 mg	0.030	0.10 F1

Note : These MPE Class are only conventional mass.

The End of Certificate

ใบตรวจสอบสภาพตุ้มน้ำหนัก
(Weights Checklist)

Equipment: Standard Weight

Model: 1 g

Serial No.: Weight 001

Certificate No.: C02251945

Job No.: WO-00091492

Check date		รายการตรวจเช็ค (Description)	Check before delivery		หมายเหตุ (Remark)
04 Nov 2025			04 Nov 2025		
(Normal)	(Defective)		(Normal)	(Defective)	
		General			
☒	☐	1. ความสะอาดภายนอกของตัวตุ้มน้ำหนัก (External cleanliness of the weight)	☒	☐	
☒	☐	2. กล่อง (Box)	☒	☐	
		Mass			
☒	☐	1. รอยขีดข่วน (Abrasion)	☒	☐	
☒	☐	3. ลักษณะรูปร่าง (Shape characteristics)	☒	☐	
☐	☐	4. คีมจับตัวตุ้มน้ำหนัก (Tweezers)	☐	☐	ไม่มี
☐	☐	5. อื่นๆ (Other)	☐	☐	N/A

ข้อเสนอแนะ/ Note :

Mr. Nopparat Suriyapong
Service Engineerบริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phraekhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.

CAL-FM-C02-13: 30 Jun 2025

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

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Certificate of Calibration

Certificate No.: C02251946 Page 2 of 2

Calibration Results:

Nominal Value	Marking	Conventional Mass	Uncertainty ($\pm$ mg)	MPE Class ($\pm$ mg)
100 g	None	100 g - 0.04 mg	0.16	0.5 F1

Note : These MPE Class are only conventional mass.

The End of Certificate

Equipment: Standard Weight Certificate No.: C02251946
Manufacturer: LS Job No.: WO-00091492
Model: 100 g Issued Date: 04 November 2025
Serial No.: Weight 002 Page: 1 of 2
ID No.: - Class: -
Condition of the item : Normal

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoon, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature 22 °C $\pm$ 2 °C
Relative Humidity 50 % $\pm$ 10 %
Atmospheric Pressure 1005 mbar $\pm$ 25 mbar

Calibration Place: Mass Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangkok,
Phraekhanong, Bangkok 10260 Thailand

Calibration By: Mr. Nopparat Suriyapong
Calibration Date: 04 November 2025
The Method Used: In house method, CAL-WI-48, base on OIML R111-1
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited. Certificate No. C02251804.

(Mr. Nopparat Suriyapong)
Person in charge(Mr. Adisai Maknoi)
Authorized signatory

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).

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

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

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CAL-FM-C02-13: 30 Jun 2025

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

Delivering Growth - in Asia and Beyond.

CAL-FM-C02-13: 30 Jun 2025

ใบตรวจสอบสภาพตมน้ำหนัก
(Weights Checklist)Equipment: Standard Weight
Model: 100 g
Serial No.: Weight 002Certificate No.: C02251946
Job No.: WO-00091492

Check date		รายการตรวจเช็ค (Description)	Check before delivery		หมายเหตุ (Remark)
04 Nov 2025			04 Nov 2025		
(Normal)	(Defective)		(Normal)	(Defective)	
		General			
☒	☐	1. ความสะอาดภายนอกของตัวตมน้ำหนัก (External cleanliness of the weight)	☒	☐	
☒	☐	2. กล่อง (Box)	☒	☐	
		Mass			
☒	☐	1. รอยขีดข่วน (Abrasion)	☒	☐	
☒	☐	3. ลักษณะรูปร่าง (Shape characteristics)	☒	☐	
☐	☐	4. คีมจับตมน้ำหนัก (Tweezers)	☐	☐	ไม่มี
☐	☐	5. อื่นๆ (Other)	☐	☐	N/A

ข้อแนะนำ/ Note :

Mr. Nopparat Suriyapong
Service Engineer

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

Delivering Growth - in Asia and Beyond.



Certificate of Calibration

Equipment: Standard Weight
Manufacturer: LS
Model: 200 g
Serial No.: Weight 003
ID No.: -
Condition of the item : Normal

Certificate No.: C02251947
Job No.: WO-00091492
Issued Date: 04 November 2025
Page: 1 of 2
Class: -

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature 22 °C ± 2 °C
Relative Humidity 50 % ± 10 %
Atmospheric Pressure 1005 mbar ± 25 mbar

Calibration Place: Mass Laboratory, DKSH Technology Limited.
2533 Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Nopparat Suriyapong

Calibration Date: 04 November 2025

The Method Used: In house method, CAL-WI-48, base on OIML R111-1

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Limited, Certificate No. C02251804.

(Mr. Nopparat Suriyapong)
Person in charge(Mr. Adisai Maknoi)
Authorized signatory

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).

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

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2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
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CAL-FM-C02-13: 30 Jun 2025

Certificate No.: C02251947 Page 2 of 2

Calibration Results:

Nominal Value	Marking	Conventional Mass	Uncertainty ($\pm$ mg)	MPE Class ($\pm$ mg)
200 g	None	200 g - 0.42 mg	0.30	1.0 F1

Note : These MPE Class are only conventional mass.

The End of Certificate

ใบตรวจสอบสภาพตมน้ำหนัก
(Weights Checklist)Equipment: Standard Weight
Model: 200 g
Serial No.: Weight 003Certificate No.: C02251947
Job No.: WO-00091492

Check date		รายการตรวจเช็ค (Description)	Check before delivery		หมายเหตุ (Remark)
04 Nov 2025			04 Nov 2025		
(Normal)	(Defective)		(Normal)	(Defective)	
		General			
☒	☐	1. ความสะอาดภายนอกของตัวตมน้ำหนัก (External cleanliness of the weight)	☒	☐	
☒	☐	2. กล่อง (Box)	☒	☐	
		Mass			
☒	☐	1. รอยขีดข่วน (Abrasion)	☒	☐	
☒	☐	3. ลักษณะรูปร่าง (Shape characteristics)	☒	☐	
☐	☐	4. คีมจับตมน้ำหนัก (Tweezers)	☐	☐	ไม่มี
☐	☐	5. อื่นๆ (Other)	☐	☐	N/A

ข้อแนะนำ/ Note :

Mr. Nopparat Suriyapong
Service Engineer

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2533 Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
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CAL-FM-C02-13: 30 Jun 2025

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Certificate of Calibration

Certificate No.: C01253238

Page: 2 of 2

Equipment: Electronic Balance
Manufacturer: Sartorius
Model: BSA224S-CW
Serial No.: 34490341
ID No.: -
Condition of the item: Normal

Certificate No.: C01253238
Job No.: WO-00091491
Issued Date: 03 November 2025
Page: 1 of 2

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

Environment Condition: Temperature 25 °C ± 0.5 °C
Relative Humidity 67 % ± 3.3 %

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: 28 October 2025

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. C02250448

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	-0.0002	-0.0001	0.0001			

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

Nominal test value (g)	Standard Deviation
20	0.00005
200	0.00007

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	0.10000	0.1000	0.0000	0.00012	2.06
0.2	0.20000	0.2000	0.0000	0.00012	2.06
0.5	0.50000	0.5000	0.0000	0.00012	2.06
1	1.00001	1.0000	0.0000	0.00012	2.06
2	2.00002	2.0000	0.0000	0.00012	2.06
5	5.00001	5.0000	0.0000	0.00012	2.06
10	10.00001	10.0000	0.0000	0.00012	2.05
20	20.00001	20.0000	0.0000	0.00012	2.05
50	50.00001	50.0000	0.0000	0.00014	2.03
100	99.99992	100.0000	0.0001	0.00018	2.01
200	199.99992	200.0000	0.0001	0.00030	2.00

The End of Certificate

(Mr. Piyapat Saidoung)
Person in charge

(Mr. Adisai Maknoi)
Authorized signatory

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2533 Sukhumvit Road, Bangkok, Phra Khanong, Bangkok 10260
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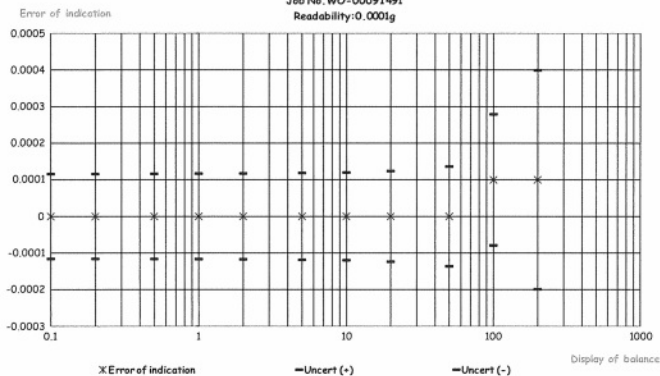
CAL-FM-C01-15: 30 Jun 2025

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2533 Sukhumvit Road, Bangkok, Phra Khanong, Bangkok 10260
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CAL-FM-C01-15: 30 Jun 2025

Without Adjustment
Job No. WO-00091491
Readability: 0.0001g

ใบตรวจสอบสภาพเครื่องชั่ง
Electronic Balance Checklist

Equipment: Electronic Balance

Certificate No.: C01253238

Model: BSA224S-CW

Job No.: WO-00091491

Serial No.: 34490341

Check date	รายการตรวจเช็ค (Description)		Check before delivery		หมายเหตุ (Remark)
			28 Oct 2025		
(Normal)	(Defective)		(Normal)	(Defective)	
General					
☒	☐	1. สายไฟ/ อะแดปเตอร์ (Electrical wire/ Adaptor)	☒	☐	
☒	☐	2. ความสมบูรณ์ของกระถังกันลม (Cover)	☒	☐	
☒	☐	3. ความสมบูรณ์ของระดับน้ำ (Bubble spirit level)	☒	☐	
☒	☐	4. ความสมบูรณ์ของชุดขาตั้งเครื่อง (Leveling foot)	☒	☐	
☒	☐	5. การตอบสนองของปุ่มกด (Keys)	☒	☐	
☒	☐	6. ความสมบูรณ์ของหน้าจอ (Display)	☒	☐	
☒	☐	7. การแสดงผลของหน้าจอ (Screen display)	☒	☐	
☒	☐	8. ชุดรองจานชั่ง (Stopper/ Pan support)	☒	☐	
☒	☐	9. การทำงานของฟังก์ชัน (Internal/ External Function)	☒	☐	
☒	☐	10. ความสะอาดของตัวเครื่องภายนอก (External cleanliness of the balance)	☒	☐	
☒	☐	11. สภาพแวดล้อม ณ สถานที่ตั้งเครื่องชั่ง (Environment at the location of the balance)	☒	☐	

ข้อแนะนำ/ Note :

Mr. Piyapat Saidoung
Service Engineer



Certificate of Calibration

Certificate No.: C06250442 Page 2 of 3

Equipment: SPECTROPHOTOMETER
Manufacturer: HACH
Model: DR 3900
Serial No.: 2008400
ID No.: -
Condition of the item: Normal

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

Environment Condition: Temperature 25.1 °C ± 0.3 °C
Relative Humidity 65.5 % ± 2.2 %

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

Calibration By: Mr.Piyapat Saidoung
Calibration Date: 30 October 2025
The Method Used: In house method, CAL-VI-24, base on ASTM E 275-08 and ASTM E 387-04
Traceability: This certificate is traceable to the CRM maintained by National Institute of Standards and Technology (NIST) through Starna Scientific Limited.

