

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ

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	CHROMIUM COPPER FUME IRON MANGANESE NICKEL	Perkin Elmer	PinAAcle 900F / PFB20031902	Perkin Elmer Co.,Ltd.	WO-02787590	14/5/2024	13/5/2025
2	Analytical Balance	TOTAL SUSPENDED PARTICULATE	Mettler Toledo	MS204TS/00 / C252436235	National Food Institute, Ministry of Industry, Thailand	2502228-003-01	19/3/2025	18/3/2026
3	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	ALUMINUM MAGNESIUM SODIUM	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4/11/2024	3/11/2025
4	Dionex Aquion RFIC Ion Chromatography	CHLORINE HYDROGEN CHLORIDE SODIUM HYPOCHLORITE SULPHURIC ACID	Thermo Scientific	Dionex Aquion RFIC / 220380031	ARCHEMICA LAB CO., LTD	ID1047	23/4/2024	22/4/2025
5	Microbalance	TOTAL DUST	Mettler Toledo	XP6 / B322373893	National Food Institute, Ministry of Industry, Thailand	2502228 002 01	20/3/2025	19/3/2026

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

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No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	CHROMIUM IRON LEAD NICKEL	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	30/1/2025	29/1/2026
2	Analytical Balance	FAT OIL AND GREASE	Mettler Toledo	AB204-S/FACT / 1129361010	Technology Promotion Association (Thailand-Japan)	24MM292	11/5/2024	10/5/2025
			Mettler Toledo	AB204-S/FACT / 1129361010	United Analyst and Engineering Consultant Co., Ltd.	250422 1 BL002 25	23/4/2025	22/4/2026
3	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2/4/2024	1/4/2025
			Mettler Toledo	XSR205DU / C210685394	National Food Institute,Ministry of Industry, Thailand	2502226-002-01	20/3/2025	19/3/2026
4	Analytical Balance	TOTAL SUSPENDED SOLIDS	Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2402283-001-01	2/4/2024	1/4/2025
			Mettler Toledo	XSR205DU / C009071872	National Food Institute,Ministry of Industry, Thailand	2502226-001-01	20/3/2025	19/3/2026
5	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	24TM1113	11/7/2024	16/7/2025
6	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UC4-1320 / 1021	Technology Promotion Association (Thailand-Japan)	24TM1114	11/7/2024	10/7/2025
7	BOD Incubator	BIOCHEMICAL OXYGEN DEMAND	ARCO	UR-1320 / -	Technology Promotion Association (Thailand-Japan)	24TM587	1/4/2024	31/3/2025

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*
8	DO Meter	BIOCHEMICAL OXYGEN DEMAND	YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	24TW39	21/2/2024	20/2/2025
			YSI	5100 / 11B 101863	Technology Promotion Association (Thailand-Japan)	25TW29	18/2/2025	16/2/2026
9	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Italia Srl.	HI 839800-02 / H 018500 I	Hanna Instruments (Thailand) Ltd.	HIT-2510-0375	7/3/2025	6/3/2026
10	Heating Block	CHEMICAL OXYGEN DEMAND	Hanna Instruments Inc.(Romania)	HI839800-02 / 4500052101	Hanna Instruments (Thailand) Ltd.	HIT-2427-0942	1/7/2024	30/6/2025
11	Hot Air Oven	TOTAL DISSOLVED SOLIDS TOTAL SUSPENDED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1/4/2024	31/3/2025
12	Incubator	TOTAL COLIFORM BACTERIA	Binder	KB400 / 20220000022479	Technology Promotion Association (THAILAND-JAPAN)	24TM938	9/7/2024	8/7/2025
13	Inductively Coupled Plasma- Optical Emission Spectrometer(ICP-OES)	CHROMIUM LEAD NICKEL	Agilent Technologies, USA	5110 VDV(G8015AA) / MY8030001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	4/11/2024	3/11/2025
14	Kjeltec Distillation Unit	TOTAL KJELDAHL NITROGEN	FOSS	KT9 / 91905393	FOSS South East Asia	12875	5/7/2024	4/7/2025
15	pH Meter	pH	EcoSense	pH100A / JC04744	Technology promotion association (thailand-japan)	25CH408	3/4/2025	2/4/2026
16	pH Meter	pH	Horiba	LAQUA-PH210 / HA0A0007	technology promotion association (thailand-japan)	24CH399	2/4/2024	1/4/2025
			Horiba	LAQUA-PH210 / HA0A0007	technology promotion association (thailand-japan)	25CH353	20/3/2025	18/3/2026
17	pH Meter	pH	Horiba	LAQUA-PH210 / HA0E0041	technology promotion association (thailand-japan)	24CH725	19/6/2024	17/6/2025
18	UV/VIS Spectrophotometer	CHEMICAL OXYGEN DEMAND	Hitachi	U-5100 / 23A4-008	DQE Services Co.,Ltd.	SP24-028	11/9/2024	9/9/2025

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

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Stack									
1	Pre-Test Console	Total Suspended Particulate	Apex Instruments, USA.	XC-572-V 1701019	Envi Equipment Service Co., Ltd.	E24-060048	18 Jun 24	17 Jun 25	-
2	Flue gas Analyzer	Sulphur Dioxide Oxide of Nitrogen as Nitrogen Dioxide Carbon Monoxide	Testo	Testo 350 60899615	Entech Industrial Solution Co., Ltd.	G 670490	17 Jul 24	16 Jul 25	-

List of Opacity Training Certification for Opacity Measurement

No.	Name	Training Course	Train	Date	Remark
1	Mr.Natthapong Mounghai	Opacity	Pollution Control Department	22-23 March 2018	-
2	Mr.Ronnapob Putragulpattana	Opacity	Pollution Control Department	22-23 March 2018	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
1	Primary Flow Calibrator	Calibrate personal pump	TSL Inc	4146 41461922008	Innovative Instrument Co., Ltd.	25-AFM-013	15 Jan 25	14 Jan 26	-
2	Aneroid Barometer	Sodium Hydroxide Hydrogen Chloride Chlorine Total Dust Copper Fume	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	25P1359	17 Apr 25	16 Apr 26	-
3	Digital Thermo - Hygrometer	Sodium Hydroxide Hydrogen Chloride Chlorine Total Dust Copper Fume	Digicon	TH-02 435031148	Technology Promotion Association (Thailand-Japan)	24H1487	15 Jul 24	14 Jul 25	-
4	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Svantek	SV35A 73246	Innovative Instrument Co., Ltd.	24-ACT-077	30 May 24	29 May 25	-
5	Sound Level Meter	$L_{Aeq\ 8\ hrs}$, L_{Amax}	Rion, Japan	NL-42 00408979	Sithiporn Associates Co., Ltd.	ACL25020	13 Jan 25	12 Jan 26	-
6	Sound Level Meter	$L_{Aeq\ 8\ hrs}$, L_{Amax}	Rion, Japan	NL-42 00321441	Sithiporn Associates Co., Ltd.	ACL24156	30 May 24	29 May 25	-
7	Sound Level Meter	$L_{Aeq\ 8\ hrs}$, L_{Amax}	Rion, Japan	NL-42 00408982	Sithiporn Associates Co., Ltd.	ACL25022	13 Jan 25	12 Jan 26	-
8	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143227	Innovative Instrument Co., Ltd.	24-NDM-179	16 Jul 24	15 Jul 25	-
9	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143233	Innovative Instrument Co., Ltd.	24-NDM-178	16 Jul 24	15 Jul 25	-
10	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 143229	Innovative Instrument Co., Ltd.	24-NDM-170	15 Jul 24	14 Jul 25	-
11	Noise Dosimeter	Noise Dosimeter	Svantek	SV 104 117694	Innovative Instrument Co., Ltd.	24-NDM-108	26 Apr 24	25 Apr 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Workplace									
12	Light Meter	Lux	Extech Instrument, Taiwan	407026 A 037351	Innovative Instrument Co., Ltd.	25-LXM-074	11 Mar 25	10 Mar 26	-
13	Thermal Environment Monitor	Heat Meter	TSI QUEST	QuesTemp 34 TEX040016	Innovative Instrument	24-TPM-315	9 Jul 24	8 Jul 25	-
14	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPS030008	Innovative Instrument Co.,Ltd.	25-TPM-050	28 Jan 25	27 Jan 26	-
15	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPS030007	Innovative Instrument Co.,Ltd.	25-TPM-052	28 Jan 25	27 Jan 26	-
16	Thermal Environment Monitor	Heat Meter	3M	QuesTemp 32 TPQ020023	Innovative Instrument Co.,Ltd.	24-TPM-349	6 Aug 24	5 Aug 25	-

List of Instruments Certification for Water Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Water									
1	pH Meter	pH	Ecosence	pH100A 24H005160JEN	Technology Promotion Association (Thailand-Japan)	24CH1422	14 Nov 24	13 Nov 25	-
2	DO Meter	DO	YSI	Pro 20i 24F101579	Technology Promotion Association (Thailand-Japan)	24TW258	6 Dec 24	5 Dec 25	-

PinAAcle 900F Preventive Maintenance Report

Company Name: UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,


Phra Khanong, Bangkok 10260

Instrument Serial No.: PFBS20031902

Date: 14-May-2024

PinAAcle 900F Preventive Maintenance (PM)

Company Name:		United Analyst and Engineering Consultant Co., LTD.	
Address (Instrument Location):		41 Sukumvit Rd., Phra Khanong, Bangkok 10260	
Serial Number:	PFBS20031902	PM Number:	2 of 2
Customer Name (if applicable):	K. Yinda	Telephone Number:	095-5580049
Customer Support Engineer Name:	K. Chayanon	Service Order Number:	WO-02787590
Date PM Performed: (DD-MM-YYYY)	14-May-2024	Next PM Due Date: (DD-MM-YYYY)	14-Nov-2024
Standard Labor Hours to Complete PM :		5 hours	

Part Number	Release	Publication Date	
09370145 Rev.9	A	January 2018	

Scope

The purpose of this PM is to ensure the continued functionality of the PinAAcle 900F by inspecting and replacing any worn or damaged parts. This service should only be performed by a trained representative of PerkinElmer.

The customer should save their method before the PM begins.

General Instructions:

The customer must provide the engineer operational data to demonstrate recent Instrument performance prior to starting the PM.

Always check with the customer before making any changes that may affect the customer's analysis or calibration, including a current back-up of system software and/or data files.

The completed document should be signed by an authorized PerkinElmer and customer representative and left with the customer.

Update the PM sticker and instrument logbook as required.

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Component List

Component / Specific Model	Serial #	Configuration Notes
PinAAcle900F	PFBS20031902	Syngistix V.4.0.1.1935
Fias100(New Install)	100524040501	

Parts Lists

Parts Included with the PM		
Part Number (if applicable)	Description	Quantity
B0501696	Fan Filters	N/A
N3160156	O-Ring Kits for Sampling Introduction (Stainless Steels Nebulizer)	N/A
N3160157	O-Ring Kits for Sampling Introduction (Plastic Nebulizer)	N/A
N9301714	Replacement Acetylene Filter Cartridge	N/A
TH001022	Replacement Air Filter Cartridge	N/A

Additional Reagents and Standards Required for PM

Part Number (if applicable)	Description	Quality	Batch/Lot #	Expired Date (MM/YY)
N9300183	1000 mg/L Copper Standard	AR	27-39CUY1	Apr 2025

Additional Reagents and Standards Required for PM (Customer Support Solution)

Part Number (if applicable)	Description	Quantity	Batch/Lot #	Expiration Date (MM/YY)
N/A	DI Water	250 ml.	AR	AR
N/A	0.5% HNO ₃	250 ml.	AR	AR

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Additional Tools Required for PM

Part Number (if applicable)	Description	Quantity	Serial #
N1013000	0.2A Neutral density filter	1	101N0089015
N1013002	1.0A Neutral density filter	1	101N0089015
03030997	System 2 EDL Driver	1	03030997
N3050605	As System 2 EDL	1	16148
N3050121	Cu Lumina HCL	1	060419-030180
N3050109	Ba Lumina HCL	1	061219-020041
N3050139	K Lumina HCL	1	030819-010130
N3050152	Ni Lumina HCL	1	052719-020020

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Procedure Checklist

Use (✓) to check off those steps in the checklist that have been completed.

1. General:

- ☒ Review the instrument performance with the customer and document any recent problems.
- ☒ Inspect the customer log book and make any appropriate PM entries.
- ☒ Perform general inspection of system for cleanliness.

2. PC Instrument Software:

- ☒ Instrument Software user files/databases archived, packed, and/or deleted as needed.

3. Mechanical:

- ☒ Inspect and clean all fans and filters. Replace filters if necessary.
- ☒ Inspect all gas lines for leaks and/or wear. Replace if needed.
- ☒ Clean exterior of the instrument.
- ☒ Inspect the burner head, burner chamber, and nebulizer. Clean if needed as stated in the Hardware Guide.
- ☒ Check burner head dimensions with the feeler gauge as stated in the Hardware Guide in the Maintenance chapter section on cleaning the burner head and checking sloth width. Replace if out of specification.
- ☒ Check the condition of the end cap, burner head, and nebulizer O-rings. Replace if necessary.
- ☒ Check the drain system for signs of wear. Replace worn or damaged parts.
- ☒ Visually check for proper flame conditions when igniting the Air-C2H2 and N2O-C2H2 flames (if applicable).