The standard for Wavelength Certificate No. 121284 and 121285
The standard for Photometric Certificate No. 121289
The standard for Stray light Certificate No. 121282

(Mr. Piyapat Saidoung)
Person in charge

(Miss Kaewkan Suradech)
Authorized signatory

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

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Calibration Results:

Without Adjustment

Wavelength Accuracy (nm), The spectral bandwidth of Std at 5 nm and UUC at 5 nm

Standard Wavelength	Unit Under Calibration	Correction	Uncertainty
418.40	418	0.40	0.59
459.30	459	0.30	0.59
638.00	638	0.00	0.59
585.56	586	-0.44	0.59
747.61	748	-0.39	0.59
807.04	807	0.04	0.59

Photometric Accuracy (Absorbance)

Wavelength	Standard absorbance	Unit Under Calibration	Correction	Uncertainty
420 nm	0.0000	0.000	0.0000	0.0045
	0.5895	0.589	0.0005	0.0045
	0.7610	0.759	0.0020	0.0045
	1.0253	1.024	0.0013	0.0045
440 nm	0.0000	0.000	0.0000	0.0045
	0.5783	0.577	0.0013	0.0045
	0.7430	0.741	0.0020	0.0045
	1.0022	1.000	0.0022	0.0045
465 nm	0.0000	0.000	0.0000	0.0045
	0.5280	0.529	-0.0010	0.0045
	0.6851	0.686	-0.0009	0.0045
	0.9509	0.952	-0.0011	0.0045
546.1 nm	0.0000	0.000	0.0000	0.0045
	0.5446	0.544	0.0006	0.0045
	0.6932	0.693	0.0002	0.0045
	0.9952	0.995	0.0002	0.0045
590 nm	0.0000	0.000	0.0000	0.0045
	0.5824	0.581	0.0014	0.0045
	0.7208	0.719	0.0018	0.0045
	1.0917	1.089	0.0027	0.0045
635 nm	0.0000	0.000	0.0000	0.0045
	0.5660	0.565	0.0010	0.0045
	0.6882	0.687	0.0012	0.0045
	1.0846	1.083	0.0016	0.0045

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2533 Sukhumvit Road, Bangkok, Prachanong, Bangkok 10260
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CAL-FM-C06-17: 30 Jun 2025

Certificate No.: C06250442 Page 3 of 3

Calibration Results:

Without Adjustment

Stray light *	Standard: cut-off	UUC: Wavelength (nm)	UUC: Transmission (%T)	Absorbance (A)
	391.57 +/- 0.11 nm	392	4.5	1.347

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

The End of Certificate

Checklist for Spectrophotometer

Worksheet number: WO-00091491

Instrument type: Spectrophotometer

Model: DR 3900

S/N: 2008400

Check (receive)		Checklist	Check (send)		Note
30 Oct 2025			30 Oct 2025		
Normal	Defective		Normal	Defective	
☒	☐	1. Integrity of the tools	☒	☐	
☒	☐	2. Cleanliness of tools	☒	☐	
☒	☐	3. On-Off Switch	☒	☐	
☒	☐	4. Keypad	☒	☐	
☒	☐	5. Display, Screen Contrast	☒	☐	
☐	☐	6. Battery Backup >= 2.5 VDC	☐	☐	-
☐	☐	7. Wavelength Control	☐	☐	-
☒	☐	8. Wavelength Check	☒	☐	807nm=807.0nm
☐	☐	9. UV < 3,000 hour	☐	☐	-
☒	☐	10. Visible < 5,000 hour	☒	☐	
☐	☐	11. Carousel Module	☐	☐	-

Recommend :

Mr.Piyapat Saidoung
Service Engineer



Certificate of Calibration

Calibration Results:

pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	Error (mV)	(pH)		
414.12	414	-0.12	0.00	0.58	2.00
354.96	355	0.04	1.00	0.58	2.00
295.80	295	-0.80	2.01	0.58	2.00
236.64	236	-0.64	3.01	0.58	2.00
177.48	177	-0.48	4.00	0.58	2.00
118.32	118	-0.32	5.00	0.58	2.00
59.16	60	0.84	6.00	0.58	2.00
0.00	0	0.00	7.00	0.58	2.00
-59.16	-59	0.16	8.00	0.58	2.00
-118.32	-118	0.32	9.00	0.58	2.00
-177.48	-177	0.48	10.00	0.58	2.00
-236.64	-236	0.64	10.99	0.58	2.00
-295.80	-295	0.80	11.99	0.58	2.00
-354.96	-355	-0.04	13.00	0.58	2.00
-414.12	-414	0.12	14.00	0.58	2.00

Equipment: pH METER
Manufacturer: Mettler Toledo
Model: Seven2Go S2
Serial No.: B633886757
ID No.: -
Condition of the item: Normal

Certificate No.: C07250498
Job No.: WO-00091491
Issued Date: 3 November 2025
Page: 1 of 3

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

Environment Condition: Temperature 22.0 °C ± 0.3 °C
Relative Humidity 58.2 % ± 3.6 %

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

Calibration By: Mr.Piyapat Saidoung
Calibration Date: 29 October 2025

The Method Used: In house method, CAL-WI-58, base on ASTM E 70-07

Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 1100242, 1100244, 1100243 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20240602EA

(Mr. Piyapat Saidoung)
Person in charge

(Miss Kaewkan Suradech)
Authorized signatory

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CAL-FM-C07-15: 30 Jun 2025

Checklist for pH Meter

Worksheet number: WO-00091491

Sample Test Results

Manufacturer: Mettler Toledo Model: InLabExpert Go-ISM Electrode Serial No.: 4501841

The three-point calibration using three standard buffer solutions; pH 4.007, pH 6.988 and pH 10.010

-During calibration, display of pH meter reading; pH 4.01, pH 7.00 and pH 10.01

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.007	4.01	0.003	0.0071	2.00
6.988	7.00	0.012	0.0095	2.00
10.010	10.01	0.000	0.013	2.00

Practical slope and zero point*

The three-point calibration using three standard buffer solutions; pH 4.007, pH 6.988 and pH 10.010

-During calibration, display of pH meter reading; pH 4.01, pH 7.00 and pH 10.01

The practical slope of the pH electrode; 58.17 (mV/pH), 98.32%

The zero point of the pH electrode; 7.38 (pH)

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

The End of Certificate

Instrument type: pH METER

Model: Seven2Go S2

S/N: B633886757

Check (receive)	Checklist	Check (send)		Note
		29 Oct 2025	29 Oct 2025	
Normal	Defective	Normal	Defective	
☒	☐	1. Integrity of the tools	☒	
☒	☐	2. Cleanliness of tools	☒	
☒	☐	3. On-Off Switch	☒	
☒	☐	4. Keypad	☒	
☒	☐	5. Display, Screen Contrast	☒	
☒	☐	6. Electrode and Connection Cable	☒	
☐	☐	7. Electrode (Level KCl)	☐	-
☒	☐	8. Electrode (Dust Protection Hood)	☒	
☐	☐	9. Stand	☐	-

Recommend :

Mr.Piyapat Saidoung
Service Engineer

DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-R31-03: 20 Jul 2025

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-R31-03: 20 Jul 2025



Certificate of Calibration

Certificate No.: C15251176

Page: 2 of 2

Equipment : Digital Thermometer with Probe
Manufacturer: Mettler Toledo
Model: Seven2Go S2
Serial No.: B633886757
ID No.: -
Condition of the item: Normal

Certificate No.: C15251176
Job No.: WO-00091491
Issued Date: 04 November 2025
Page: 1 of 2

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

Environment Condition : Temperature: 30 °C ± 10 °C
Relative Humidity: 55 % ± 25 %
Voltage: 220 VAC ± 10 %

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

Calibration By : Mr. Piypat Saidoung

Calibration Date : 29 October 2025

The Method Used : In house method, CAL-WI-69, by comparison with standard thermometer

Traceability : This certificate is traceable to the International System of Unit maintained by:
Quality Reborn Co.,Ltd. (QR)

(Mr. Piypat Saidoung)
Person in charge

(Mr. Pramote Ramrong)
Authorized signatory

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2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
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CAL-FM-C15-15: 30 Jun 2025

Reference standard equipment:

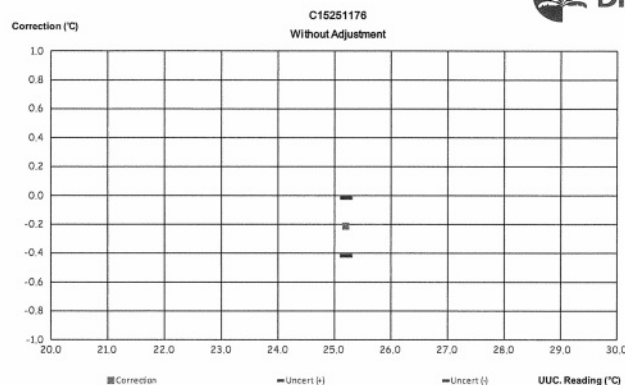
Equipment	Certificate no	Cal. date	Next Cal. date
Digital Thermometer with Probe	QR24-3149	26 November 2024	26 November 2025

Calibration Results:

Without Adjustment

Sensor Type: RTD		Serial No.: 4501841		Channel: -	
Diameter (mm): 12		Length (mm): 180		Immersion (mm): 150	
Calibrate Point (°C)	STD. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)		Uncertainty (± °C)
25.0	24.986	25.2	-0.214		0.20

The End of Certificate



ใบตรวจสอบสภาพเครื่องมือวัดอุณหภูมิ
(Digital Thermometer Checklist)