4. Electrical:

- ☒ Inspect PC boards. Clean if necessary.
- ☒ Carefully check all internal and external cable connections.
- ☒ Check instrument firmware revisions upgrade to current levels (if necessary).
- ☒ Run Diagnostics Test within the Advanced function of the Spectrometer page. Check the results in the service log folder in the Spectrometer BM Log Viewer.

5. Optics:

- ☒ Inspect and clean the sample compartment windows, if needed.
- ☒ Inspect optics. Clean or replace if necessary.

6. Gasses:

- ☒ Verify that the Gasses supplied to the instrument are within the pressure and purity specifications found in the PinAAcle 900F Series Pre-Installation Checklist SDB.
- ☒ Verify that the acetylene filter and air filter element is dry. Replace if necessary.

7. Flame Interlock Check:

Description: Check to ensure that all safety interlocks are closed.

Parameter	Specification	Test Results	Pass/Fail
Flame Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Drain Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Nebulizer Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
C ₂ H ₂ Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Air Pressure Sensor	Air/C ₂ H ₂ Flame correctly shuts down	Active	Passed
Burner Head Sensor	Choosing Nitrous Oxide as the oxidant should trigger an interlock shuts down	Active	Passed

8. After PM Performance tests:

8.1 Detector Linearity with Barium

Description: Ensures that the detector is linear in the Visible Range.

Parameter	Specification	Certificate Value at 553.6 nm (Abs.)	Test Results	Pass/Fail
1.0 A ND Filter	± 5% from Cert.	0.9995	1.0143	Passed
0.2 A ND Filter	± 5% from Cert.	0.1936	0.1966	Passed

8.2 Baseline Noise at 1.0 Absorbance with Barium

Description: Ensures that a high absorbance will not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.002	Passed

8.3 AA Baseline Noise with Copper

Description: Check baseline noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.001	0.0002	Passed

8.4 D_j Background Compensation with Copper

Description: Verifies the instruments ability to compensate for Background absorption.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.010	0.0001	Passed

8.5 AA-BG Baseline Noise with Copper

Description: Ensures that background correction does not produce excessive noise.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.002	Passed

8.6 AA-BG Baseline Noise with Arsenic

Description: Ensures that background correction does not produce excessive noise at a low wavelength.

Parameter	Specification	Results	Pass/Fail
Standard Deviation	≤ 0.005	0.0022	Passed

8.7 Flame Sensitivity

Description: Instrument Sensitivity checked against Copper standard.

Standard Copper Sensitivity	Specification	Results (Abs.)	Pass/Fail
5 mg/L Sensitivity SS Neb (if applicable)	> 0.250 Abs.	N/A	Not Applicable
2 mg/L Sensitivity HS Neb (if applicable)	> 0.250 Abs.	0.8005	Passed

10. Review:

- ☒ Review with the customer PM work performed.
- ☒ Review with the customer routine maintenance procedures.
- ☒ Discuss recommended customer supplied materials to have on hand.
- ☒ Attach PM sticker.

Additional Comments

Additional Comments Regarding the PM

Review

The preventive maintenance checks and if applicable performance tests for PinAAcle 900F have been completed.

This PinAAcle 900F Passes ☒ Fails ☐ the preventive maintenance.

Review of Preventive Maintenance:

Authorized PerkinElmer Representative:	Date: 14-May-2024 (DD-MMM-YYYY)
Authorized Customer Representative:	Date: 14-May-2024 (DD-MMM-YYYY)

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.

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](#)

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.

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	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8014	77 76030001
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) Conical Other
Spray Chamber	Cyclonic Single Pass (Cyclonic Double Pass) Other
Torch	Radial (Dual View) Other
Torch Type	One Piece (Semi Dismountable) Fully Dismountable Other
Injector Diameter	2.4mm (1.8mm) 1.4mm 0.8mm Other
Injector Material	Quartz Ceramic Other

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.
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

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.
- ☒ 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.

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

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

Restore Instrument

- ☐ For HF applications, ask the customer to reinstall their sample introduction system. ^{N16}
- ☒ 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.

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	1500.4	2219.4	4124.9	6965.9
Mn 257.610 nm SRBR	3915.0	7492.1	13017.6	31121.6
Al 396.152 nm SBR	9.9	10.7	9.9	21.1
K 766.491 nm SBR	5.7	29.1	4.8	45.3

* 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

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	231.411 VAC	226.931 VAC
Mains Current	0.091 A	0.105 A
Instrument Temperature	22.1 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	63.9 °C
Water Flow Oscillator	No measurement	1.34 L/min
Water Flow Detector	0.86 L/min	0.81 L/min
Water Inlet Temperature	19.7 °C	19.7 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-40.1 °C	-39.6 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	649.92 kPa	691.55 kPa
Purge Gas Supply Pressure*1	646.66 kPa	612.41 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.70 L/min
Nebulizer Back Pressure	No measurement	138.43 kPa
Plasma Gas Flow	No measurement	11.91 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1204.7 W
RF Supply Current	No measurement	7.958 A
RF Supply Voltage	No measurement	204.417 V

*1 If option installed

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	—
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-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

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:

6003193100

Date Service Completed:

04 Nov 2024

Service Engineer Name:

Kanyakorn S.

Customer Name:

Aphorn Onkong

Service Engineer Signature:

Kanyakorn S.

Customer Signature:

Aphorn Onkong

Total number of pages in this document:

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เอกสารไม่ควบคุม

Report Summary

Instrument Model Agilent 5100/5110 VDV ICP-OES
Instrument ID G8011A/G8015A
Instrument Serial Number MY18030001
Software Version 7.3.1.9507
Firmware Version 3442
Tested By Pre Test_PM_Kanyakorn S.
Test Completed On 11/4/2024 9:19:10 AM

Result Summary

Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

เอกสารไม่ควบคุม

Resolution Test

Pass

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.98
As (188.980 nm)	≤ 8.20	6.17
C (193.027 nm)	≤ 11.50	8.30
Mo (202.032 nm)	≤ 8.20	6.38
Cr (208.158 nm)	≤ 13.40	8.98
Zn (213.857 nm)	≤ 8.70	6.60
Pb (220.353 nm)	≤ 9.50	7.09
Co (228.615 nm)	≤ 17.20	11.67
Ba (230.424 nm)	≤ 9.40	7.20
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	14.11
Cr (267.716 nm)	≤ 11.00	8.04
Cu (324.754 nm)	≤ 25.00	18.97
Cu (327.395 nm)	≤ 14.20	11.23
Sr (338.071 nm)	≤ 33.50	24.30
Ba (455.403 nm)	≤ 44.00	33.47
Sr (460.733 nm)	≤ 36.00	17.23
Ba (493.408 nm)	≤ 36.00	25.37
Ba (614.171 nm)	≤ 42.00	25.54
Ar (675.283 nm)	≤ 74.00	56.51
K (766.491 nm)	≤ 80.00	65.86

เอกสารไม่ควบคุม

Sensitivity Test

Fail

Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8
Se (196.026 nm)	≥ 41.0	SRBR	87.6	862.0	79.7
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	264700.2	4420.0
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5583.2
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8
K (766.491 nm)	≥ 1.8	SBR	5.7	99038.2	14587.7
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8
Zn (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7
Zn (213.857 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7929.5	499.0
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16911.7
Cr (267.718 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956480.4	138336.9
K (766.491 nm)	≥ 24.0	SBR	26.1	1395190.2	47996.2

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.73	
Se (196.026 nm)	≤ 2.60	0.95	
Zn (213.857 nm)	≤ 1.50	0.31	
Pb (220.353 nm)	≤ 2.60	0.73	
Mn (257.610 nm)	≤ 1.50	0.39	
Al (396.152 nm)	≤ 1.50	0.39	
Ba (493.408 nm)	≤ 1.50	0.87	
K (766.491 nm)	≤ 1.50	0.32	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	1.21	
Se (196.026 nm)	≤ 1.50	0.84	
Zn (206.200 nm)	≤ 1.50	0.56	
Zn (213.857 nm)	≤ 1.50	0.96	
Cd (214.439 nm)	≤ 1.50	0.26	
Pb (220.353 nm)	≤ 1.50	0.51	
Mn (257.610 nm)	≤ 1.50	0.97	
Cr (267.716 nm)	≤ 1.50	0.22	
Cu (324.754 nm)	≤ 1.50	0.24	
Al (396.152 nm)	≤ 1.50	0.33	
Ba (493.408 nm)	≤ 1.50	0.40	
K (766.491 nm)	≤ 1.50	0.65	

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Plate Count	3442
Tested By	Post Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 11:07:24 AM
Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
Software Version	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass
Subsystem Communications Test	Pass
Optics Test	
Pass	
Intensity	Radial 3184054 Axial 3177175
Wavelength	Radial 737.212 Axial 737.212

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.97	
As (188.980 nm)	≤ 8.20	6.14	
C (193.027 nm)	≤ 11.50	8.33	
Mo (193.032 nm)	≤ 8.20	6.33	
Cr (206.133 nm)	≤ 13.40	9.06	
Zn (213.637 nm)	≤ 8.70	6.70	
Pb (220.353 nm)	≤ 9.50	7.03	
Co (228.615 nm)	≤ 17.20	11.72	
Ba (230.424 nm)	≤ 9.40	7.32	
Mn (257.610 nm)	≤ 13.30	9.44	
Mn (260.568 nm)	≤ 20.30	14.21	
Cr (267.716 nm)	≤ 11.00	7.94	
Cu (324.754 nm)	≤ 25.00	18.99	
Cu (327.395 nm)	≤ 14.20	11.27	
Sr (338.071 nm)	≤ 33.50	24.40	
Ba (455.403 nm)	≤ 44.00	33.50	
Sr (460.793 nm)	≤ 36.00	17.31	
Ba (493.408 nm)	≤ 36.00	25.44	
Ba (614.171 nm)	≤ 42.00	25.16	
Ar (675.283 nm)	≤ 74.00	56.15	
K (766.491 nm)	≤ 80.00	65.56	

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เอกสารไม่ควบคุม

Sensitivity Test						Fail
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4	
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2	
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4	
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2	
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7	
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0	
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3	
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	174.9	1566.7	73.0	
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2	
Zn (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1	
Zn (213.857 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1	
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7	
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.8	1006637.8	1044.0	
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8	
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6	
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3	
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3	
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0	

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เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	0.81	
Se (196.026 nm)	≤ 2.60	0.96	
Zn (213.857 nm)	≤ 1.50	0.22	
Pb (220.353 nm)	≤ 2.60	0.37	
Mn (257.610 nm)	≤ 1.50	0.27	
Al (396.152 nm)	≤ 1.50	0.25	
Ba (493.408 nm)	≤ 1.50	0.53	
K (766.491 nm)	≤ 1.50	0.15	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.81	
Se (196.026 nm)	≤ 1.50	0.65	
Zn (213.857 nm)	≤ 1.50	0.79	
Zn (213.857 nm)	≤ 1.50	0.81	
Cd (214.439 nm)	≤ 1.50	0.35	
Pb (220.353 nm)	≤ 1.50	0.33	
Mn (257.610 nm)	≤ 1.50	1.02	
Cr (267.716 nm)	≤ 1.50	0.32	
Cu (324.754 nm)	≤ 1.50	0.51	
Al (396.152 nm)	≤ 1.50	0.37	
Ba (493.408 nm)	≤ 1.50	0.68	
K (766.491 nm)	≤ 1.50	0.74	

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Post Test_PM_Kanyakorn S.	
Test Completed On	11/4/2024 11:30:15 AM	
Result Summary		
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
Water Flow Test	Pass	
Gas Flows Test	Pass	
RF Generator Test	Pass	
Camera Test	Pass	
Optics Test	Skipped	
Advanced Valve System Test	Skipped	
Resolution Test	Skipped	
Sensitivity Test	Skipped	
Precision Test	Skipped	
Subsystem Communications Test	Pass	
Air Flow Test	Pass	
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
15.00	19.00	
Water Flow Test	Pass	
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.30	0.81	20.55

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เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	154.65	2.00	2.00	110.92
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	115.38	18.00	17.97	21.48
RF Generator Test			Pass		
RF Power Supply Test	Passed				
RF Power Supply (V)	128.554				
RF Oscillator Test	Passed				
RF Oscillator Frequency (MHz)	25.834				
Work Coil Current (A)	44.660				
RF Power Supply Current (A)	1.999				
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.228	Passed		
Dark Current Test	6000	1.168	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	change mirror
Test Completed On	11/8/2024 10:35:28 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.79	
As (188.980 nm)	≤ 8.20	5.80	
C (193.027 nm)	≤ 11.50	8.15	
Mo (202.032 nm)	≤ 8.20	5.90	
Cr (206.158 nm)	≤ 13.40	8.85	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	6.61	
Co (228.615 nm)	≤ 17.20	11.79	
Ba (230.424 nm)	≤ 9.40	7.25	
Mn (257.610 nm)	≤ 13.30	9.47	
Mn (260.568 nm)	≤ 20.30	14.50	
Cr (267.716 nm)	≤ 11.00	7.91	
Cu (324.754 nm)	≤ 25.00	18.72	
Cu (327.395 nm)	≤ 14.20	11.09	
Sr (338.071 nm)	≤ 33.50	25.39	
Ba (455.403 nm)	≤ 44.00	33.09	
Sr (460.793 nm)	≤ 36.00	18.54	
Ba (493.408 nm)	≤ 36.00	25.74	
Ba (514.171 nm)	≤ 42.00	25.23	
Ar (675.283 nm)	≤ 74.00	58.92	
K (766.491 nm)	≤ 80.00	63.16	

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เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	110.5	868.9	54.3	
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3	
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9	
Pb (220.353 nm)	≥ 46.0	SRBR	164.5	2492.3	159.8	
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6	
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0	
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903164.1	15166.0	
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3	
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2	
Zn (206.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1	
Zn (213.857 nm)	≥ 1743.0	SRBR	6399.3	157551.5	601.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2	
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.6	
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6	
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5	
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9	
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5	
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.5	60122.8	
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1	

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เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.56	
Se (196.026 nm)	≤ 2.60	1.16	
Zn (213.857 nm)	≤ 1.50	0.50	
Pb (220.353 nm)	≤ 2.60	0.74	
Mn (257.610 nm)	≤ 1.50	0.63	
Al (396.152 nm)	≤ 1.50	0.54	
Ba (493.408 nm)	≤ 1.50	0.78	
K (766.491 nm)	≤ 1.50	0.44	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.82	
Se (196.026 nm)	≤ 1.50	0.82	
Zn (206.200 nm)	≤ 1.50	0.35	
Zn (213.857 nm)	≤ 1.50	0.34	
Cd (214.439 nm)	≤ 1.50	0.44	
Pb (220.353 nm)	≤ 1.50	0.48	
Mn (257.610 nm)	≤ 1.50	0.83	
Cr (267.716 nm)	≤ 1.50	0.53	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.56	
Ba (493.408 nm)	≤ 1.50	1.29	
K (766.491 nm)	≤ 1.50	0.74	

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เอกสารไม่ควบคุม



Certificate of Calibration

AquionRFIC : Anion (ID#1047)

This certificate is to verify that instrument below are calibrated

by Archemica Lab Co.,Ltd.

AquionRFIC	S/N : 220380031
AS-DV	S/N : 220360045

for

United Analyst and Engineering Consultant Co.,Ltd.

บริษัท วิศวกรและที่ปรึกษา จำกัด
ARCHEMICA LAB CO.,LTD

Operator Signature : K. Channarong Date : Apr 23, 2024

(Mr.Channarong Khiao-Un)

Test Engineer

เอกสารไม่ควบคุม

Qualification Report

PM Check list, CM_OQ and PQ

AquionRFIC : Anion (ID#1047)

Aquion : Cation (ID#1048)

For

United Analyst Engineering Consultant Co.,Ltd.
(Validate System 2024)

PM Anion ID#1047

Preventive Maintenance Check List

เอกสารไม่ควบคุม

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Checklist ICS Preventive Maintenance

Dionex Ion Chromatography Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co.,Ltd.	Khun.Suwan Kongthong / Lab
Engineer	Date
Mr.Channarong Khiao-Un	23-24/Apr/2024

Instrument Detail

Instrument Model	Application
AquionRFIC	Anion
Instrument components	Serial Number
AquionRFIC	220380031
AS-DV	220360045

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
AS18	AG18	ADRS-600	-	EGC III KOH
				CR-ATC

Remark: เปลี่ยนไส้กรอง Column, Guard Column และ Suppressor เนื่องจาก peak shift และ tail

Perform By Archemica

K. Channarong
Archemica
23/Apr/2024

Suron
Customer
23/Apr/2024

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Checklist ICS Preventive Maintenance

General ICS Maintenance Checklist

No.	Description	Result			
		Checked	Cleaned	Replaced	N.A.
Power on & Connection					
1	Instrument power on	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
2	Instrument connection	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Injection Valve Rebuild		Checked	Cleaned	Replaced	N.A.
3	Rebuilt injection valve 6 port	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	- Rotor seal	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	- Stator face	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Optional) Auxiliary Valve Rebuild		Checked	Cleaned	Replaced	N.A.
6	Rebuilt auxiliary valve - port	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Check Valve Cartridge		Checked	Cleaned	Replaced	N.A.
9	Inlet check valve assembly	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Outlet check valve assembly	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Verified correct flow orientation	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Pump Piston Rinse Seal, Piston Seal and Piston		Checked	Cleaned	Replaced	N.A.
12	Piston rinse seal in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Piston seal in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Piston in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Piston rinse seal in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Piston seal in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Piston in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste Valve and Priming Valve		Checked	Cleaned	Replaced	N.A.
18	Waste valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Priming valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cell Detector		Checked	Cleaned	Replaced	N.A.
20	Check conductivity cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Check electrochemical cell	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22	- Working electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
23	- Reference electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
24	- Gasket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
25	- Cell body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other		Checked	Cleaned	Replaced	N.A.
26	Sample Loop Size 25 uL	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	End-line filter	<input checked="" type="checkbox"/>	-	<input type="checkbox"/>	<input type="checkbox"/>
28	Leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Lubricate pump mechanic	<input type="checkbox"/>	<input checked="" type="checkbox"/>	-	<input type="checkbox"/>
30	Reconnected liquid lines to the valve	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
31	Reconnected liquid lines to pump heads	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
32	Primed pump	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
33	Checked pump for leaks	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
34	Checked gas for leaks	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>

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AS-DV Autosampler Preventive Maintenance Checklist

Model	Serial number	Firmware Version
<input checked="" type="checkbox"/> AS-DV	220360045	1.6.0

No.	Description	Result			
Power on & Connection		Checked	Cleaned	Replaced	N.A.
1.	AS-DV power on	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
2.	AS-DV connection	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Sampling Tip		Checked	Cleaned	Replaced	N.A.
3.	Sampling needle	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Sampling tubing (Transfer line)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Reconnect sampling needle & tubing	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Other		Checked	Cleaned	Replaced	N.A.
6.	Check carousel movement	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
7.	Check needle movement	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
8.	Lubricate needle drive	<input type="checkbox"/>	<input checked="" type="checkbox"/> Lubricated	-	<input type="checkbox"/>
9.	AS-DV cover	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Optional) High Pressure Valve		Checked	Cleaned	Replaced	N.A.
10.	High pressure valve - Port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
11.	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
12.	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13.	- Reconnected liquid line to the valve	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Others / comments

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Dionex Ion Chromatography
Preventive Maintenance Report

Customer Organization	Name/ Department
United Analyst and Engineering Consultant Co.,Ltd.	Khun.Suwan Kongthong / Lab
Engineer	Date
Mr.Channarong Khiao-Un	23-24/Apr/2024

Instrument Detail

Instrument Model	Application
Aquion	Cation
Instrument components	Serial Number
Aquion	220340349

Consumable Detail

Columns	Guard Columns	Suppressors	Concentrators	Etc.
CS12A	CG12A	CDER-600	-	-
Remark: ระบบไม่มีปัญหาการใช้งาน, System ใช้งานได้ปกติ				

Perform By Archemica

Archemica

Date

23/Apr/2024



Customer

Date

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PM Cation ID#1048

Preventive Maintenance
Check List

General ICS Maintenance Checklist

No.	Description	Result			
Power on & Connection		Checked	Cleaned	Replaced	N.A.
1	Instrument power on	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
2	Instrument connection	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Injection Valve Rebuild		Checked	Cleaned	Replaced	N.A.
3	Rebuilt injection valve - port	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	- Rotor seal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	- Stator face	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(Optional) Auxiliary Valve Rebuild		Checked	Cleaned	Replaced	N.A.
6	Rebuilt auxiliary valve - port	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7	- Rotor seal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	- Stator face	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Check Valve Cartridge		Checked	Cleaned	Replaced	N.A.
9	Inlet check valve assembly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Outlet check valve assembly	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Verified correct flow orientation	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
Pump Piston Rinse Seal, Piston Seal and Piston		Checked	Cleaned	Replaced	N.A.
12	Piston rinse seal in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Piston seal in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Piston in primary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Piston rinse seal in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	Piston seal in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Piston in secondary pump head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Waste Valve and Priming Valve		Checked	Cleaned	Replaced	N.A.
18	Waste valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	Priming valve	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cell Detector		Checked	Cleaned	Replaced	N.A.
20	Check conductivity cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Check electrochemical cell	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
22	- Working electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
23	- Reference electrode	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
24	- Gasket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
25	- Cell body	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other		Checked	Cleaned	Replaced	N.A.
26	Sample Loop Size 25 uL	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	End-line filter	<input type="checkbox"/>	-	<input type="checkbox"/>	<input type="checkbox"/>
28	Leak sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	Lubricate pump mechanic	<input type="checkbox"/>	<input checked="" type="checkbox"/> Lubricated	-	<input type="checkbox"/>
30	Reconnected liquid lines to the valve	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
31	Reconnected liquid lines to pump heads	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
32	Primed pump	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
33	Checked pump for leaks	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>
34	Checked gas for leaks	<input checked="" type="checkbox"/>	-	-	<input type="checkbox"/>

CM OQ

Chromeleon
Operation Qualification

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification

General Information

	Computer Name	Version Number:
Instrument Controller:	DESKTOP-C4FS3L7	7.3.1 Build 6535
Client:	DESKTOP-C4FS3L7	7.3.1.6535
Operator:	Mr.Channarong Khiao-Un	

Overall Test Result: Passed

Comparison Format:

All Parameters:	Significant Digits:	10
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Kaannarong 23/Apr/2024

Reviewer's Signature // Date

Operator's Signature // Date

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เอกสารไม่ควบคุม

ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Detection Algorithm: Cobra
Calibration Type: Lin, With Offset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

Report Variable	Peak Name	Status
Offset (c0)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Slope (c1)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Correlation Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Std. Deviation	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Rel. Std. Dev.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Variance Coeff.	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

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ThermoFisher
SCIENTIFIC
Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Calibration Point X	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Calibration Point Y	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Amount [ng]	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Resolution (EP)	Acetanilide	ok
	Acetophenone	ok
Resolution (USP)	Acetanilide	ok
	Acetophenone	ok
Peak Asymmetry (EP/USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Peak Asymmetry (AIA)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

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Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Report Variable	Peak Name	Status
Theoretical Plates (EP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (USP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok
Theoretical Plates (JP)	Acetanilide	ok
	Acetophenone	ok
	Propiophenone	ok

Test Result: Passed



Chromeleon Operational Qualification, Part 2
Most Frequently Used Parameters: Comparison with Expected Results

Detection Algorithm: Cobra
Calibration Type: Lin, WithOffset
Evaluation Type: Area
Standard Method: External
Calibration Mode: Total

Variable Category	Report Variable	Peak Name	Status
Injection	No.		ok
	Name		ok
	Type		ok
	Position		ok
	Status		ok
	Volume		ok
	Dilution Factor		ok
	Weight		ok
	IntStd		ok
	InstrumentMethod		ok
Chromatogram	ProcessingMethod		ok
	Channel		ok
	No. of Peaks		ok
	Chromatogram Start Time		ok
	Signal Min.		ok
	Signal Max.		ok
	Unit		ok
	Noise		ok
Peak Results	No.	Acetanilide	ok
	No.	Acetophenone	ok
	No.	Propiophenone	ok
	Peak Name	Acetanilide	ok
	Peak Name	Acetophenone	ok
	Peak Name	Propiophenone	ok
	Ret.Time	Acetanilide	ok
	Ret.Time	Acetophenone	ok
	Ret.Time	Propiophenone	ok
	Ret.Time	Propiophenone	ok

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Chromeleon Operational Qualification, Part 2
Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Abs.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(abs)	Acetophenone	ok
	Ret.Dev.(abs)	Propiophenone	ok
	Ret.Ret.Dev.	Acetanilide	ok
	Ret.Dev.(rel)	Acetophenone	ok
	Ret.Dev.(rel)	Propiophenone	ok
	Area	Acetanilide	ok
	Area	Acetophenone	ok
	Area	Propiophenone	ok
	Rel.Area	Acetanilide	ok
	Rel.Area (Total)	Acetophenone	ok
	Rel.Area (Total)	Propiophenone	ok
	Height	Acetanilide	ok
	Height	Acetophenone	ok
	Height	Propiophenone	ok
	Rel.Height (Total)	Acetanilide	ok
	Rel.Height (Total)	Acetophenone	ok
	Rel.Height (Total)	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
	Concentration	Acetanilide	ok
	Concentration	Acetophenone	ok
	Concentration	Propiophenone	ok
	Rel.Amount	Acetanilide	ok
	Rel.Amount	Acetophenone	ok
	Rel.Amount	Propiophenone	ok
	Peak Width (0%)	Acetanilide	ok
	Peak Width (0%)	Acetophenone	ok
	Peak Width (0%)	Propiophenone	ok
	Peak Width (5%)	Acetanilide	ok
	Peak Width (5%)	Acetophenone	ok
	Peak Width (5%)	Propiophenone	ok
	Peak Width (10%)	Acetanilide	ok
	Peak Width (10%)	Acetophenone	ok
	Peak Width (10%)	Propiophenone	ok