Equipment : Digital Thermometer with Probe

Certificate No.: C15251176

Serial No.: B633886757

Model : Seven2Go S2

Check Date		รายการตรวจเช็ค (Description)	Check before delivery		หมายเหตุ (Remark)
29-Oct-2025			29-Oct-2025		
Normal	Defective		Normal	Defective	
		General			
☒	☐	1. สายไฟ (Electric wire)	☒	☐	
☐	☐	2. Adaptor / Power supply 220 / 110 VAC	☐	☐	ไม่มี
☒	☐	3. การทำงาน (On/Off Switch)	☒	☐	
☒	☐	4. การทำงาน (Selector Key)	☒	☐	
☒	☐	5. หน้าจอแสดงผล (Display)	☒	☐	
☒	☐	6. แบตเตอรี่ (Battery)	☒	☐	
☒	☐	7. สภาพตัวเครื่อง (Equipment Body)	☒	☐	
☒	☐	8. หัววัดเซ็นเซอร์ (Sensor (In / Ex)	☒	☐	

Note :

Mr. Piypat Saidoung
Service Engineer



Certificate of Calibration

Certificate No.: C31252326

Page: 2 of 4

Equipment: Oven
Manufacturer: Binder
Model: ED 115
Serial No.: 950360
ID No.: -
Shelves(pc.): 2
Condition of the item: Normal

Certificate No.: C31252326
Issued Date: 31 October 2025
Job No.: WO-00091491
Ventilation Valve: Closed
Page: 1 of 4

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature: 21 °C ± 1.3 °C
Relative Humidity: 63 % ± 5.4 %
Voltage: 231 VAC ± 1.1 VAC

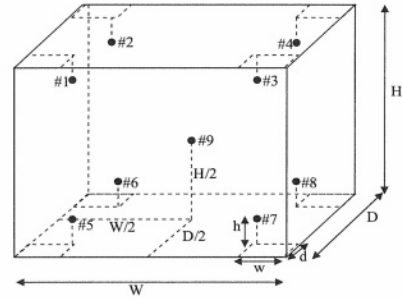
Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Bovon Jannantha

Calibration Date: 28 October 2025 to 29 October 2025

The Method Used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10250012



Standard Installation Locations

Volume (Calibration Zone) = 22 (Liters)

Inside chamber: W = 60 (cm) D = 40 (cm) H = 48 (cm)

Standard Locations (#1, #2, #3, #4): w = 10 (cm) d = 10 (cm) h = 10 (cm)

Standard Locations (#5, #6, #7, #8): w = 10 (cm) d = 10 (cm) h = 10 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	101	102	103	104	105	106	107	108	109

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

(Mr. Bovon Jannantha)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

ชื่อย่อ: Bureau of Standards and Calibration
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi, Thailand 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025

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DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinburi, Thailand 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025

Certificate No.: C31252326

Page: 3 of 4

Calibration Results:

Before adjustment

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:
104 104 102.75 102.86 103.14 102.85 102.66 101.85 102.29 102.20 102.42

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	104.01	0.01	0.66
#2	104.03	0.03	0.66
#3	104.27	0.27	0.67
#4	104.20	0.20	0.67
#5	103.90	-0.10	0.66
#6	103.88	-0.12	0.70
#7	103.68	-0.32	0.66
#8	103.67	-0.33	0.67
#9	103.94	-0.06	0.66

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
104	104	104	104.01	104.03	104.27	104.20	103.90	103.88	103.68	103.67	103.94	0.70

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104	0.42	0.22	0.82

Note: * Maximum uncertainty of the each position

Certificate No.: C31252326

Page: 4 of 4

After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	179.67	-0.33	0.84
#2	180.51	0.51	0.89
#3	180.10	0.10	0.90
#4	180.33	0.33	0.88
#5	180.13	0.13	0.89
#6	179.96	-0.04	1.5
#7	179.72	-0.28	0.85
#8	179.91	-0.09	1.1
#9	179.80	-0.20	0.98

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
180	180	180	179.67	180.51	180.10	180.33	180.13	179.96	179.72	179.91	179.80	1.5

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180	0.96	1.11	2.21

Note: * Maximum uncertainty of the each position

The End of Certificate

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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

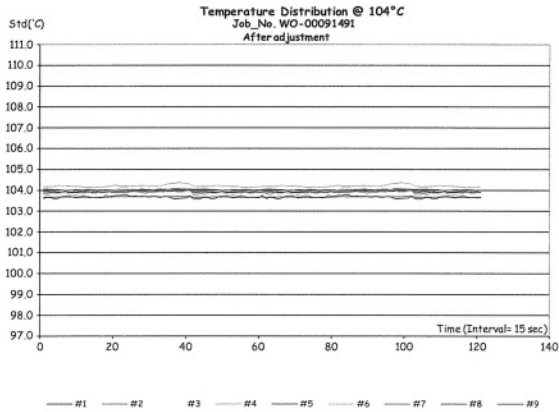
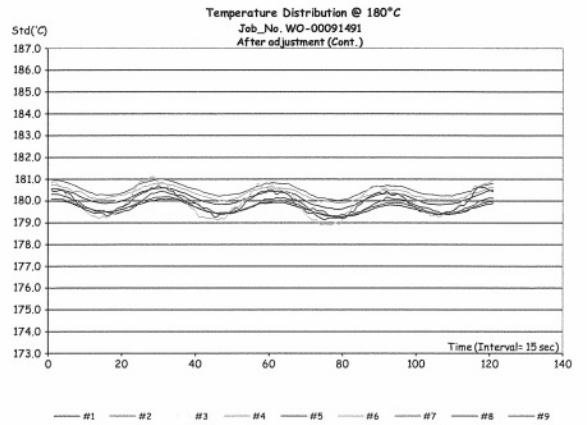
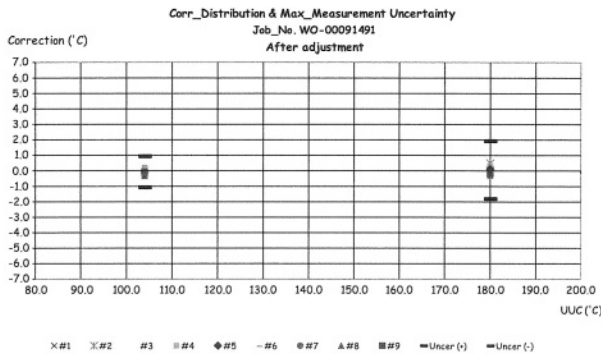
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CAL-FM-C31-11: 30 Jun 2025

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CAL-FM-C31-11: 30 Jun 2025



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: Oven
รุ่น: ED 115
หมายเลขเครื่อง: 950360

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
28 Oct 2025			29 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☐	☐	5. การทำงาน พัดลม	☐	☐	ไม่มี
☒	☐	6. สภาพ Lever of Ventilation valve	☒	☐	
☒	☐	7. สภาพ Lever door open / close	☒	☐	
☒	☐	8. สภาพ Door seal	☒	☐	
☒	☐	9. การทำงานของระบบ Safety	☒	☐	
☐	☐	10. การทำงานของระบบทำความเย็น	☐	☐	ไม่มี
☐	☐	11. การทำงานของระบบทำความร้อน	☐	☐	ไม่มี
☒	☐	12. สภาพตัวเครื่อง	☒	☐	
☒	☐	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อเสนอแนะ:

Mr. Bovon Jannantha
Service Engineer



Certificate of Calibration

Equipment: Oven
Manufacturer: Binder
Model: ED 115
Serial No.: 20190000012946
ID No.: -
Shelves(pc.): 2
Condition of the item: Normal

Certificate No.: C31252327
Issued Date: 31 October 2025
Job No.: WO-00091491
Ventilation Valve: Closed
Page: 1 of 4

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature: 21 °C ± 1.1 °C
Relative Humidity: 63 % ± 5.4 %
Voltage: 231 VAC ± 1.1 VAC

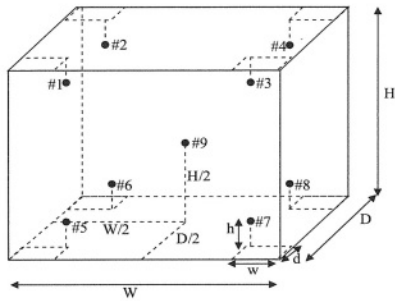
Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Bovon Jannantha
Calibration Date: 28 October 2025 to 29 October 2025
The Method Used: In house method, CAL-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10250012

(Mr. Bovon Jannantha)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

**Standard Installation Locations**

Volume (Calibration Zone)= 48 (Liters)

Inside chamber: W = 52 (cm) D = 40 (cm) H = 48 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 5 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions**Indicating Temperature:** The average reading of indicating device which forms the integral part of the enclosure.**Measured Temperature:** The average reading of standards at any positions or location.**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

חברת דקש טכנולוגיות פרטיות בע"מ
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025

Calibration Results:**Before adjustment**

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:
104 104 106.46 106.61 106.51 106.74 104.68 104.39 104.67 104.42 104.61

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	105.86	1.86	0.83
#2	105.99	1.99	0.84
#3	105.90	1.90	0.83
#4	106.18	2.18	0.83
#5	104.15	0.15	0.84
#6	103.87	-0.13	0.85
#7	104.14	0.14	0.84
#8	103.87	-0.13	0.86
#9	104.05	0.05	0.84

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
104	104	104	105.86	105.99	105.90	106.18	104.15	103.87	104.14	103.87	104.05	0.86

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104	2.20	0.21	2.68

Note: * Maximum uncertainty of the each position

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CAL-FM-C31-11: 30 Jun 2025

After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 177 °C

Locations	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
#1	180.41	3.41	1.1
#2	180.78	3.78	1.0
#3	180.50	3.50	1.0
#4	181.54	4.54	1.1
#5	179.56	2.56	1.1
#6	180.51	3.51	1.1
#7	179.84	2.84	1.1
#8	178.43	1.43	1.4
#9	180.08	3.08	1.2

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
180	177	177	180.41	180.78	180.50	181.54	179.56	180.51	179.84	178.43	180.08	1.4

Chamber Characterization

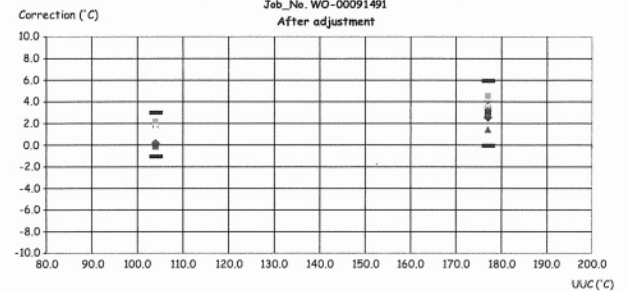
Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
177	2.19	1.02	4.65

Note: * Maximum uncertainty of the each position

The End of Certificate**Corr_Distribution & Max_Measurement Uncertainty**

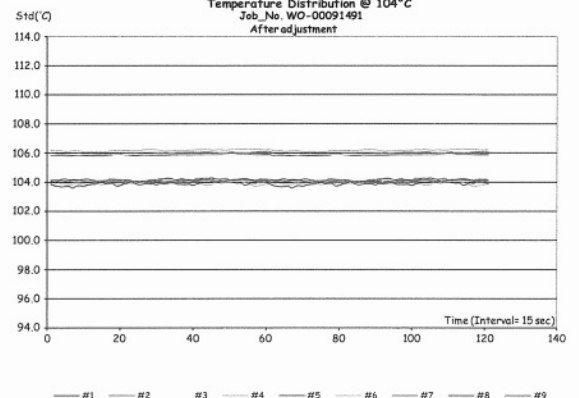
Job_No. WO-00091491

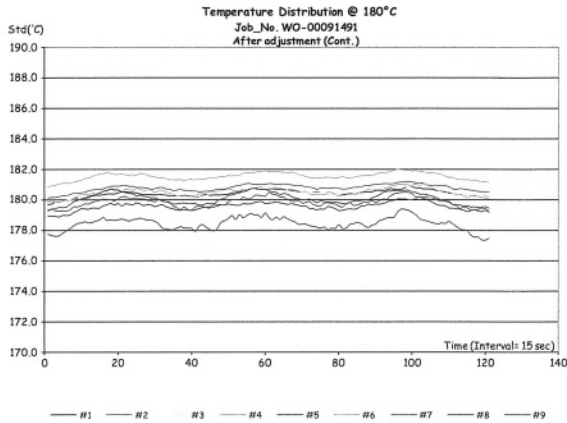
After adjustment

**Temperature Distribution @ 104°C**

Job_No. WO-00091491

After adjustment





ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: Oven

รุ่น: ED 115

หมายเลขเครื่อง: 20190000012946

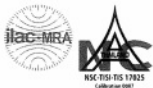
ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
28 Oct 2025			29 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☐	☐	5. การทำงาน ฟัดลม	☐	☐	ไม่มี
☒	☐	6. สภาพ Lever of Ventilation valve	☒	☐	
☒	☐	7. สภาพ Lever door open / close	☒	☐	
☒	☐	8. สภาพ Door seal	☒	☐	
☒	☐	9. การทำงานของระบบ Safety	☒	☐	
☐	☐	10. การทำงานของระบบทำความเย็น	☐	☐	ไม่มี
☐	☐	11. การทำงานของระบบทำความร้อน	☐	☐	ไม่มี
☒	☐	12. สภาพตัวเครื่อง	☒	☐	
☒	☐	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ขอแนะนำ:

Mr. Bovon Jannantha
Service Engineer

บริษัท ดีเคเอส เอเชีย เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate of Calibration

Certificate No.: C31252348

Page: 2 of 4

Equipment: Hot Air Oven
Manufacturer: Memmert
Model: UF 110
Serial No.: B417.1014
ID No.: -
Shelves(pc.): 2
Condition of the item: Normal

Certificate No.: C31252348
Issued Date: 30 October 2025
Job No.: WO-00091491
Ventilation Valve: Closed
Page: 1 of 4

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature: 21 °C ± 1.7 °C
Relative Humidity: 63 % ± 5.4 %
Voltage: 231 VAC ± 1.1 VAC

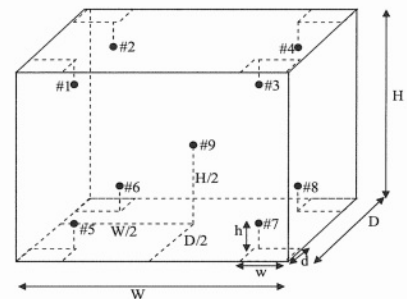
Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Bovon Jannantha

Calibration Date: 30 October 2025

The Method Used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10250012



Standard Installation Locations

Volume (Calibration Zone)= 48 (Liters)

Inside chamber: W= 52 (cm) D= 40 (cm) H= 48 (cm)

Standard Locations (#1, #2, #3, #4): w= 5 (cm) d= 5 (cm) h= 5 (cm)

Standard Locations (#5, #6, #7, #8): w= 5 (cm) d= 5 (cm) h= 5 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	201	202	203	204	205	206	207	208	209

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.**Measured Temperature:** The average reading of standards at any positions or location.**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

(Mr. Bovon Jannantha)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025

บริษัท ดีเคเอส เอเชีย เทคโนโลยี จำกัด
DKSH Technology Limited
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CAL-FM-C31-11: 30 Jun 2025

Calibration Results:

Before adjustment

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:
104 104 104.33 103.64 104.16 103.57 103.34 103.60 103.15 103.55 103.57

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 104.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	104.57	0.57	0.38
#2	104.06	0.06	0.38
#3	104.52	0.52	0.38
#4	103.99	-0.01	0.38
#5	103.75	-0.25	0.38
#6	103.96	-0.04	0.38
#7	103.56	-0.44	0.38
#8	103.92	-0.08	0.38
#9	103.92	-0.08	0.38

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
104.0	104.0	104.0	104.57	104.06	104.52	103.99	103.75	103.96	103.56	103.92	103.92	0.38

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
104.0	0.69	0.07	1.13

Note: * Maximum uncertainty of the each position

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025

After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 180.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	181.35	1.35	0.55
#2	179.95	-0.05	0.54
#3	180.67	0.67	0.54
#4	179.76	-0.24	0.53
#5	179.09	-0.91	0.53
#6	179.66	-0.34	0.54
#7	178.68	-1.32	0.54
#8	179.43	-0.57	0.53
#9	179.60	-0.40	0.53

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
180.0	180.0	180.0	181.35	179.95	180.67	179.76	179.09	179.66	178.68	179.43	179.60	0.55

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
180.0	1.85	0.13	2.90

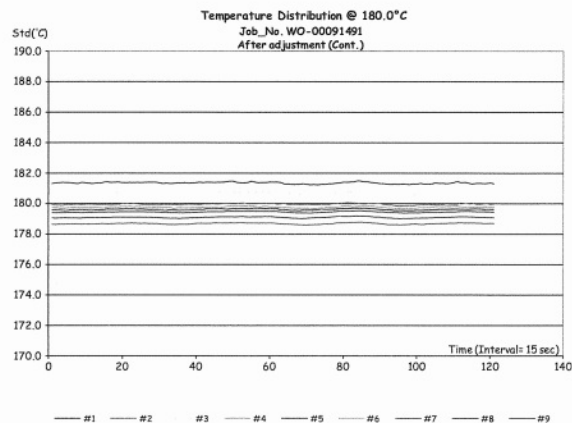
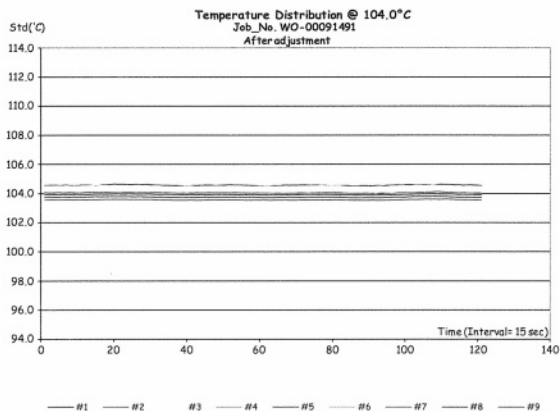
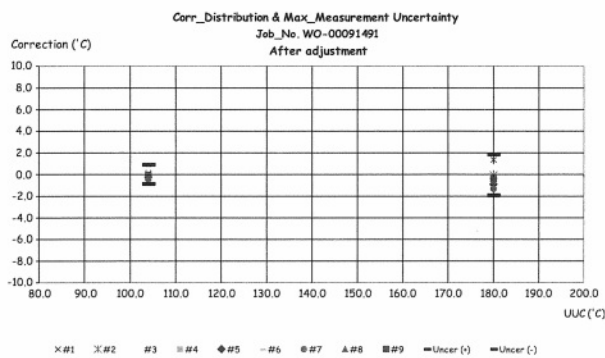
Note: * Maximum uncertainty of the each position

The End of Certificate

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DKSH Technology Limited
2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: Hot Air Oven

รุ่น: UF 110

หมายเลขเครื่อง: B417.1014

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
30 Oct 2025			30 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☒	☐	5. การทำงาน พัดลม	☒	☐	
☒	☐	6. สภาพ Lever of Ventilation valve	☒	☐	
☒	☐	7. สภาพ Lever door open / close	☒	☐	
☒	☐	8. สภาพ Door seal	☒	☐	
☒	☐	9. การทำงานของระบบ Safety	☒	☐	
☐	☐	10. การทำงานของระบบทำความเย็น	☐	☐	ไม่มี
☐	☐	11. การทำงานของระบบทำความร้อน	☐	☐	ไม่มี
☒	☐	12. สภาพตัวเครื่อง	☒	☐	
☒	☐	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อแนะนำ:

Mr. Bovon Jannantha
Service Engineer

บริษัท วิทยาศาสตร์ ดิเคช จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate of Calibration

Equipment:	Cooled Incubator	Certificate No.:	C31252328
Manufacturer:	OmRon	Issued Date:	31 October 2025
Model:	E5CC	Job No.:	WO-00091491
Serial No.:	03021	Ventilation Valve:	Closed
ID No.:	-	Page:	1 of 3
Shelves(pc.):	9		
Condition of the item:	Normal		

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature: 23 °C ± 0.4 °C
Relative Humidity: 63 % ± 5.4 %
Voltage: 231 VAC ± 1.1 VAC

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

Calibration By: Mr. Bovon Jannantha

Calibration Date: 28 October 2025

The Method Used: In house method, CAL-WI-16, base on TLAS-G20

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10250012

(Mr. Bovon Jannantha)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

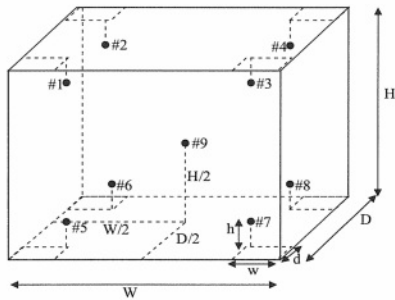
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2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025

Certificate No.: C31252328

Page: 2 of 3



Standard Installation Locations

Volume (Calibration Zone)= 541 (Liters)

Inside chamber: W = 110 (cm) D = 60 (cm) H = 160 (cm)

Standard Locations (#1, #2, #3, #4): w = 11 (cm) d = 6 (cm) h = 16 (cm)

Standard Locations (#5, #6, #7, #8): w = 11 (cm) d = 6 (cm) h = 16 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	301	302	303	304	305	306	307	308	309

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.