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Chromeleon Operational Qualification, Part 2
Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Peak Width (50%)	Acetanilide	ok
	Peak Width (50%)	Acetophenone	ok
	Peak Width (50%)	Propiophenone	ok
	Left Width (0%)	Acetanilide	ok
	Left Width (0%)	Acetophenone	ok
	Left Width (0%)	Propiophenone	ok
	Right Width (0%)	Acetanilide	ok
	Right Width (0%)	Acetophenone	ok
	Right Width (0%)	Propiophenone	ok
	Peak Start	Acetanilide	ok
	Peak Start	Acetophenone	ok
	Peak Start	Propiophenone	ok
	Peak Stop	Acetanilide	ok
	Peak Stop	Acetophenone	ok
	Peak Stop	Propiophenone	ok
	Peak Start Value	Acetanilide	ok
	Peak Start Value	Acetophenone	ok
	Peak Start Value	Propiophenone	ok
	Peak Stop Value	Acetanilide	ok
	Peak Stop Value	Acetophenone	ok
	Peak Stop Value	Propiophenone	ok
	BL-Value Peak Start	Acetanilide	ok
	BL-Value Peak Start	Acetophenone	ok
	BL-Value Peak Start	Propiophenone	ok
	BL-Value Peak Stop	Acetanilide	ok
	BL-Value Peak Stop	Acetophenone	ok
	BL-Value Peak Stop	Propiophenone	ok
	Type	Acetanilide	ok
	Type	Acetophenone	ok
	Type	Propiophenone	ok
	Resolution (EP)	Acetanilide	ok
	Resolution(EP)	Acetophenone	ok
	Resolution(USP)	Acetanilide	ok
	Resolution(USP)	Acetophenone	ok
	Asymmetry(EP)	Acetanilide	ok
	Asymmetry(EP)	Acetophenone	ok
	Asymmetry(EP)	Propiophenone	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Results	Asymmetry(AIA)	Acetanilide	ok
	Asymmetry(AIA)	Acetophenone	ok
	Asymmetry(AIA)	Propiophenone	ok
	Theor. Plates(EP)	Acetanilide	ok
	Theor. Plates(EP)	Acetophenone	ok
	Theor. Plates(EP)	Propiophenone	ok
	Theor. Plates(USP)	Acetanilide	ok
	Theor. Plates(USP)	Acetophenone	ok
	Theor. Plates(USP)	Propiophenone	ok
	Theor. Plates(JP)	Acetanilide	ok
	Theor. Plates(JP)	Acetophenone	ok
	Theor. Plates(JP)	Propiophenone	ok
Peak Calibration	Cal.Mode	Acetanilide	ok
	Cal.Mode	Acetophenone	ok
	Cal.Mode	Propiophenone	ok
	Cal.Type	Acetanilide	ok
	Cal.Type	Acetophenone	ok
	Cal.Type	Propiophenone	ok
	Weights	Acetanilide	ok
	Weights	Acetophenone	ok
	Weights	Propiophenone	ok
	Calibr. Coefficient C0	Acetanilide	ok
	Calibr. Coefficient C0	Acetophenone	ok
	Calibr. Coefficient C0	Propiophenone	ok
	Calibr. Coefficient C1	Acetanilide	ok
	Calibr. Coefficient C1	Acetophenone	ok
	Calibr. Coefficient C1	Propiophenone	ok
	RF-Value	Acetanilide	ok
	RF-Value	Acetophenone	ok
	RF-Value	Propiophenone	ok
	No. of Points	Acetanilide	ok
	No. of Points	Acetophenone	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	Residual for Cal.Point X	Acetanilide	ok
	Residual for Cal.Point X	Acetophenone	ok
	Residual for Cal.Point X	Propiophenone	ok
	Calibration Point Status	Acetanilide	ok
	Calibration Point Status	Acetophenone	ok
	Calibration Point Status	Propiophenone	ok
	Amount	Acetanilide	ok
	Amount	Acetophenone	ok
	Amount	Propiophenone	ok
Component	Cal.Type	Acetanilide	ok
	Peak Type	Acetanilide	ok
	Left Limit	Acetophenone	ok
	Right Limit	Acetanilide	ok
	Group	Acetanilide	ok
	Factor	Acetophenone	ok
	Amount	Acetanilide	ok
	Conc.Unit	Acetophenone	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Calibration	No. of Points	Propiophenone	ok
	No. of Points(disabled)	Acetanilide	ok
	No. of Points(disabled)	Acetophenone	ok
	No. of Points(disabled)	Propiophenone	ok
	Variance	Acetanilide	ok
	Variance	Acetophenone	ok
	Variance	Propiophenone	ok
	Var.Coeff	Acetanilide	ok
	Var.Coeff	Acetophenone	ok
	Var.Coeff	Propiophenone	ok
	Std.Dev.	Acetanilide	ok
	Std.Dev.	Acetophenone	ok
	Std.Dev.	Propiophenone	ok
	Rel.Std.Dev.	Acetanilide	ok
	Rel.Std.Dev.	Acetophenone	ok
	Rel.Std.Dev.	Propiophenone	ok
	Corr.Coeff.	Acetanilide	ok
	Corr.Coeff.	Acetophenone	ok
	Corr.Coeff.	Propiophenone	ok
	R-Square	Acetanilide	ok
	R-Square	Acetophenone	ok
	R-Square	Propiophenone	ok
	Adj. R-Square	Acetanilide	ok
	Adj. R-Square	Acetophenone	ok
	Adj. R-Square	Propiophenone	ok
	X	Acetanilide	ok
	X	Acetophenone	ok
	X	Propiophenone	ok
	Y	Acetanilide	ok
	Y	Acetophenone	ok
	Y	Propiophenone	ok
	W	Acetanilide	ok
	W	Acetophenone	ok
	W	Propiophenone	ok
	F(X)	Acetanilide	ok
	F(X)	Acetophenone	ok
	F(X)	Propiophenone	ok

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Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

Variable Category	Report Variable	Peak Name	Status
Peak Purity	PPI	Acetanilide	ok
	PPI	Acetophenone	ok
	PPI	Propiophenone	ok
	RSD PPI	Acetanilide	ok
	RSD PPI	Acetophenone	ok
	RSD PPI	Propiophenone	ok
	Match	Acetanilide	ok
	Match	Acetophenone	ok
	Match	Propiophenone	ok
	RSD Match	Acetanilide	ok
	RSD Match	Acetophenone	ok
	RSD Match	Propiophenone	ok
	Rel.Max at	Acetanilide	ok
	Rel.Max at	Acetophenone	ok
	Rel.Max at	Propiophenone	ok

Test Result: Passed

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Chromeleon Operational Qualification, Part 3
System Suitability Test: Comparison with Expected Results

Variable Category	Report Variable	Status
System Suitability	Number	ok
	Name	ok
Test Case	Inj.Condition	ok
	Eval. Formula	ok
	Operator	ok
	Statistics	ok
	Rounding	ok
	MinimumNumberOfInjections	ok
	MaximumNumberOfInjections	ok
	Channel	ok
	Peak	ok
	Ref. Value Formula 1	ok
	Ref. Value Formula 2	ok
	N.A.	ok
System Suitability	Inj. Eval. Result	ok
	Eval. Result	ok
	Peak Result	ok
	Injection Condition Result	ok
	Ref. Value 1	ok
	Ref. Value 2	ok
	Result	ok
	Message	ok
	Average	ok
	Count	ok
	Maximum	ok
	Minimum	ok
	Range	ok
	Rel. Range	ok
	Rel. Std. Dev.	ok
	Std. Dev.	ok
	Sum	ok
Test Case Result		

Test Result: Passed

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SOFTWARE OQ



Chromeleon

Part 1 - Verification of Selected Results	PASS
Part 2 - Most Frequently Used Parameters: Comparison with Expected Results	PASS
Part 3 - System Suitability Test: comparison with Expected Results	PASS



OVERALL TEST RESULT: PASS

Field Service Representative Signature:	Customer Signature:
<i>[Signature]</i>	<i>[Signature]</i>
Date: 27/Apr/2024	Date: 22/Apr/2024

เอกสารไม่ควบคุม

PQ Anion ID#1047

Performance Qualification

TEST EQUIPMENT AND STANDARDS



Test Equipment

Equipment	Manufacturer	Model	Serial Number	Cal/Ver Date	Good Until
Multimeter	Fluke	289	27970244	N/A	N/A
Thermocouple	Fluke	K-Type	27970244	N/A	N/A
Balance	Mettler Toledo	AB204-S	1129361010	N/A	N/A
IC Qualification	Thermo Scientific	Test Box	21379153	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

Standards/Chemicals

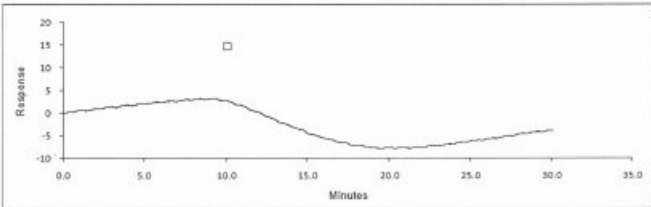
Description	Manufacturer	Concentration	Part Number	Lot Number	Expiration Date
Nitrate	Thermo Scientific	5 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	10 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	25 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	50 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	100 ppm	060254	231226	Dec-2024
Nitrate	Thermo Scientific	1000 ppm	060254	231226	Dec-2024
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A



Field Service Representative Signature:	Customer Signature:
<i>[Signature]</i>	<i>[Signature]</i>
Date: 27/Apr/2024	Date: 22/Apr/2024

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	chrom://desktop-c4fs3i7/ChromeleonLocal/Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC_OQ_seq/278.smp/EC.D_1.channel

Noise and Drift

Test	Measured (nS)	OQ Limit (nS)	Result	Conversion Factor
Noise	1.1 nS	≤ 2.0 nS	PASS	1000
Drift	16.1 nS/hr	≤ 20.0 nS/hr	PASS	1000

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>K. Bannachorn</i>	<i>Sunon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal://Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC_OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Repeatability 01	25	0.265	2.825
Repeatability 02	25	0.265	2.822
Repeatability 03	25	0.265	2.831
Repeatability 04	25	0.265	2.835
Repeatability 05	25	0.265	2.834
Repeatability 06	25	0.265	2.836

Repeatability

Test	Measured (% RSD)	OQ Limit (% RSD)	Result
Retention Time	0.0	≤ 5.0	PASS
Area	0.2	≤ 1.0	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>K. Bannachorn</i>	<i>Sunon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal://Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC_OQ

Peak Results

Sample Name	Injection Volume (µL)	Retention Time (min)	Area
Reference Blank	25	0.265	0.053
High Standard	25	0.265	49.734
Carryover	25	0.265	0.051

Results

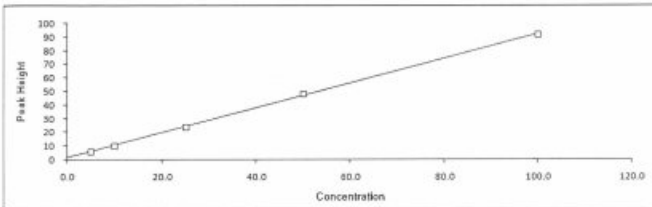
Test	Observed (%)	OQ Limit (%)	Result
AREA	0.00	≤ 0.10	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>K. Bannachorn</i>	<i>Sunon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม



Information

System Name	Aquion RFIC
Detector SN	220360045
Data Path	ChromeleonLocal://Archemica/Service Contract/Validate 2024/1PM1PQ 23-04-24/Anion/IC_OQ

Peak Results

Sample Name	Concentration	Peak Height	Calculated
Detector Linearity 01	5	5.872	4.82
Detector Linearity 02	10	10.299	9.68
Detector Linearity 03	25	23.794	24.52
Detector Linearity 04	50	48.473	51.65
Detector Linearity 05	100	91.855	99.34

Linearity

Test	Observed	OQ Limit	Result
r ²	0.999	≥ 0.999	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>K. Bannachorn</i>	<i>Sunon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

EG Current Test

Set Point (mM)	Expected (mA)	Reading (mA)	Deviation (mA)	OQ Limit (mA)	Result
1.00	1.6082	1.604	0.00	± 0.01	PASS
5.00	8.041	8.019	0.02	± 0.05	PASS
10.00	16.082	16.037	0.05	± 0.10	PASS
50.00	80.41	80.17	0.24	± 0.50	PASS
100.00	160.82	160.32	0.50	± 1.00	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>K. Pannarong</i>	<i>Simon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

IC Pump Flow Rate

Set Point (mL) (mL/min)	Reading (mL/min)	Deviation (%)	OQ Limit (%)	Result
0.5	0.4995	0.100	± 2.0	PASS
1.0	0.999	0.10	± 2.0	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>K. Pannarong</i>	<i>Simon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

Column Compartment

Set Point (°C)	Reading (°C)	Deviation (°C)	OQ Limit (°C)	Result
30.0	30.5	0.5	± 2.0	PASS

OVERALL TEST RESULT: PASS



Field Service Representative Signature:	Customer Signature:
<i>K. Pannarong</i>	<i>Simon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

N/A

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Field Service Representative Signature:	Customer Signature:
<i>K. Pannarong</i>	<i>Simon</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

These Operational Qualification Results should be reviewed by the Customer. If the qualification is accepted, both the Customer and the Service Representative should sign the Operational Qualification Results, below.

OPERATIONAL QUALIFICATION RESULTS

Based upon the actual results obtained, this Operational Qualification **PASSED** the acceptance criteria described in the Operational Qualification in the Installation Checklist procedure.

Service Representative

A Field Service Representative signature below confirms the completion of all aspects of the Operational Qualification and have concluded that the system has been successfully verified to be operating as required.

Customer

A Customer signature below confirms the completion of all aspects of the Operational Qualification have been completed and that the system has been successfully verified to be operating as required.