Measured Temperature: The average reading of standards at any positions or location.

Measured Uniformity: The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Overall Variation: The difference of maximum and minimum measured temperatures throughout observation time.

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025

Certificate No.: C31252328

Page: 3 of 3

Calibration Results:

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	19.84	-0.16	0.66
#2	19.82	-0.18	0.68
#3	20.35	0.35	0.65
#4	20.29	0.29	0.67
#5	20.02	0.02	0.98
#6	19.99	-0.01	0.77
#7	20.16	0.16	0.86
#8	20.18	0.18	0.72
#9	20.01	0.01	0.74

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
			#1	#2	#3	#4	#5	#6	#7	#8	#9	
20	20	20	19.84	19.82	20.35	20.29	20.02	19.99	20.16	20.18	20.01	0.98

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20	0.58	0.66	1.31

Note: * Maximum uncertainty of the each position

The End of Certificate

บริษัท วิทยาศาสตร์ ดิเคช จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025

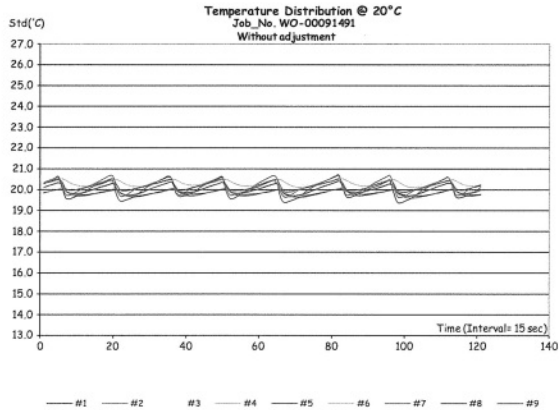
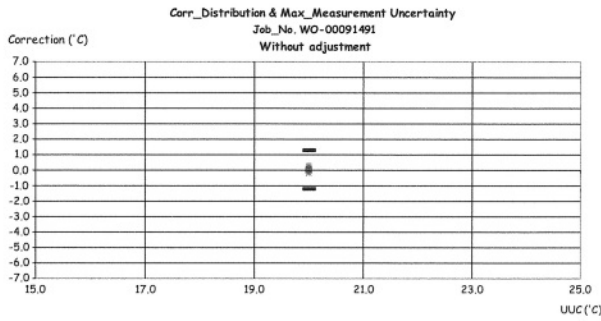
ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: E5CC

หมายเลขเครื่อง: 03021



ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
28 Oct 2025			28 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☒	☐	5. การทำงาน ฟัดลม	☒	☐	
☐	☐	6. สภาพ Lever of Ventilation valve	☐	☐	ไม่มี
☒	☐	7. สภาพ Lever door open / close	☒	☐	
☒	☐	8. สภาพ Door seal	☒	☐	
☐	☐	9. การทำงานของระบบ Safety	☐	☐	ไม่ได้ตรวจสอบ
☒	☐	10. การทำงานของระบบทำความเย็น	☒	☐	
☐	☐	11. การทำงานของระบบทำความชื้น	☐	☐	ไม่มี
☒	☐	12. สภาพตู้เครื่อง	☒	☐	
☒	☐	13. สภาวะแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อแนะนำ :

Mr. Bovon Jannantha
Service Engineer

บริษัท ดีเคเอสเอช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Phrahanong, Bangkok 10260
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Certificate of Calibration

Certificate No.: C31252347

Page: 2 of 4

Equipment: Cooled Incubator
Manufacturer: Accuplus
Model: i250
Serial No.: 0213-0004
ID No.: -
Shelves(pc.): 4
Condition of the item: Normal

Certificate No.: C31252347
Issued Date: 31 October 2025
Job No.: WO-00091491
Ventilation Valve: None
Page: 1 of 4

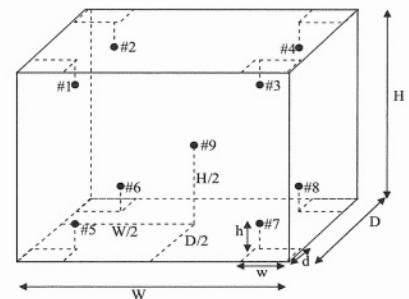
Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature: 20 °C ± 1.0 °C
Relative Humidity: 60 % ± 5.7 %
Voltage: 231 VAC ± 1.4 VAC

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

Calibration By: Mr. Bovon Jannantha
Calibration Date: 29 October 2025

The Method Used: In house method, CAL-WI-16, base on TLAS-G20
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10250012



Standard Installation Locations

Volume (Calibration Zone)= 128 (Liters)

Inside chamber: W = 50 (cm) D = 48 (cm) H = 106 (cm)

Standard Locations (#1, #2, #3, #4): w = 5 (cm) d = 5 (cm) h = 11 (cm)

Standard Locations (#5, #6, #7, #8): w = 5 (cm) d = 5 (cm) h = 11 (cm)

#9: Geometric center of the chamber

Position of Std	#1	#2	#3	#4	#5	#6	#7	#8	#9
Channel of Logger	301	302	303	304	305	306	307	308	309

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the enclosure.**Measured Temperature:** The average reading of standards at any positions or location.**Measured Uniformity:** The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the chamber at steady-state. The reference probe is preferably located in the geometric center of the chamber.**Measured Stability:** The one-half of greatest maximum difference of measured temperatures at any one probe.**Overall Variation:** The difference of maximum and minimum measured temperatures throughout observation time.

(Mr. Bovon Jannantha)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

Calibration Results:

Before adjustment

Setting: Indicating: #1: #2: #3: #4: #5: #6: #7: #8: #9:
20.0 20.0 19.50 19.78 19.75 19.65 19.82 19.79 19.75 19.71 19.62

After adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 20.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	19.83	-0.17	0.34
#2	20.14	0.14	0.40
#3	20.07	0.07	0.33
#4	20.03	0.03	0.39
#5	20.16	0.16	0.35
#6	20.12	0.12	0.30
#7	20.03	0.03	0.33
#8	20.00	0.00	0.29
#9	19.92	-0.08	0.38

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
20.0	20.0	20.0	#1	#2	#3	#4	#5	#6	#7	#8	#9	
20.0	20.0	20.0	19.83	20.14	20.07	20.03	20.16	20.12	20.03	20.00	19.92	0.40

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
20.0	0.33	0.29	0.84

Note: * Maximum uncertainty of the each position

After adjustment (Cont.)

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 29.0 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	28.73	-0.27	0.33
#2	29.05	0.05	0.37
#3	28.98	-0.02	0.30
#4	28.94	-0.06	0.35
#5	29.07	0.07	0.32
#6	29.03	0.03	0.27
#7	28.94	-0.06	0.30
#8	28.91	-0.09	0.26
#9	28.85	-0.15	0.34

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)									Uncertainty (± °C)*
29.0	29.0	29.0	#1	#2	#3	#4	#5	#6	#7	#8	#9	
29.0	29.0	29.0	28.73	29.05	28.98	28.94	29.07	29.03	28.94	28.91	28.85	0.37

Chamber Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
29.0	0.30	0.27	0.63

Note: * Maximum uncertainty of the each position

The End of Certificate

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท Road, Bangkok, Phrahanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

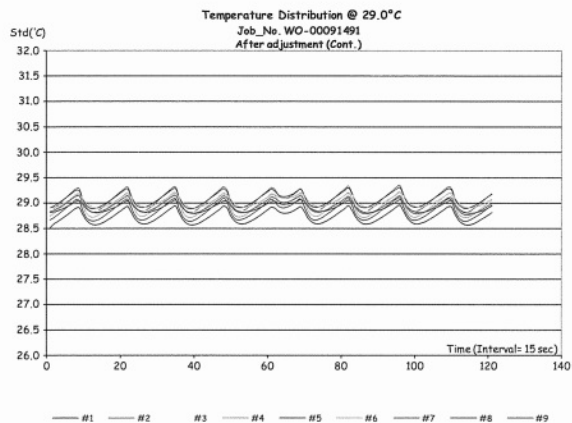
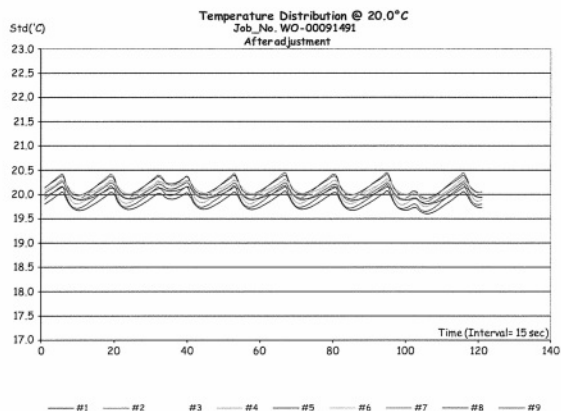
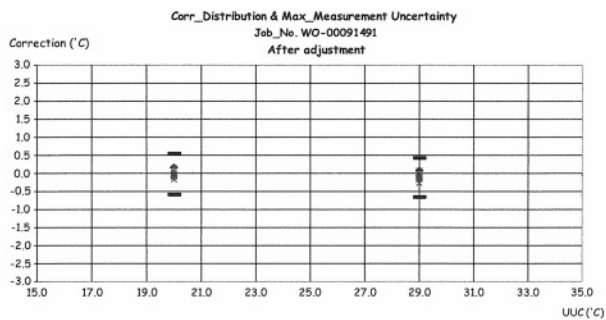
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CAL-FM-C31-11: 30 Jun 2025

บริษัท ดีเคเอส อีเซีย จำกัด
DKSH Technology Limited
2533 สุขุมวิท Road, Bangkok, Phrahanong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C31-11: 30 Jun 2025



ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: Cooled Incubator

รุ่น: i250

หมายเลขเครื่อง: 0213-0004

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
29 Oct 2025			29 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. สาย ไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☒	☐	5. การทำงาน พัดลม	☒	☐	
☐	☐	6. สภาพ Lever of Ventilation valve	☐	☐	ไม่มี
☒	☐	7. สภาพ Lever door open / close	☒	☐	
☒	☐	8. สภาพ Door seal	☒	☐	
☐	☐	9. การทำงานของระบบ Safety	☐	☐	ไม่ได้ตรวจสอบ
☒	☐	10. การทำงานของระบบทำความเย็น	☒	☐	
☐	☐	11. การทำงานของระบบทำความชื้น	☐	☐	ไม่มี
☒	☐	12. สภาพตู้เครื่อง	☒	☐	
☒	☐	13. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ขอแนะนำ:

Mr. Bovon Jannantha
Service Engineer

บริษัท วิทยาศาสตร์ ดัชนี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate of Calibration

Equipment: COD Reactor
Manufacturer: Hach
Model: DRB 200
Serial No.: 19070C0337
ID No.: -
Condition of the item: Normal
Covers: Open (Max) Locations heating Block: Left and Right

Certificate No.: C17250174
Issued Date: 03 November 2025
Job No.: WO-00091491
Page: 1 of 5

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature: 21 °C ± 0.9 °C
Relative Humidity: 60 % ± 5.5 %
Voltage: 231 VAC ± 1.0 VAC

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

Calibration By: Mr. Bovon Jannantha

Calibration Date: 29 October 2025

The Method Used: In house method, CAL-WI-59, base on Direct Measurement with Standard Thermometer

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT),Thailand through DKSH Technology Limited.
Certificate No. C10250012

(Mr. Bovon Jannantha)

Person in charge

(Mr. Udon Srichana)

Authorized signatory

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

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).