Field Service Representative Signature:	Customer Signature:
<i>K. Khamwong</i>	<i>Mr. Pheraphat Tuanjit</i>
Date: 23/Apr/2024	Date: 23/Apr/2024

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2502228-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XP6
Serial No.: B322373893
Capacity: 6.1 g
Date of Calibration: 20 March 2025
Environment Condition: Ambient Temperature: 22.8 ± 0.4 °C Relative Humidity: 48 ± 0.35 %
Place of Calibration: 206 Balance Room 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Condition of Equipment: Good Condition
Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019
2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8905567572	TCS	M34041005	19 April 2025
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFLBTH 017/23	Quality Reborn	QR25-0542	10 February 2025

3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

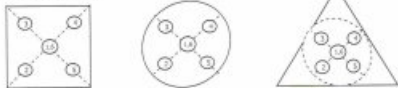
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
3	0.00000079
6	0.00000067

2. Off-Center Error:

A mass of 2 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
2.000018	2.000017	2.000014	2.000014	2.000024	2.000019	0.000005

Calibration Certificate

Certificate No.: 2502228-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XP6
Serial No.: B322373893
ID No.: UAE.AIR.019/2556
Order No.: 2502228
Operation No.: 2502228-002
Date of Receipt: 19 March 2025
Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk
Scientist
Approved by Mr.Pheraphat Tuanjit
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%
This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2502228-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XP6
Serial No.: B322373893
Capacity: 6.1 g
Date of Calibration: 20 March 2025
Calibration Results: (Continued)
Calibration Range: 0-6 g
Calibration Adjustment: Internal Calibration
3. Departure from Nominal Value:

Page 3 of 3

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (g)	Coverage Factor K
Unloaded	0.0000000	0.0000000	0.0000000	0.0000032	2.00
0.001	0.0010030	0.0010032	0.0000001	0.0000032	2.00
0.01	0.0100030	0.0100032	0.0000001	0.0000032	2.00
0.05	0.0499960	0.0500001	-0.0000005	0.0000044	2.00
0.10	0.1000110	0.1000111	0.0000001	0.0000057	2.00
0.15	0.1500070	0.150010	-0.000003	0.0000071	2.00
0.17	0.1700130	0.170012	0.000001	0.0000077	2.00
0.20	0.2000110	0.200015	-0.000004	0.0000065	2.00
1.50	1.5000190	1.500017	0.000002	0.000017	2.00
3.00	3.0000260	3.000017	0.000009	0.000019	2.00
4.50	4.5000610	4.500023	0.000038	0.000023	2.00
6.00	6.0000180	6.000014	0.000004	0.000023	2.00

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

Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

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>

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.
- 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.

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Important Customer Web Links

- For more information about Agilent Technologies services, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- 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.
- A useful Agilent Resource Center web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>
- Need technical support, FAQs, supplies? – visit our Support Home page at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections. Join the Agilent Community at <https://community.agilent.com/welcome>

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.

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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	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 8432 A	M1 13160001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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- ☐ 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 issues with the customer before starting.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. **NA**
- ☒ 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.

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Preventive Maintenance Procedures

FLAME SYSTEM section

☐ 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
 - ☐ ABA

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.

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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.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars.
- ☒ 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 and connections
- ☒ 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.

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FURNACE SYSTEM section

☒ 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.

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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

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 locks 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.

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.

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- ☐ 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 G8410-90050.

Sample preparation system (SPS 3) accessory

☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 @ Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate 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.

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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.

Revision: 10.00, Issued: November 2021

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Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive 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 %	49.7
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.559%
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.27
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 (327.4 nm)		
Precision %RSD	≤ 4.0%	—
Abs value	≥ 0.10	—
MSR%	≥ 70 %	—

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AA consumable and parts list table

Part Description	Part Number	Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution – Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*	Common
Kit, Mk 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hivac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica – round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica – rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	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.

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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 Completion

Service request number 6007549143 Date service completed 30 Jan 2025
 Agilent signature Kanyakorn S. Customer signature David Y.
 Total number of pages in this document 13



Frequency:

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

Power Supply:

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.12	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.04	5.50	Passed
310.00 V Rail	270.00	330.00	341.00	Passed

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SVD Results Report



Report ID: 2 Diagnostic Start Time: 1/30/2025 9:13:26 AM Diagnostic End Time: 1/30/2025 9:47:25 AM
 Customer: UAE Service Engineer: Kanyakorn S.
 Address: Soi Udomsuk 41, Sukhumvit Rd. Contact Details: 02637636381
 Bangkok

Instrument Configuration

Configuration:
 Serial Number: MY13100001 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:

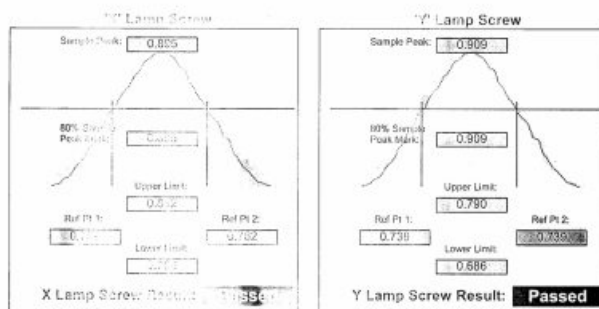
Instrument Run Hours: 69918.180 D2 Run Hours: 53396.500
 Zero Wavelength Offset: 30.133 D2 Serial Number: not set 1
 Mono Correction: 0.770 D2 Install Date: 1/1/1970
 Flame Hours: 32411.834 D2 Original Intensity: 1.000
 D2 Last Intensity: 475.000

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Optics

Beam Balance:

Lamp Type: Copper
 Lamp Socket Used: 3
 Peak Selected: 324.80
 Lamp Alignment: **Performed**



Grating Scan

	Lower Limit (nm)	Measured (nm)	Upper Limit (nm)	Result:
Zero Order	-8.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	648.90	649.50	649.97	Passed

เอกสารไม่ควบคุม

Wavelength Repeatable Error:

Lamp Used: Copper
Peak Used(nm): 324.759
Connected to Socket: 3

Lamp Current(mA): 4
Slit Width(nm): 0.2
Slit Height: Normal

Lamp Alignment:

Lower Limit(nm): 324.773 324.888 Upper Limit(nm)

(Typical from Zero Error) (Typical from end)

Sample 1: 324.823 Sample 2: 324.823
Sample 3: 324.873 Sample 4: 324.823
Sample 5: 324.823 Sample 6: 324.819
Sample 7: 324.819 Sample 8: 324.819
Sample 9: 324.823 Sample 10: 324.819

Mean: 324.823 Standard Deviation: 0.003

Result:

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Auto Lamp Recognition:

Lamp 1: Unpopulated Lamp/Not Connected Lamp 5: Not Supported
Lamp 2: 87 - Silver Cadmium Lamp/Dec(UltraV) (Ag/C Lamp) Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu) Lamp 7: Not Supported
Lamp 4: Unpopulated Lamp/Not Connected Lamp 8: Not Supported

Result:

GTA Temperature Monitoring:

Notes:

Signatures:

Date

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Method:

Wavelength Drive:

Slit Drive:

Turret Drive:

Auto Burner Adjuster:

Method:

Signal Processing Linearity:

On-Scale - Scale: New Date Mode

	Lower Limit	Actual	Upper Limit	Result:
S2	114	3	297	
S3	118	14	191	
S4	271	1.2	332	
S5	474	7	579	
S6	935	1	1008	
S7	1435	9	1754	
S8	2438	1.29	3053	
S9	4747	1.1	5313	

Interlocks:

Burner Flame:

NO Burner Flame:

Flame Off:

Gas Control Flame:

Pressure Release Gas Flame:

Liquid Trap Flame:

Flame Detect:

SCU Active:

Oxidant Pressure:

Oxidant Changeover:

Ignition:

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Sequential by time report 1/30/2025 10:53 AM SpectraAA

Page 1 of 1

Analyst: 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM

Date Started: Sensitivity Test 01

Worksheet: Comment

Methods: Cu

Computer name: DESKTOP-RSUIFRS

Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc mg/L	%RSD	Mean Abs		
CAL Z1113	0.000	38.8	0.0002		
	Readings				
	0.0002	0.0003	0.0001	1/30/2025	10:51:48 AM
STANDARD 1	5.000	0.1	0.5571		
	Readings				
	0.5571	0.5563	0.5575	1/30/2025	10:52:22 AM

Abs **Linear Origin - Cal Set 1**

Curve Fit: = Linear Origin

Characteristic Conc: = 0.038 mg/L

r: = 1.0000

Calculated Conc: = 0.000 5.000

Residuals: = -0.007 0.000

Abs = 0.11141 x C

5 ppm Cu					
	5.000	0.3	0.5598		
	Readings				
	0.5592	0.5596	0.5615	1/30/2025	10:52:54 AM

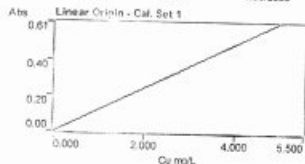
เอกสารไม่ควบคุม

Analyst
Date Started 1/30/2025 10:33 AM GMT: 1/30/2025 3:33 AM
Worksheet Precision Test
Comment
Methods Cu
Computer name DESKTOP-BSUFRS
Serial Number MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZIRCO	0.000	64.1	-0.0002
Readings			
	-0.0003	-0.0003	-0.0001
1/30/2025	10:46:52 AM		

STANDARD 1	Conc. mg/L	%RSD	Mean Abs
	5.000	0.3	0.6052
Readings			
	0.5035	0.6073	0.6047
1/30/2025	10:47:24 AM		



Curve Fit = Linear Origin
Characteristic Conc = 0.039 mg/L
r = 1.0000
Calculated Conc = -0.002 5.000
Residuals = 0.002 0.000

Abs = 0.12105 x C

5 ppm Cu	Conc. mg/L	%RSD	Mean Abs
	5.007	0.2	0.6051
Readings			
	0.6065	0.6052	0.6047
	0.6055	0.6076	0.6064
1/30/2025	10:48:32 AM		

SPS 4

Down height 0.53 (mm)

Pump speed Medium

Key to tube colors
● Sample
● Calibration
● Calibration/QC
● Sample/QC
● Not Assigned

Sensitivity Check 1.5 mg/L gives about 0.2 Abs at 324.8 nm, A/A burner

Optimization: Lamp
HC Lamp 1.30
1.00
0.50
0.00

0.917

Optimize Lamp
Optimize Sign

Rescale
Inst Zero

Gain 49 %

Ok

Sampler Offline

Gold Tube

Back 1 1

Type 1 1

Gold Tube

Align Probe

Rinse

Stop Rinse

Park

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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.: 24MM292
Page.: 1 of 3

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : AB204-S/FACT

Serial No. : 1129361010

ID No. : UAE.WAS.002/2552

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

Location : Balance Room (108)

Received order : 11 May 2024
Calibration Date : 11 May 2024
Ambient Temperature : 15 °C to 40 °C
Relative Humidity : 30 % to 90 %

Calibrated by : Khit Ruttanaprapachai

Approved by : Kunchit
Approved Signatory

() Ponpan Palpim
() Suwit Imjai
(✓) Kunchit Promprat

Issue Date : 15 May 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-1

Cert.No.: 24MM292
Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 based on UKAS LAB 14 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15864	24053	70RC007	MM-0013-24	25 Jan 2026

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certificate is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity : 0 g to 220 g Resolution 0.0001 g

Before Adjustment :

Applied Weight	Balance Reading	Correction	Measurement Uncertainty	Coverage Factor
(g)	(g)	(g)	(± mg)	(k)
100	100.0000	0.0000	0.19	2.03
200	200.0006	-0.0006	0.30	2

After Adjustment :

1. Determination of the standard deviation of weighing machine (n = 10)

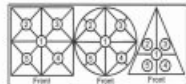
Applied Weight	Standard Deviation of Reading (g)
(g)	
100	0.00007
200	0.00005

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2405-0166OC-1

Cert.No.: 24MM292
Page: 3 of 3



Maximum difference between off-center and central loading

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	(g)
-0.0004	-0.0004	-0.0003	-0.0003	-0.0004	0.0001

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.0000	0.0000	0.15	2.13
0.01	0.0100	0.0000	0.15	2.13
0.05	0.0500	0.0000	0.15	2.13
0.1	0.1000	0.0000	0.15	2.13
0.5	0.5000	0.0000	0.15	2.13
1	1.0000	0.0000	0.15	2.13
10	10.0000	0.0000	0.15	2.11
50	49.9999	+0.0001	0.17	2.06
100	99.9999	+0.0001	0.19	2.03
150	149.9998	+0.0002	0.29	2
200	199.9990	+0.0010	0.30	2

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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เอกสารไม่ควบคุม



United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Tel: 0 2763 2828 Fax: 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com



Certificate of Calibration

Certificate No.: 250422-1-BL002-25
Code No.: BL002-25
Page: 1 of 3

Customer Name: United Analyst and Engineering Consultant Co., Ltd.
Address: 3 Soi Udomsuk 41, Sukhumvit Rd., Bang Chak, Phrakhanong, Bangkok 10260

Equipment: Electronic Balance
Manufacturer: Mettler Toledo
Model: AB204-S/FACT
Serial No.: 1129361010
Asset No.: UAE.WAS.002/2552
Building: N/A Floor: 1 Room: 107

Received Date: April 22, 2025

Date of Calibration: April 23, 2025

Calibration Conditions: Temperature 22.8 °C to 23.4 °C
Humidity 54.8 % to 68.9 %
Pressure 756.6 mmHg to 758.2 mmHg

Calibrated by: Sakkarin Srirahang

Approved by: Surwit Chotnok

Signature:

Issued Date: April 25, 2025

Note : 1) The Uncertainties are for a confidence probability of approximately 95%