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

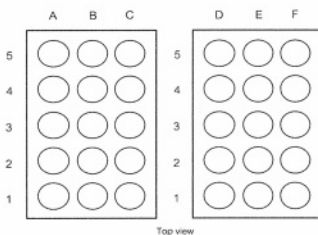
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Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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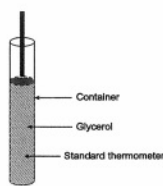
CAL-FM-C17-09: 30 Jun 2025

Certificate No.: C17250174

Page: 2 of 5



Location of standard



Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

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CAL-FM-C17-09: 30 Jun 2025

Certificate No.: C17250174

Page: 3 of 5

Calibration Results:

Before Adjustment

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
Left	150	150
Right	150	150

Location heating Block:	A1	A2	A3	A4	A5
Measured Temperature (°C)	142.19	142.64	141.28	142.95	141.03

Location heating Block:	B1	B2	B3	B4	B5
Measured Temperature (°C)	141.28	140.14	141.75	142.95	142.50

Location heating Block:	C1	C2	C3	C4	C5
Measured Temperature (°C)	139.73	139.74	141.73	143.33	138.90

Location heating Block:	D1	D2	D3	D4	D5
Measured Temperature (°C)	145.60	145.01	146.02	146.43	145.60

Location heating Block:	E1	E2	E3	E4	E5
Measured Temperature (°C)	145.60	143.86	143.65	142.61	142.07

Location heating Block:	F1	F2	F3	F4	F5
Measured Temperature (°C)	143.31	143.65	144.31	146.02	143.65

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinong, Bangkok 10260
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Calibration Results:

After Adjustment

Measured temperature at the spread locations:

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
Left	150	150
Right	150	150

Location heating Block:	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	150.41	0.41	0.69
A2	150.97	0.97	0.70
A3	149.61	-0.39	0.71
A4	150.81	0.81	0.71
A5	149.42	-0.58	0.72
B1	149.46	-0.54	0.71
B2	149.04	-0.96	0.70
B3	149.90	-0.10	0.72
B4	151.20	1.20	0.71
B5	150.74	0.74	0.72
C1	148.96	-1.04	0.70
C2	148.94	-1.06	0.69
C3	150.87	0.87	0.68
C4	150.91	0.91	0.69
C5	148.67	-1.33	0.73
D1	150.20	0.20	0.72
D2	149.59	-0.41	0.68
D3	150.59	0.59	0.70
D4	151.05	1.05	0.72
D5	150.26	0.26	0.72
E1	150.24	0.24	0.72
E2	149.47	-0.53	0.68
E3	149.33	-0.67	0.73
E4	148.97	-1.03	0.75
E5	148.87	-1.13	0.81
F1	149.26	-0.74	0.68
F2	149.35	-0.65	0.73
F3	150.00	0.00	0.73
F4	151.29	1.29	0.70
F5	149.38	-0.62	0.73

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
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CAL-FM-C17-09: 30 Jun 2025

Characterization of the unit under calibration:

Locations heating Block	Desired	Unit Under Calibration (°C)		Measured Temperature (°C)
	(°C)	Setting	Reading	
Left	150	150	150	0.29
Right	150	150	150	0.42

The End of Certificate

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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C17-09: 30 Jun 2025

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: COD Reactor

รุ่น: DRB 200

หมายเลขเครื่อง: 19070C0337

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
29 Oct 2025			29 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General/			
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☒	☐	5. สภาพ Hole	☒	☐	
☒	☐	6. สภาพฝาปิด	☒	☐	
☒	☐	7. สภาพตัวเครื่อง	☒	☐	
☒	☐	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อเสนอแนะ:

Mr. Bovon Jannantha
Service Engineer

บริษัท ดีเคเอส อีซี จำกัด
DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate of Calibration

Equipment:	COD Reactor	Certificate No.:	C17250175
Manufacturer:	Hach	Issued Date:	31 October 2025
Model:	DRB 200	Job No.:	WO-00091491
Serial No.:	19050C0191	Page:	1 of 4
ID No.:	-		
Condition of the item:	Normal		
Covers: Open (Max)	Locations heating Block: Left and Right		

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thaloam, Amphur Srirachaphot,
Prachinburi 25140 Thailand

Environment Condition: Temperature: 21 °C ± 0.9 °C
Relative Humidity: 60 % ± 5.5 %
Voltage: 231 VAC ± 1.0 VAC

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

Calibration By: Mr. Bovon Jannantha
Calibration Date: 29 October 2025
The Method Used: In house method, CAL-WI-59, base on Direct Measurement with Standard Thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through DKSH Technology Limited.
Certificate No. C10250012

(Mr. Bovon Jannantha)
Person in charge

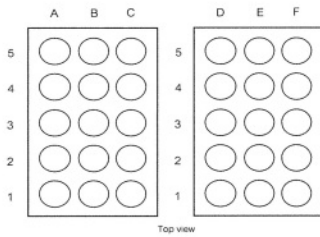
(Mr. Udon Srachana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

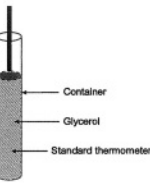
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DKSH Technology Limited
2533 ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
2533 Sukhumvit Road, Bangkok, Prachinburi, Bangkok 10260
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CAL-FM-C17-09: 30 Jun 2025



Location of standard



Sample test

Standard Installation Locations

The standard thermometer touches the lower end of the boring

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the unit under calibration.

Measured Temperature: The average reading of standards at any positions or location.

Measured Stability: The one-half of greatest maximum difference of measured temperatures at any one probe.

Calibration Results:

Without Adjustment

Measured temperature at the spread locations:

Locations heating Block:	Setting (°C)	Unit Under Calibration (°C)
Left	150	150
Right	150	150

Location heating Block:	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (± °C)
A1	148.85	-1.15	0.66
A2	150.35	0.35	0.66
A3	148.84	-1.16	0.65
A4	149.13	-0.87	0.65
A5	148.80	-1.20	0.65
B1	148.16	-1.84	0.67
B2	149.47	-0.53	0.67
B3	148.74	-1.26	0.66
B4	151.33	1.33	0.65
B5	148.67	-1.33	0.65
C1	148.89	-1.11	0.66
C2	149.38	-0.62	0.66
C3	150.90	0.90	0.66
C4	151.29	1.29	0.66
C5	148.74	-1.26	0.66
D1	150.46	0.46	0.66
D2	150.52	0.52	0.62
D3	150.47	0.47	0.68
D4	149.95	-0.05	0.67
D5	149.46	-0.54	0.67
E1	149.16	-0.84	0.66
E2	148.81	-1.19	0.70
E3	150.75	0.75	0.69
E4	150.40	0.40	0.68
E5	149.60	-0.40	0.66
F1	148.02	-1.98	0.68
F2	150.14	0.14	0.67
F3	149.23	-0.77	0.68
F4	150.60	0.60	0.67
F5	152.08	2.08	0.66

Characterization of the unit under calibration:

Locations heating Block	Desired (°C)	Unit Under Calibration (°C)		Measured Temperature (°C)
		Setting	Reading	
Left	150	150	150	0.15
Right	150	150	150	0.44

The End of Certificate

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: COD Reactor

รุ่น: DRB 200

หมายเลขเครื่อง: 19050C0191

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
29 Oct 2025			29 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☒	☐	5. สภาพ Hole	☒	☐	
☒	☐	6. สภาพฝาปิด	☒	☐	
☒	☐	7. สภาพตัวเครื่อง	☒	☐	
☒	☐	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ข้อเสนอแนะ:

Mr. Bovon Jannantha
Service Engineer

Certificate of Calibration

Certificate No.: C29250030

Page: 2 of 2

Equipment: Block Digestion Unit
Manufacturer: Environmental Express
Model: SC2100-35V240
Serial No.: 2021CEP296
ID No.: -
Condition of the item: Normal

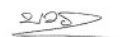
Certificate No.: C29250030
Issued Date: 03 November 2025
Job No.: WO-00091491
Digestion Block: 18 holes.
Page: 1 of 2

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

Environment Condition: Temperature: 23 °C ± 0.4 °C
Relative Humidity: 50 % ± 3.7 %
Voltage: 230 VAC ± 2.4 VAC

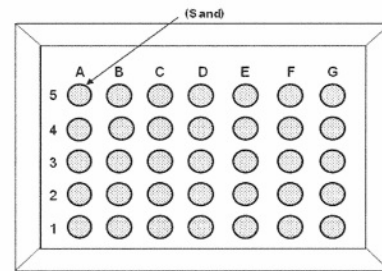
Calibration Place: Double A (1991) Public Company Limited. (Water Laboratory IP1)
1 Moo 2, Thatoom, Srimahaphot,
Prachinburi 25140 Thailand.

Calibration By: Mr. Bovon Jannantha
Calibration Date: 30 October 2025
The Method Used: In house method, direct measurement with standard Thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)
Certificate No.:TC25/0051


(Mr. Bovon Jannantha)
Person in charge


(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
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Location of standard

Fig. 2.: Digestion block

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature: The average reading of working standard at any positions or location.

Calibration Results:

Before adjustment

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC, (°C)	Uncertainty of Measurement (± °C)
A1	104.0	104.0	104.0	104.6	0.6	1.4
A3				104.9	0.9	1.4
A5				104.8	0.8	1.4
B2				104.3	0.3	1.4
B4				104.1	0.1	1.4
C1				104.3	0.3	1.4
C3				104.1	0.1	1.4
C5				105.0	1.0	1.4
D2				104.8	0.8	1.4
D4				104.2	0.2	1.4
E1				104.4	0.4	1.4
E3				104.5	0.5	1.4
E5				104.8	0.8	1.4
F2				104.7	0.7	1.4
F4				104.9	0.9	1.4
G1				104.6	0.6	1.4
G3				104.7	0.7	1.4
G5				104.5	0.5	1.4

The End of Certificate

บริษัท ดีเคเอส เอช จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนนสุขุมวิท แขวงคลองเตย เขตคลองเตย กรุงเทพมหานคร 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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CAL-FM-C29-08: 30 Jun 2025

บริษัท ดีเคเอส เอช จำกัด
DKSH Technology Limited
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CAL-FM-C29-08: 30 Jun 2025

ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

Certificate of Calibration

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: Block Digestion Unit
รุ่น: SC2100-35V240
หมายเลขเครื่อง: 2021CEP296

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
30 Oct 2025			30 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☒	☐	5. สภาพ Hole	☒	☐	
☐	☐	6. สภาพฝาปิด	☐	☐	ไม่มี
☒	☐	7. สภาพตัวเครื่อง	☒	☐	
☒	☐	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

Equipment: Block Digestion Unit
Manufacturer: Gerhardt
Model: KT 20s
Serial No.: GER5720190108
ID No.: -
Condition of the item: Normal

Certificate No.: C29250029
Issued Date: 31 October 2025
Job No.: WO-00091491
Digestion Block: 20 holes.
Page: 1 of 4

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

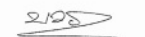
Environment Condition: Temperature: 23 °C ± 0.4 °C
Relative Humidity: 50 % ± 3.7 %
Voltage: 230 VAC ± 2.4 VAC

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

Calibration By: Mr. Bovon Jannantha
Calibration Date: 29 October 2025
The Method Used: In house method, direct measurement with standard Thermometer
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical Center Laboratory (NTL)
Certificate No.:TC25/0051

ชื่อแนะนำ: _____

Mr. Bovon Jannantha
Service Engineer


(Mr. Bovon Jannantha)
Person in charge


(Mr. Udon Srichana)
Authorized signatory

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognized national standard laboratories.
The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor (k=2) to provide a level of confidence of approximately 95%. It is determined in accordance with Evaluation of measurement data - Guide to the expression of uncertainty in measurement (JCGM 100).
These results may be affected by deviations from specified conditions. The results relate only to the items tested, calibrated or sampled. The report shall not be reproduced except in full without approval of DKSH Technology Limited.

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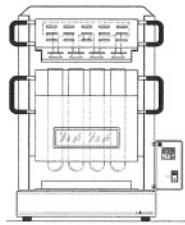
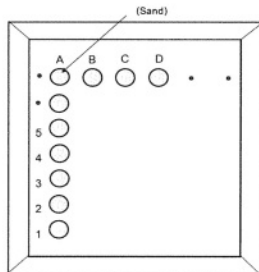


Fig. 1.: Front view



Location of standard

Fig. 2.: Digestion block

Definitions

Indicating Temperature: The average reading of indicating device which forms the integral part of the Digestion block.

Measured Temperature: The average reading of working standard at any positions or location.

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Calibration Results:**Before adjustment**

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty of Measurement (± °C)
A1	380	380	380	384.1	4.1	1.5
A2				385.9	5.9	1.5
A3				384.3	4.3	1.5
A4				384.4	4.4	1.5
A5				385.2	5.2	1.5
B1				384.6	4.6	1.5
B2				386.2	6.2	1.5
B3				383.7	3.7	1.5
B4				384.2	4.2	1.5
B5				385.6	5.6	1.5
C1				384.1	4.1	1.5
C2				384.7	4.7	1.5
C3				383.9	3.9	1.5
C4				383.3	3.3	1.5
C5				384.9	4.9	1.5
D1				383.9	3.9	1.5
D2				384.5	4.5	1.5
D3				383.4	3.4	1.5
D4				382.8	2.8	1.5
D5				384.7	4.7	1.5

The End of Certificate

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Calibration Results:**After adjustment**

Locations	Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty of Measurement (± °C)
A1	380	380	380	381.1	1.1	1.5
A2				382.3	2.3	1.5
A3				381.1	1.1	1.5
A4				382.1	2.1	1.5
A5				382.0	2.0	1.5
B1				381.4	1.4	1.5
B2				382.7	2.7	1.5
B3				380.4	0.4	1.5
B4				381.0	1.0	1.5
B5				382.3	2.3	1.5
C1				381.2	1.2	1.5
C2				381.5	1.5	1.5
C3				381.0	1.0	1.5
C4				380.5	0.5	1.5
C5				381.8	1.8	1.5
D1				381.3	1.3	1.5
D2				381.1	1.1	1.5
D3				380.3	0.3	1.5
D4				379.2	-0.8	1.5
D5				381.5	1.5	1.5

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ใบตรวจสอบสภาพเครื่องควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: Block Digestion Unit

รุ่น: KT 20s

หมายเลขเครื่อง: GER5720190108

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
29 Oct 2025			29 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
General					
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒	☐	
☒	☐	4. การแสดงผล Display	☒	☐	
☒	☐	5. สภาว Hole	☒	☐	
☐	☐	6. สภาวฝาปิด	☐	☐	ไม่มี
☒	☐	7. สภาวดัชนี	☒	☐	
☒	☐	8. สภาวแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ขอแนะนำ :

Mr. Bovon Jannantha
Service Engineer

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Certificate of Calibration

Equipment: Moisture Balance
Manufacturer: Sartorius
Model: MA35
Serial No.: 26303311
ID No.: -
Condition of the item: Normal

Certificate No.: C01253239
Job No.: WO-00091491
Issued Date: 03 November 2025
Page: 1 of 2

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom,
Amphur Srimahaphote, Prachinburi 25140 Thailand

Environment Condition: Temperature 22 °C ± 0.8 °C
Relative Humidity 63 % ± 4.8 %

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

Calibration By: Mr. Piyapat Saidoung
Calibration Date: 29 October 2025
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. C02250448

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	20	(g)
Reference Points (g)					
A	B	C	D	E	
-	0.000	0.000	0.000	0.000	

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.001 (g)

Nominal test value (g)	Standard Deviation
2	0.0003
20	0.0004

Error of indication from nominal or conventional mass value., Readability 0.001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Error of Indication (g)	Uncertainty (±g)	k
1	1.0000	1.000	0.000	0.00096	2.02
2	2.0000	2.000	0.000	0.00096	2.02
5	5.0000	5.000	0.000	0.00096	2.02
10	10.0000	10.000	0.000	0.00096	2.02
12	12.0000	12.000	0.000	0.00096	2.02
15	15.0000	15.000	0.000	0.00096	2.02
20	20.0000	20.000	0.000	0.00096	2.02
22	22.0000	22.000	0.000	0.00096	2.02
25	25.0000	25.000	0.000	0.00096	2.02
30	30.0000	30.000	0.000	0.00096	2.02
35	35.0000	35.000	0.000	0.00097	2.02

The End of Certificate

(Mr. Piyapat Saidoung)
Person in charge

(Mr. Adisai Maknoi)
Authorized signatory

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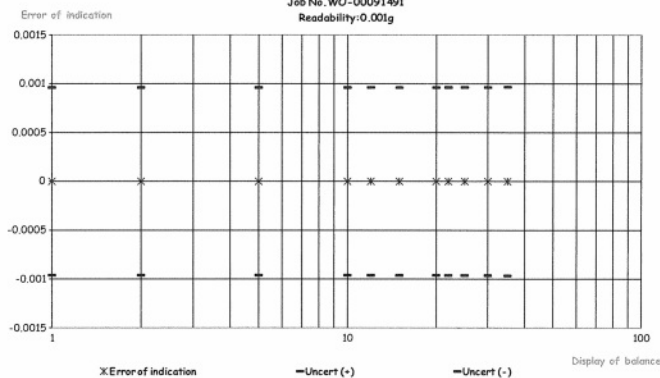
CAL-FM-C01-15: 30 Jun 2025

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2533 Sukhumvit Road, Bangkok, Phraekhanong, Bangkok 10260
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CAL-FM-C01-15: 30 Jun 2025

Without Adjustment
Job No. WO-00091491
Readability: 0.001g



ใบตรวจสอบสภาพเครื่องชั่งวิเคราะห์ความชื้น Moisture Balance Checklist

Equipment: Moisture Balance

Model: MA35

Serial No.: 26303311

Certificate No.: C01253239

Job No.: WO-00091491

Check date	รายการตรวจเช็ค (Description)		Check before delivery	หมายเหตุ (Remark)	
29 Oct 2025			29 Oct 2025		
(Normal)	(Defective)		(Normal)	(Defective)	
General					
☒	☐	1. สายไฟ/ อะแดปเตอร์ (Electrical wire/ Adaptor)	☒	☐	
☒	☐	2. ความสมบูรณ์ของกระถังกันลม (Cover)	☒	☐	
☒	☐	3. ความสมบูรณ์ของระดับน้ำ (Bubble spirit level)	☒	☐	
☒	☐	4. ความสมบูรณ์ของชุดขาตั้งเครื่อง (Leveling foot)	☒	☐	
☒	☐	5. การตอบสนองของปุ่มกด (Keys)	☒	☐	
☒	☐	6. ความสมบูรณ์ของหน้าจอ (Display)	☒	☐	
☒	☐	7. การแสดงผลของหน้าจอ (Screen display)	☒	☐	
☒	☐	8. ชุดรองจานชั่ง (Stopper/ Pan support)	☒	☐	
☒	☐	9. การทำงานของฟังก์ชัน (Internal/ External Function)	☒	☐	
☒	☐	10. ความสะอาดของตัวเครื่องภายนอก (External cleanliness of the balance)	☒	☐	
☒	☐	11. สภาพแวดล้อม ณ สถานที่ตั้งเครื่องชั่ง (Environment at the location of the balance)	☒	☐	

ข้อแนะนำ/ Note :

Mr. Piyapat Saidoung
Service Engineer



Certificate of Calibration

Certificate No.: C30250640

Page: 2 of 3

Equipment: Moisture Balance
Manufacturer: Sartorius
Model: MA35
Serial No.: 26303311
ID No.: -
Condition of the item: Normal