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

3) This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the United Analyst and Engineering Consultant Co., Ltd. (UAE)

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United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Tel: 0 2763 2828 Fax: 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com



Certificate No.: 250422-1-BL002-25
Code No.: BL002-25
Page: 2 of 3

Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: 1129361010
Max. Capacity: 220 g
Calibration Date: April 23, 2025
Condition As-Received: In Condition

Manufacturer: Mettler Toledo
Readability: 0.0001 g
ID No.: UAE.WAS.002/2552

Condition of Equipment:

2. Reference Standards:

1. Calibration Method: This instrument was calibrated by method UAE-CP-CAL-006 In-House Method based on UKAS Lab 14 : 2022

Reference Standard:	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Standard Weight Class E2 (ICML)	1 mg to 1 kg	8749109122	AWARC	25-009359	Mettler-Toledo	21-Jan-27
Standard Weight Class F1 (ICML)	1 mg to 200 g	11119512	AWARC	24-013840	Mettler-Toledo	04-Feb-26
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Traceability	Due Date
Thermo-Hygro-Baro Meter	MHB-3825D	AK.66457	SUCCESS	SG-H-00997/67	Success Gateway	21-Nov-25
Thermo-Hygro-Baro Meter	MHB-3825D	AK.66457	TPA	25PT95	TPA	25-Feb-26

3. This certification is traceable to SI Unit

4. This certification was certified only for the instrument we calibrated

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

6. Through the reference standard laboratory of AMARC 25-009359 Calibration 0132

Calibration Result:

1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
200*	0.000045

2. Eccentric or off-center loading

A mass of 100 g was placed and moved to various position on pan
The Balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	Maximum Difference (g)
100.0000	99.9996	99.9997	100.0003	100.0005	0.0005

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United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Tel: 0 2763 2828 Fax: 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com



Certificate No.: 250422-1-BL002-25
Code No.: BL002-25
Page: 3 of 3

Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: 1129361010
Max. Capacity: 220 g
Calibration Date: April 23, 2025

Manufacturer: Mettler Toledo
Readability: 0.0001 g
ID No.: UAE.WAS.002/2552

Calibration Result: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Error of indication from nominal or conventional mass value:

Nominal Value (g)	Reference Value (g)	Indication (g)	Correction (g)	Uncertainty (± mg)	Coverage Factor k
Unload	0.0000000	0.0000	0.0000	0.10	2.05
0.01	0.0100025	0.0099	0.0001	0.10	2.05
0.05	0.0500056	0.0500	0.0000	0.10	2.05
0.1	0.1000012	0.0999	0.0001	0.10	2.05
0.5	0.5000133	0.5000	0.0000	0.10	2.05
1	1.0000105	1.0000	0.0000	0.10	2.05
10	10.000010	10.0000	0.0000	0.11	2.04
40	40.000076	40.0000	0.0000	0.14	2.00
50	50.000056	50.0000	0.0001	0.13	2.00
80	80.000107	80.0000	0.0001	0.18	2.00
100	100.000109	99.9999	0.0002	0.17	2.00
120	120.000015	119.9999	0.0003	0.21	2.00
150	150.000165	149.9998	0.0003	0.24	2.00
160	160.000175	159.9997	0.0005	0.26	2.00
200	200.000129	199.9998	0.0004	0.30	2.00

4. Effect of Tare test:

Tare Load (g)	Test Load (g)	Indication (g)	Correction (g)
100	20.000041	19.9999	0.0001
	40.000076	39.9998	0.0002
	60.000066	59.9997	0.0003
	80.000107	79.9999	0.0002
	100.000168	100.0004	-0.0003

Remark:

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

เอกสารไม่ควบคุม

-o-o-End-o-o-

Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
Bangchack, Prakhong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
ID No.: UAE.WAO.010/2565

Order No.: 2402283
Operation No.: 2402283-002
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong **Approved by** 
Scientist (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full, except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Page 2 of 4

Date of Calibration: 2 April 2024
Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %

Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	890567572	TCS	MC3040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Reborn	QR24-0343	9 February 2025

3. This certificate is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

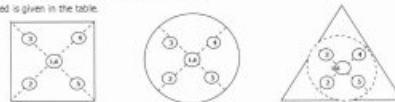
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000042
80	0.000052
160	0.000048
200	0.000048

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1 (g)	2 (g)	3 (g)	4 (g)	5 (g)	6 (g)	(Maximum Difference) (g)
100.0000	100.0001	99.9999	99.9999	100.0001	100.0000	0.0001

F-CS-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 2 April 2024

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.001003	0.00101	-0.00001	0.0000089	2.00
0.005	0.005003	0.005020	0.000000	0.0000092	2.00
0.01	0.010003	0.010030	0.000000	0.0000089	2.00
0.05	0.049996	0.050000	0.000000	0.0000096	2.00
0.1	0.100011	0.100000	0.000001	0.000011	2.00
0.5	0.500016	0.50001	0.000001	0.000014	2.00
1	1.000003	1.00002	-0.00002	0.000016	2.00
2	2.000023	2.00001	0.000001	0.000017	2.00
5	5.000017	5.00002	0.000000	0.000020	2.00
10	10.000009	10.00000	0.000001	0.000026	2.00
20	20.000031	20.00000	0.000000	0.000037	2.00
30	30.000040	30.00001	0.000003	0.000050	2.00
50	50.000028	50.00002	0.000001	0.000068	2.00
80	80.000068	80.00002	0.000005	0.00011	2.00

F-CS-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.0001	0.00000	0.00015	2.00
100	100.00006	100.0001	0.00000	0.00015	2.00
110	110.00007	110.0001	0.00000	0.00016	2.00
120	120.00009	120.0000	0.00001	0.00017	2.00
130	130.00010	130.0000	0.00001	0.00019	2.00
140	140.00014	140.0000	0.00001	0.00020	2.00
150	150.00009	150.0001	0.00000	0.00020	2.00
160	160.00010	160.0001	0.00000	0.00022	2.00
170	170.00012	170.0001	0.00000	0.00023	2.00
200	200.00016	200.0002	0.00000	0.00028	2.00

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

F-CS-012 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: 2502226-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
ID No.: UAE.WAO.010/2565
Order No.: 2502226
Operation No.: 2502226-002
Date of Receipt: 19 March 2025
Date of Calibration: 20 March 2025

Calibrated by Mr.Yothin Charoensuk **Approved by** *for N. Nigrobat*
Scientist (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 25 March 2025

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-012 Revision: 01 Date: 20-04-65

2008 เอกสารไม่ควบคุม 35 มูลนิธิสถาบันอาหาร กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์
2008 Soi 35, Asoi Asoi Road, Bang Yai Khon Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8645 nfi.com

Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
Capacity: 82 g / 220 g
Resolution: 0.0001 g / 0.001 g
ID No.: UAE.WAO.010/2565

Page 2 of 4

Date of Calibration: 20 March 2025
Environment Condition: Ambient Temperature: 21.2 ± 0.6 °C Relative Humidity: 48 ± 3.5 %
Place of Calibration: 208 Balance Room, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Condition of Equipment: Good Condition
Condition of This Results of Calibration:
1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019
2. Reference Standards:
Reference Standard **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**
Standard Weight Class E2 1mg to 200g 8505567572 TCS M04041005 19 April 2025
Instrument **Model** **Serial No.** **Calibrated By** **Certificate No.** **Due Date**
Thermo-Hygro Meter 608-H1 NFI.BTH 017/23 Quality Reborn Q025-0542 10 February 2026
3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

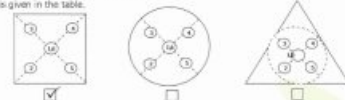
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.0000042
80	0.0000042
100	0.000000
200	0.000000

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0001	100.0001	100.0001	100.0001	100.0001	100.0001	0.0000

F-CS-012 Revision: 01 Date: 20-04-65

2008 เอกสารไม่ควบคุม 35 มูลนิธิสถาบันอาหาร กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์
2008 Soi 35, Asoi Asoi Road, Bang Yai Khon Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8645 nfi.com

Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
Capacity: 82 g / 220 g
Resolution: 0.0001 g / 0.001 g
ID No.: UAE.WAO.010/2565

Date of Calibration: 20 March 2025 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0-80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 82 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unloaded	0.000000	0.00000	0.00000	0.0000007	2.00
0.001	0.001003	0.00100	0.00000	0.0000090	2.00
0.005	0.005002	0.00501	-0.00001	0.0000092	2.00
0.01	0.010003	0.01002	-0.00002	0.0000089	2.00
0.05	0.049996	0.05001	-0.00001	0.0000096	2.00
0.1	0.100011	0.10002	-0.00001	0.000011	2.00
0.5	0.500016	0.50004	-0.00002	0.000014	2.00
1	1.000003	1.00005	-0.00005	0.000016	2.00
2	2.000023	2.00006	-0.00004	0.000017	2.00
5	5.000015	5.00006	-0.00005	0.000020	2.00
10	10.000009	10.00005	-0.00004	0.000026	2.00
20	20.000030	20.00007	-0.00004	0.000037	2.00
30	30.000039	30.00009	-0.00005	0.000050	2.00
50	50.000028	50.00008	-0.00005	0.000068	2.00
80	80.000067	80.00013	-0.00006	0.00011	2.00

Calibration Report

Certificate No.: 2502226-002-01
Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C210685394
Capacity: 82 g / 220 g
Resolution: 0.0001 g / 0.001 g
ID No.: UAE.WAO.010/2565

Page 4 of 4

Date of Calibration: 20 March 2025
Calibration Results: (Continued)
Calibration Range: >80-200 g
Calibration Adjustment: Internal Calibration
3. Departure from Nominal Value: (Range: >80 - 200 g ; Resolution: 0.0001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.00010	90.00002	-0.00008	0.00015	2.00
100	100.00006	100.00001	-0.00005	0.00016	2.00
110	110.00007	110.00002	-0.00005	0.00017	2.00
120	120.00009	120.00002	-0.00007	0.00018	2.00
130	130.00010	130.00002	-0.00008	0.00019	2.00
140	140.00013	140.00002	-0.00011	0.00019	2.00
150	150.00009	150.00002	-0.00007	0.00021	2.00
160	160.00010	160.00002	-0.00008	0.00022	2.00
170	170.00012	170.00002	-0.00010	0.00023	2.00
200	200.00013	200.00002	-0.00011	0.00028	2.00

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

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65

2008 เอกสารไม่ควบคุม 35 มูลนิธิสถาบันอาหาร กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์
2008 Soi 35, Asoi Asoi Road, Bang Yai Khon Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8645 nfi.com

F-CS-012 Revision: 01 Date: 20-04-65

2008 เอกสารไม่ควบคุม 35 มูลนิธิสถาบันอาหาร กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์
2008 Soi 35, Asoi Asoi Road, Bang Yai Khon Subdistrict, Bang Phai District, Bangkok 10710, Thailand
Tel: +66(0) 2422 8668 Fax: +66(0) 2422 8645 nfi.com

Calibration Certificate

Certificate No.: 2402283-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR205DU
Serial No.: C009071872
ID No.: UAE.WAO.012/2563
Order No.: 2402283
Operation No.: 2402283-001
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist
Approved by (Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 9 April 2024

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Page 2 of 4

Date of Calibration: 2 April 2024
Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 2.5 %
Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Condition of Equipment: Good Condition
Condition of This Results of Calibration:
1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019
2. Reference Standards:
Reference Standard Model Serial No. Calibrated By Certificate No. Due Date
Standard Weight Class E2 1mg to 200g 8005567572 TCS H23040535 8 April 2024
Instrument Model Serial No. Calibrated By Certificate No. Due Date
Thermo-Hygro Meter 608-H1 NFI.BTH 016/23 Quality Reborn QR24-0343 9 February 2025
3. This certification is traceable to SI UNIT
4. This certificate was certified only for the instrument we calibrated.
5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

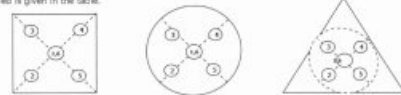
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
40	0.000052
80	0.000063
100	0.000048
200	0.000053

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0001	100.0002	99.9999	100.0001	100.0001	0.0003

F-CS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (+g)	Coverage Factor
Unloaded	0.000000	0.000000	0.000000	0.0000268	2.00
0.001	0.001003	0.001011	-0.000011	0.00002691	2.00
0.005	0.005003	0.004999	0.000004	0.00002694	2.00
0.01	0.010003	0.010000	0.000003	0.00002691	2.00
0.05	0.049996	0.050000	0.000004	0.00002698	2.00
0.1	0.100011	0.100000	0.000011	0.000027	2.00
0.5	0.500016	0.500001	0.000015	0.00002814	2.00
1	1.000003	1.000002	-0.000002	0.00002816	2.00
2	2.000023	2.000001	0.000022	0.00002817	2.00
5	5.000017	5.000002	0.000015	0.00002820	2.00
10	10.000009	10.000000	0.000009	0.00002826	2.00
20	20.000031	20.000002	0.000029	0.00002837	2.00
30	30.000040	30.000003	0.000037	0.00002852	2.00
50	50.000028	50.000004	-0.000024	0.00002868	2.00
80	80.000068	80.000005	-0.000063	0.00002911	2.00

F-CS-012 Revision: 01 Date: 20-04-65

Calibration Report

Certificate No.: 2402283-001-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C009071872
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.012/2563