Certificate No.: C30250640
Job No.: WO-00091491
Issued Date: 03 November 2025
Page: 1 of 3

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

Environment Condition: Temperature 22 °C ± 0.9 °C
Relative Humidity 61 % ± 3.2 %

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

Calibration By: Mr. Piypat Saidoung
Calibration Date: 29 October 2025
The Method Used: In-house method, CAL-WI-56, temperature measure in the sample chamber
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (Thailand), NIMT through DKSH Technology Co., Ltd. Certificate No. C15250398

(Mr. Piypat Saidoung)
Person in charge

(Mr. Adisai Maknoi)
Authorized signatory

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Calibration Results:

Temperature Test

Pre-Calibration

Unit Under Calibration			Measurement	Error	Measurement
Desired	Setting	Reading	Temperature	Temperature	Uncertainty
(°C)	(°C)	(°C)	(°C)	(°C)	(±°C)
75	75	-	84.6	-9.6	1.6
105	105	-	120.1	-15.1	1.8

Without Adjustment

Unit Under Calibration			Measurement	Error	Measurement
Desired	Setting	Reading	Temperature	Temperature	Uncertainty
(°C)	(°C)	(°C)	(°C)	(°C)	(±°C)
75	65	-	75.6	-0.6	1.6
105	90	-	105.5	-0.5	1.7

Error Temperature = Desired - Measurement Temperature

Black body sensor of STD thermometer size; Ø ~2.5 cm

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CAL-FM-C30-13: 30 Jun 2025



Certificate No.: C30250640

Page: 3 of 3

Sample Test *

Determination Moisture by Standard Solution (NaCl)

Standard solution for sample test made from salt and distilled water; 90.00% ± 0.015%

UUC Setting		UUC Reading		Standard	Error	SD	Measurement
Temperature	End of Analysis	Time	Moisture	(NaCl)			Uncertainty
(°C)	Mode	(mm.ss)	(%)**	(%)	(%)	(± %)	(± %)
160	Automatic	9.00	90.07	90.00	0.07	0.01	0.060

Determination Moisture by Reference Material Sample (RM)

Reference Material Moisture in Flour assigned value; 12.37% ± 0.21% Standard deviation; 0.49

Lot No. RMFF-FL01-2401-III Expired Date: Dec 2026

UUC Setting		UUC Reading		Standard	Error	SD	Measurement
Temperature	End of Analysis	Time	Moisture	(RM)			Uncertainty
(°C)	Mode	(mm.ss)	(%)**	(%)	(%)	(± %)	(± %)
105	Automatic	11.00	12.53	12.37	0.16	0.01	0.22

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

** 1% = 10mg / g

The End of Certificate

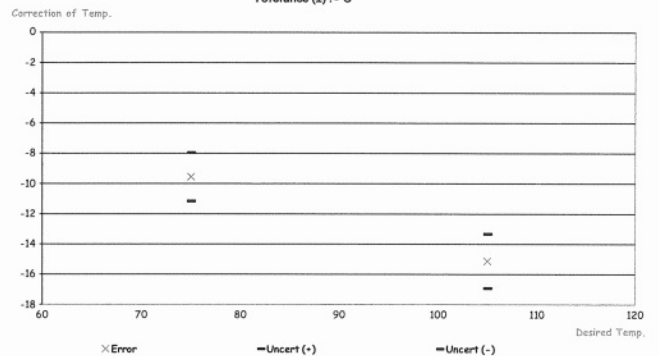
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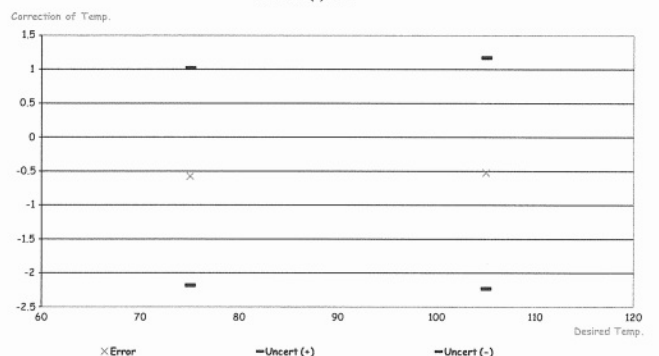
CAL-FM-C30-13: 30 Jun 2025



Pre-Calibration
Job No.: WO-00091491
Tolerance (±): -°C



Without Adjustment
Job No.: WO-00091491
Tolerance (±): -°C



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Certificate of Calibration

Certificate No.: C14250261

Page: 2 of 3

Equipment: Furnace
Manufacturer: Carbolite
Model: CWF 12/5
Serial No.: 2/96/521
ID No.: -
Voltage type: 230 VAC
Condition of the item: Normal

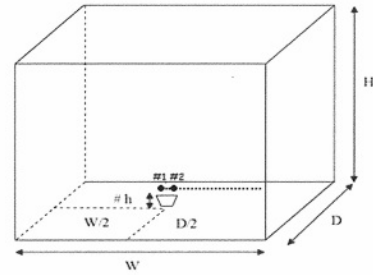
Certificate No.: C14250261
Issued Date: 31 October 2025
Job No.: WO-00091491
Furnace type: Chamber Furnace
Page: 1 of 3

Customer: Integrated Research Center Co.,Ltd. (Pulp Laboratory)
122 Moo 2, Tambol Thatoom, Amphur Srimahaphote,
Prachinburi 25140 Thailand

Environment Condition: Temperature: 24 °C ± 0.9 °C
Relative Humidity: 64 % ± 4.7 %
Voltage: 231 VAC ± 1.6 VAC

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

Calibration By: Mr. Bovon Jannantha
Calibration Date: 28 October 2025
The Method Used: In house method, CAL-WI-68, base on BS 4309
Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through N.M. Technical center laboratory Co., Ltd. Certificate No. TC25/0013



Standard Installation Locations

Volume	6	(Liters)	W	D	H
Inside chamber		(cm)	15	26	15
Standard Locations			w/2	d/2	h
#1, #2		(cm)	8	13	4

Note : #1 reference, #2 cross check

Definitions

Indicating Temperature : The temperature indicated by a suitable device installed by the manufacturer or in accordance with his instructions.

Measured Temperature : The arithmetic mean of the average temperature determined over the same specified number of temperature cycles.

Temperature variation : The difference between the mean temperatures at any two points in the working space, determined over the same specified number of temperature cycles.

Temperature fluctuation : The one-half of difference between maximum temperature and minimum temperatures of reference temperature.

(Mr. Bovon Jannantha)
Person in charge

(Mr. Udon Srichana)
Authorized signatory

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2533 Sukhumvit Road, Bangkok, Thailand 10260
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CAL-FM-C14-12: 30 Jun 2025

ชื่อย่อ: บริษัท ดเคช เทคโนโลยี จำกัด
DKSH Technology Limited
2533 สุขุมวิท ถนน, กรุงเทพฯ, ประเทศไทย 10260
2533 Sukhumvit Road, Bangkok, Thailand 10260
Phone: +66 2639 7000 Email: info.calibration@dksh.com Website: www.dksh.com/scientific-thailand

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Certificate No.: C14250261

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Calibration Results:

Without Adjustment

Measured temperature at the spread locations:

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature (°C)	Correction of UUC (°C)	Uncertainty (±°C)*	Cross check (°C)
550	550	550	550.4	0.4	4.0	549.7

Characterization of the unit under calibration:

Indicating (°C)	Temperature Variation (°C)	Temperature fluctuation (±°C)**
550	0.7	2.4

Note: * Maximum uncertainty of the each position

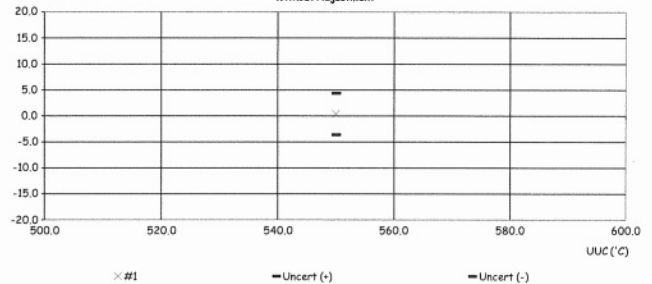
** Channel 1 is reference temperature.

The End of Certificate

Correction Distribution & Max Measurement Uncertainty

Job No.: WO-00091491

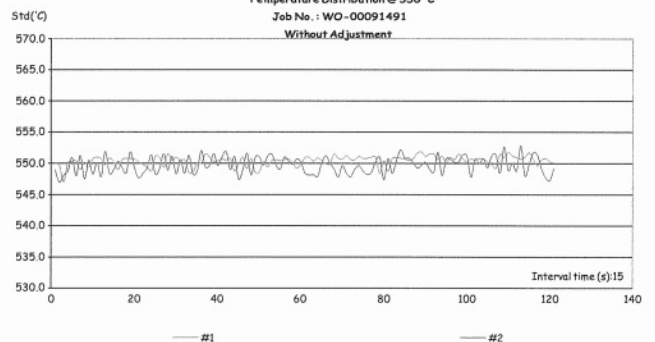
Without Adjustment



Temperature Distribution @ 550°C

Job No.: WO-00091491

Without Adjustment



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ใบตรวจสอบสภาพเตาเผาควบคุมอุณหภูมิ

เลขที่ใบงาน: WO-00091491

ชนิดเครื่องมือ: Chamber Furnace

รุ่น: CWF 12/5

หมายเลขเครื่อง: 2/96/521

ตรวจสอบ (รับ)		รายการตรวจเช็ค	ตรวจสอบ (ส่ง)		หมายเหตุ
28 Oct 2025			28 Oct 2025		
ปกติ	ไม่ปกติ		ปกติ	ไม่ปกติ	
		General			
☒	☐	1. สายไฟ	☒	☐	
☒	☐	2. การทำงาน Main Switch	☒	☐	
☒	☐	3. การทำงาน Selector Key	☒		
☒	☐	4. การแสดงผล Display			
☒	☐	5. สภาพตัวเครื่อง	☒	☐	
☒	☐	6. สภาพผนังภายในตัวเครื่อง	☒	☐	
☒	☐	7. สภาพประตูเปิด/ ปิดเครื่อง	☒	☐	
☒	☐	8. สภาพแวดล้อม ณ สถานที่ตั้งเครื่อง	☒	☐	

ขอแนะนำ :

Mr. Bovon Jannantha
Service Engineer