Date of Calibration: 2 April 2024 Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (+g)	Coverage Factor
90	90.000010	90.000000	0.000010	0.00002815	2.00
100	100.000006	100.000000	0.000006	0.00002815	2.00
110	110.000007	110.000001	0.000006	0.00002817	2.00
120	120.000009	120.000000	0.000009	0.00002818	2.00
130	130.000010	130.000000	0.000010	0.00002819	2.00
140	140.000014	140.000000	0.000014	0.00002820	2.00
150	150.000009	150.000001	0.000008	0.00002820	2.00
160	160.000010	160.000001	0.000009	0.00002822	2.00
170	170.000012	170.000001	0.000011	0.00002823	2.00
200	200.000016	200.000000	0.000016	0.00002828	2.00

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

F-CS-012 Revision: 01 Date: 20-04-65



Certificate of Calibration

Cert. No.: 24TM1113
Page : 1 of 3

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UC4-1320
Serial No. : -
ID No. : UAE.WAO.002/2550
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 July 2024
Calibration Date : 11 July 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama
Approved by :
() Ponpan Palpim
(✓) Suwit Imjai
() Kunchit Promprat
Issue Date : 14 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2407-0243QC-1
Procedure Used :-

Cert. No.: 24TM1113
Page : 2 of 3

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024

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

3. This certification is traceable to the International System of Unit.

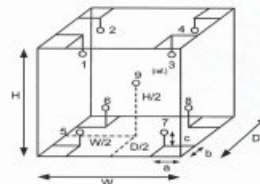
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	32
REL.Humid. (%)	78	85
AC Supply (Volt)	233	234



Probe Installation Details :

a =	10	cm
b =	10	cm
c =	10	cm

Dimension of Chamber :

D =	0.62	m
W =	1.2	m
H =	1.2	m
Capacity =	0.89	m ³

Position :	Ref. Std. ID No.:
1	19-16RTD-01
2	19-16RTD-02
3	19-16RTD-03
4	19-16RTD-04
5	19-16RTD-05
6	19-16RTD-06
7	21-16RTD-07
8	19-16RTD-08
9 (ref.)	19-16RTD-09

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2407-0243QC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 24TM1113
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	19.8	0.55	0.66	1.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.210	20.331	20.162	19.645	20.287	20.070	19.838	19.781	19.954	0.79

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

-000-

เอกสารไม่ควบคุม



Certificate of Calibration

Cert. No.: 24TM1114
Page : 1 of 3

Equipment : BOD Incubator
Manufacturer : ARCO
Model : UC4-1320
Serial No. : -
ID No. : UAE.WAO.018/2559
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 11 July 2024
Calibration Date : 11 July 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Tawatchai Pama
Approved by :
() Ponpan Palpim
(✓) Suwit Imjai
() Kunchit Promprat
Issue Date : 14 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2407-0243OC-2

Cert. No.: 24TM1114
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49023932	23LM122	TPA	26 Jul 2024

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

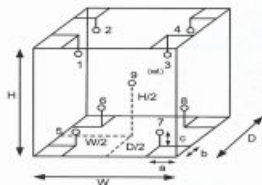
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	29
REL.Humid. (%)	78	72
AC Supply (Volt)	233	234

Position :	Ref. Std. ID No.:
1	20-16RTD-10
2	20-16RTD-02
3	20-16RTD-03
4	23-16RTD-04
5	22-16RTD-05
6	20-16RTD-06
7	20-16RTD-07
8	22-16RTD-08
9 (ref.)	22-16RTD-09



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2407-0243OC-2

Cert. No.: 24TM1114
Page : 3 of 3

Result of Calibration :-

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	19.9	0.29	0.81	1.2	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	20.361	19.640	20.312	20.079	19.908	19.672	19.955	19.818	19.758	0.48

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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เอกสารไม่ควบคุม

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. 0-2713-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM587
Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : ARCO

Model : UR-1320

Serial No. : -

ID No. : UAE.WAO.018/2551

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

Location : Lab Floor 2

Received Order : 01 April 2024

Calibration Date : 01 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by :

() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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A 0065063



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-1

Cert. No.: 24TM587
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

3. This certification is traceable to the International System of Unit.

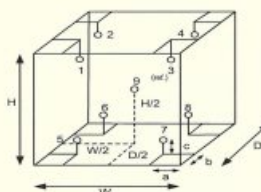
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	48	49
AC Supply (Volt)	221	220



Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

Position :	Ref. Std. ID No.:
1	18-18RTD-01
2	18-18RTD-02
3	18-18RTD-03
4	18-18RTD-04
5	18-18RTD-05
6	23-18RTD-06
7	18-18RTD-07
8	22-18RTD-08
9 (ref.)	18-18RTD-09

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a 1209743



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2404-0004OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 24TM587
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
20.0	20.0	20.0	0.45	0.55	1.3	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
20.0	19.954	20.163	20.235	19.707	19.706	19.739	19.785	19.821	19.828	0.66

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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เอกสารไม่ควบคุม
a 1209742



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000 FAX. 0-2719-9484

Cert.No.: 24TW39
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 20 February 2024
Test Date : 21 February 2024
Reference : 2402-0629DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Test Procedure :
Tested by : Walalak Sirthean
Approved by :
Approved Signatory
() Pornthippa Tameysakul
() Uinnopphol Harachai
(✓) Saitip Meangmai
Issue Date : 22 February 2024

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Cert.No.: 24TW39
Page.: 2 of 2

Condition of this result of calibration

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

Instruments	Serial No.	ID No.	Certificate No.	Due Date
1. Burette	-	130BU10	23CG1172	22 Mar 2025
2. Balance	14233621	110RC001	23MM405	16 July 2024

2. Standard Material :-

Material	Manufacturer	Lot.No.	Assay
Sodium Thiosulfate pentahydrate	Merck	AM1763316	100.2%

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 22B100125

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	8.19	0.0055

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

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

Cert.No.: 25TW29
Page.: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 11B 101863
ID No. : UAE.WAO.004/2554
Received Date : 14 February 2025
Test Date : 17 February 2025
Reference : 2502-0473DSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Test Procedure :
Tested by : Walalak Sirthean
Approved by :
Approved Signatory
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Saitip Meangmai
Issue Date : 18 February 2025

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Cert.No.: 25TW29
Page.: 2 of 2

Certificate No. : HIT-2427-0942

Page : 1 of 2

CERTIFICATE OF CALIBRATION

Equipment : COD Test Tube Heater

Meter Model : HIB39800-02 Serial No. : 04500052101

Tube Heater : 25 Vial Capacity Resolution : 0.1°C

Temperature Range : (-10 to 160)°C Temperature of Reaction : 150°C

Manufacturer : Hanna Instruments Made in : Romania

Condition As-Received : Used Product Reference : RE241152

Ambient Temperature : (25 ± 2)°C Relative Humidity : (50 ± 15)%RH

Customer name : United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk 41, Sukhumvit Rd., Bangchak,
Phrakhanong, Bangkok 10260

Received date : 26 June 2024


Calibrate date : 1 July 2024

Issue date : 3 July 2024

Calibrated Location : Hanna Instruments (Thailand) Ltd.

Calibration Procedure : This calibrator was conducted by using in-house calibration procedure
CP-04 by using certified reference standard instruments.

Calibrated by : ☒ Mr. Pichit Petthong
☐ Mr. Channarong Soinak

Approved by : 
Mr. Anan Suwanchaisakul
Authorized Signatory



This certificate was certified only for the instrument we calibrated.

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

** This certificate may not be reproduced other than in full, except with the prior written **
approval of the head of Hanna Instrument (Thailand).

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Condition of this calibration result:

Reference Standard Instruments : This certification is traceable to the international unit of unit maintained through:

Instruments	Model	Serial No.	Certificate No.	Traceable
Data Acquisition Switch Unit	34970A	MY44065265	WK2307-164-1	WK Electric Co., Ltd.
Digital Thermo-Hygrometer	HT-771SD	AL07155	24H41	Technology Promotion Association (Thailand-Japan).

Calibration Result:

Measurement Temperature Source Accuracy for COD Reactor.

Capacity (Vial)	Nominal Value (°C)	Average Value (°C)	Uncertainty of Measurement (±°C)
25 Vial	150.0	149.8	0.48

Unit : °C

(1A)	(2A)	(3A)	(4A)	(5A)
149.574	149.873	149.861	149.748	149.878
(1B)	(2B)	(3B)	(4B)	(5B)
149.490	149.940	149.954	150.103	150.048
(1C)	(2C)	(3C)	(4C)	(5C)
149.625	150.036	150.080	150.015	149.580
(1D)	(2D)	(3D)	(4D)	(5D)
149.801	149.541	149.662	150.010	149.499
(1E)	(2E)	(3E)	(4E)	(5E)
149.563	149.611	149.569	149.831	149.762

Figure: Shows the location of the temperature source.

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

** End of certificate **

เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484

Cert. No.: 24TM589
Page : 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven

Manufacturer : Memmert

Model : UF 55

Serial No. : B212.0411

ID No. : UAE.WAO.005/2556

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

Location : Lab Floor 2

Received Order : 01 April 2024

Calibration Date : 01 - 02 April 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by : 
Approved Signatory

() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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เอกสารไม่ควบคุม
A 0065065

Equipment : Hot Air Oven

Condition As-Received : Used Item

Reference : 2404-0004OC-3

Procedure Used :-

Cert. No.: 24TM589
Page : 2 of 3

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

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) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

3. This certification is traceable to the International System of Unit.

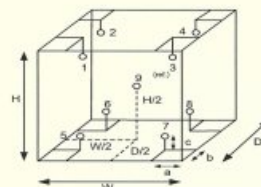
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL.Humid. (%)	47	48
AC Supply (Volt)	221	220



Probe Installation Details : Dimension of Chamber :

a = 5.0 cm	D = 0.50 m
b = 5.0 cm	W = 0.80 m
c = 5.0 cm	H = 0.75 m
	Capacity = 0.30 m³

Ref. Std. ID No.: @ Calibration Point		
Position :	(120 to 180) °C	(104) °C
1	21-18TC-01	22-18RTD-2/1
2	21-18TC-02	18RTD-2/2
3	21-18TC-03	18RTD-2/3
4	21-18TC-04	18RTD-2/4
5	21-18TC-05	18RTD-2/5
6	21-18TC-06	18RTD-2/6
7	21-18TC-07	18RTD-2/7
8	21-18TC-08	18RTD-2/8
9 (ref.)	21-18TC-09	18RTD-2/9

เอกสารไม่ควบคุม
a 1209739



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0004OC-3
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM589
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.032	0.47	0.84	2
120.0	120.0	120.0	0.12	0.72	1.3	2
180.0	180.0	180.0	0.13	1.2	1.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.484	103.847	104.226	104.232	104.106	103.891	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.
Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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เอกสารไม่ควบคุม
a 1209738



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL.0-2717-3000-29 FAX.0-2719-9484



Certificate of Calibration

Cert. No.: 24TM938
Page : 1 of 3

Equipment : Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 2022000022479
ID No. : UAE.MIC.028/2568
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10280
Location : Microbiology Laboratory
Received Order : 09 July 2024
Calibration Date : 09 July 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Khit Ruttanaprapachal

Approved by :

() Ponpan Palpim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 19 July 2024

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Incubator
Condition As-Received : Used Item
Reference : 2407-0153OC-4

Cert. No.: 24TM938
Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).
The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY49001451	24LM44	TPA	17 Mar 2025

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

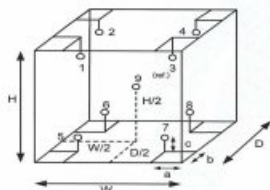
3. This certification is traceable to the International System of Unit.

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

Result of Calibration : (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Probe Installation Details :

Dimension of Chamber :	
a = 10 cm	D = 0.47 m
b = 10 cm	W = 0.65 m
c = 10 cm	H = 1.2 m
	Capacity = 0.37 m ³

Environment during calibration	
	Beginning
Temp. (°C)	23
REL.Humid. (%)	52
AC Supply (Volt)	221

Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	24-19RTD-2/8
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

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เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2407-0153OC-4
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 24TM938
Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
35.0	35.0	35.0	0.030	0.31	0.33	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.093	35.011	35.081	35.118	34.840	35.054	34.924	34.978	34.824	0.30

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

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

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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.

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.

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](#)

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.

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	United Analyst and Engineering Consultant

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 5058	77 16030001
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 (OneVeb) Conical 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

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.

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.

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

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

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	1500. %	2213.4	4124. %	6965.9
Mn 257.610 nm SRBR	3915.0	7492.1	13017. %	31121.6
Al 396.152 nm SBR	9.9	10.7	9.9	21.1
K 766.491 nm SBR	6.7	28.1	4.8	45.3

* 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	P ₀₅₅
Air Flow	P ₀₅₅
Water Flow	P ₀₅₅
Gas Flows	P ₀₅₅
RF Generator	P ₀₅₅
Camera Test	P ₀₅₅
Optics Test	P ₀₅₅
Nebulizer test	P ₀₅₅

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.

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	231.41 V	226.97 V
Mains Current	0.05 A	0.105 A
Instrument Temperature	22.1 °C	23.5 °C
RF Air Flow (sensor speed)	14.0 Hz	19.0 Hz
Plasma Exhaust Temperature	No measurement	63.6 °C
Water Flow Oscillator	No measurement	1.34 L/min
Water Flow Detector	0.86 L/min	0.81 L/min
Water Inlet Temperature	19.7 °C	19.9 °C
Polychromator Temperature	35.0 °C	35.0 °C
CCD Temperature	-40.1 °C	-39.6 °C
Thermal Stabilizer	35.0 °C	35.0 °C
Argon Supply Pressure	648.92 kPa	391.35 kPa
Purge Gas Supply Pressure*1	646.66 kPa	612.41 kPa
Option Gas Supply Pressure*1	— kPa	— kPa
Nebulizer Flow	No measurement	0.30 L/min
Nebulizer Back Pressure	No measurement	138.43 kPa
Plasma Gas Flow	No measurement	11.91 L/min
Auxiliary Gas Flow	No measurement	1.00 L/min
RF Power	No measurement	1204.9 W
RF Supply Current	No measurement	9.65 A
RF Supply Voltage	No measurement	204.41 V

*1 If option installed

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	-
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:

6007197100

Date Service Completed:

04 Nov 2024

Service Engineer Name:

Kanyasorn S.

Customer Name:

Aphorn Onkong

Service Engineer Signature:

Kanyasorn S.

Customer Signature:

Aphorn Onkong

Total number of pages in this document:

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เอกสารไม่ควบคุม

Report Summary

Instrument Model: Agilent 5100/5110 VDV ICP-OES
Instrument ID: G8011A/G8015A
Instrument Serial Number: MY18030001
Software Version: 7.3.1.9507
Firmware Version: 3442
Tested By: Pre Test_PM_Kanyasorn S.
Test Completed On: 11/4/2024 9:19:10 AM

Result Summary

Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass

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Resolution Test

Pass

Element Wavelength	Specification	Width
N (174.213 nm)	≤ 9.40	6.98
As (188.980 nm)	≤ 8.20	6.17
C (193.027 nm)	≤ 11.50	8.30
Mo (202.032 nm)	≤ 8.20	6.38
Cr (206.158 nm)	≤ 13.40	8.98
Zn (213.857 nm)	≤ 8.70	6.60
Pb (220.353 nm)	≤ 9.50	7.09
Co (228.615 nm)	≤ 17.20	11.67
Ba (230.424 nm)	≤ 9.40	7.20
Mn (257.610 nm)	≤ 13.30	9.43
Mn (260.568 nm)	≤ 20.30	14.11
Cr (267.716 nm)	≤ 11.00	8.04
Cu (324.754 nm)	≤ 25.00	18.97
Cu (327.395 nm)	≤ 14.20	11.23
Sr (338.071 nm)	≤ 33.50	24.30
Ba (455.403 nm)	≤ 44.00	33.47
Sr (460.733 nm)	≤ 36.00	17.23
Ba (493.408 nm)	≤ 36.00	25.37
Ba (614.171 nm)	≤ 42.00	25.54
Ar (675.283 nm)	≤ 74.00	56.51
K (766.491 nm)	≤ 80.00	65.86

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เอกสารไม่ควบคุม

Sensitivity Test		Fail				
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	104.1	793.0	50.8	
Se (196.026 nm)	≥ 41.0	SRBR	87.6	862.0	79.7	
Zn (213.857 nm)	≥ 1421.0	SRBR	1500.8	41823.3	749.0	
Pb (220.353 nm)	≥ 46.0	SRBR	170.7	2432.0	174.9	
Mn (257.610 nm)	≥ 3518.0	SRBR	3915.0	264700.2	4420.0	
Al (396.152 nm)	≥ 3.4	SBR	7.7	48454.6	5563.2	
Ba (493.408 nm)	≥ 34.0	SBR	45.9	1966719.7	41903.8	
K (766.491 nm)	≥ 1.8	SBR	5.7	99038.2	14687.7	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	126.5	1498.8	119.0	
Se (196.026 nm)	≥ 159.0	SRBR	112.0	1773.6	197.8	
Zn (206.200 nm)	≥ 234.0	SRBR	466.0	6784.2	199.7	
Zn (213.857 nm)	≥ 1743.0	SRBR	2217.4	95597.6	1789.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	1919.3	68724.6	1236.4	
Pb (220.353 nm)	≥ 320.0	SRBR	332.6	7929.5	499.0	
Mn (257.610 nm)	≥ 10625.0	SRBR	7492.2	991238.3	16911.7	
Cr (267.716 nm)	≥ 1048.0	SRBR	2254.6	129706.6	3150.9	
Cu (324.754 nm)	≥ 19.0	SBR	26.9	290746.3	10407.5	
Al (396.152 nm)	≥ 6.0	SBR	10.7	211329.2	18005.0	
Ba (493.408 nm)	≥ 60.0	SBR	49.3	6956460.4	138336.9	
K (766.491 nm)	≥ 24.0	SBR	28.1	1395190.2	47996.2	

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เอกสารไม่ควบคุม

Precision Test		Pass
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.73
Se (196.026 nm)	≤ 2.60	0.95
Zn (213.857 nm)	≤ 1.50	0.31
Pb (220.353 nm)	≤ 2.60	0.73
Mn (257.610 nm)	≤ 1.50	0.39
Al (396.152 nm)	≤ 1.50	0.39
Ba (493.408 nm)	≤ 1.50	0.87
K (766.491 nm)	≤ 1.50	0.32
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	1.21
Se (196.026 nm)	≤ 1.50	0.84
Zn (206.200 nm)	≤ 1.50	0.56
Zn (213.857 nm)	≤ 1.50	0.96
Cd (214.439 nm)	≤ 1.50	0.26
Pb (220.353 nm)	≤ 1.50	0.51
Mn (257.610 nm)	≤ 1.50	0.97
Cr (267.716 nm)	≤ 1.50	0.22
Cu (324.754 nm)	≤ 1.50	0.24
Al (396.152 nm)	≤ 1.50	0.33
Ba (493.408 nm)	≤ 1.50	0.40
K (766.491 nm)	≤ 1.50	0.65

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Revision	3442
Tested By	Post Test_PM_Kanyakorn S.
Test Completed On	11/4/2024 11:07:24 AM
Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Pass
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Fail
Precision Test	Pass
Subsystem Communications Test	Pass
Optics Test	
	Pass
Intensity	3184054
Wavelength	737.212

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เอกสารไม่ควบคุม

Resolution Test		Pass	
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.97	
As (188.980 nm)	≤ 8.20	6.14	
C (193.027 nm)	≤ 11.50	8.33	
Mo (202.032 nm)	≤ 8.20	6.33	
Cr (206.133 nm)	≤ 13.40	9.06	
Zn (213.857 nm)	≤ 8.70	6.70	
Pb (220.353 nm)	≤ 9.50	7.03	
Co (228.615 nm)	≤ 17.20	11.72	
Ba (230.424 nm)	≤ 9.40	7.32	
Mn (257.610 nm)	≤ 13.30	9.44	
Mn (260.568 nm)	≤ 20.30	14.21	
Cr (267.716 nm)	≤ 11.00	7.94	
Cu (324.754 nm)	≤ 25.00	18.99	
Cu (327.395 nm)	≤ 14.20	11.27	
Sr (338.071 nm)	≤ 33.50	24.40	
Ba (455.403 nm)	≤ 44.00	33.50	
Sr (460.733 nm)	≤ 36.00	17.31	
Ba (493.408 nm)	≤ 36.00	25.44	
Ba (614.171 nm)	≤ 42.00	25.16	
Ar (675.283 nm)	≤ 74.00	56.15	
K (766.491 nm)	≤ 80.00	65.56	

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เอกสารไม่ควบคุม

Sensitivity Test					
Fail					
Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	130.6	977.1	50.4
Se (196.026 nm)	≥ 41.0	SRBR	106.0	958.7	70.2
Zn (213.857 nm)	≥ 1421.0	SRBR	4124.8	44037.7	113.4
Pb (220.353 nm)	≥ 46.0	SRBR	207.2	2554.7	136.2
Mn (257.610 nm)	≥ 3518.0	SRBR	13017.8	271846.6	434.7
Al (396.152 nm)	≥ 3.4	SBR	9.7	50615.5	4717.0
Ba (493.408 nm)	≥ 34.0	SBR	133.7	2069203.0	15359.3
K (766.491 nm)	≥ 1.8	SBR	4.8	100199.5	17235.5
Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	174.9	1566.7	73.0
Se (196.026 nm)	≥ 159.0	SRBR	167.0	1863.4	110.2
Zn (206.200 nm)	≥ 234.0	SRBR	740.9	6836.0	83.1
Zn (213.857 nm)	≥ 1743.0	SRBR	6965.9	101568.1	211.7
Cd (214.439 nm)	≥ 4227.0	SRBR	5781.0	72852.9	158.1
Pb (220.353 nm)	≥ 320.0	SRBR	501.0	8464.3	267.7
Mn (257.610 nm)	≥ 10625.0	SRBR	31121.6	1006637.8	1044.0
Cr (267.716 nm)	≥ 1048.0	SRBR	4424.8	132202.9	880.8
Cu (324.754 nm)	≥ 19.0	SBR	68.7	302907.8	4345.6
Al (396.152 nm)	≥ 6.0	SBR	21.1	218771.0	9892.3
Ba (493.408 nm)	≥ 60.0	SBR	250.6	7137380.9	28367.3
K (766.491 nm)	≥ 24.0	SBR	45.3	1435050.6	31025.0

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เอกสารไม่ควบคุม

Precision Test		
Pass		
Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	0.81
Se (196.026 nm)	≤ 2.60	0.96
Zn (213.857 nm)	≤ 1.50	0.22
Pb (220.353 nm)	≤ 2.60	0.37
Mn (257.610 nm)	≤ 1.50	0.27
Al (396.152 nm)	≤ 1.50	0.25
Ba (493.408 nm)	≤ 1.50	0.53
K (766.491 nm)	≤ 1.50	0.15
Axial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.81
Se (196.026 nm)	≤ 1.50	0.65
Zn (206.200 nm)	≤ 1.50	0.79
Zn (213.857 nm)	≤ 1.50	0.81
Cd (214.439 nm)	≤ 1.50	0.36
Pb (220.353 nm)	≤ 1.50	0.33
Mn (257.610 nm)	≤ 1.50	1.02
Cr (267.716 nm)	≤ 1.50	0.32
Cu (324.754 nm)	≤ 1.50	0.51
Al (396.152 nm)	≤ 1.50	0.37
Ba (493.408 nm)	≤ 1.50	0.68
K (766.491 nm)	≤ 1.50	0.74

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เอกสารไม่ควบคุม

Report Summary		
Instrument Model	Agilent 5100/5110 VDV ICP-OES	
Instrument ID	G8011A/G8015A	
Instrument Serial Number	MY18030001	
Software Version	7.3.1.9507	
Firmware Version	3442	
Tested By	Post Test_PM_Kanyakorn S.	
Test Completed On	11/4/2024 11:30:15 AM	
Result Summary		
Subsystem Communications Test		Pass
Air Flow Test		Pass
Water Flow Test		Pass
Gas Flows Test		Pass
RF Generator Test		Pass
Camera Test		Pass
Optics Test		Skipped
Advanced Valve System Test		Skipped
Resolution Test		Skipped
Sensitivity Test		Skipped
Precision Test		Skipped
Subsystem Communications Test		Pass
Air Flow Test		Pass
30% Air Flow (relative speed)	75% Air Flow (relative speed)	
15.00	19.00	
Water Flow Test		Pass
RF Water Flow(L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.30	0.81	20.55

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เอกสารไม่ควบคุม

Gas Flows Test			Pass		
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.70	154.65	2.00	2.00	110.92
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	115.38	18.00	17.97	21.48
RF Generator Test			Pass		
RF Power Supply Test	Passed				
RF Power Supply (V)	128.554				
RF Oscillator Test	Passed				
RF Oscillator Frequency (MHz)	25.834				
Work Coil Current (A)	44.660				
RF Power Supply Current (A)	1.999				
Camera Test			Pass		
	Integration Time (ms)	Standard Deviation	Status		
Electronic Offset Test	1000	5.228	Passed		
Dark Current Test	6000	1.168	Passed		
Array Test	5	0.024	Passed		
Linearity Test		0.118	Passed		

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เอกสารไม่ควบคุม

Report Summary	
Instrument Model	Agilent 5100/5110 VDV ICP-OES
Instrument ID	G8011A/G8015A
Instrument Serial Number	MY18030001
Software Version	7.3.1.9507
Firmware Version	3442
Tested By	change mirror
Test Completed On	11/5/2024 10:35:26 AM
Result Summary	
Subsystem Communications Test	Skipped
Air Flow Test	Skipped
Water Flow Test	Skipped
Gas Flows Test	Skipped
RF Generator Test	Skipped
Camera Test	Skipped
Optics Test	Skipped
Advanced Valve System Test	Skipped
Resolution Test	Pass
Sensitivity Test	Pass
Precision Test	Pass

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เอกสารไม่ควบคุม

Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	6.79	
As (188.980 nm)	≤ 8.20	5.80	
C (193.027 nm)	≤ 11.50	8.15	
Mo (202.032 nm)	≤ 8.20	5.90	
Cr (208.158 nm)	≤ 13.40	8.85	
Zn (213.857 nm)	≤ 8.70	6.77	
Pb (220.353 nm)	≤ 9.50	6.61	
Co (228.615 nm)	≤ 17.20	11.79	
Ba (230.424 nm)	≤ 9.40	7.25	
Mn (257.610 nm)	≤ 13.30	9.47	
Mn (260.568 nm)	≤ 20.30	14.50	
Cr (267.716 nm)	≤ 11.00	7.91	
Cu (324.754 nm)	≤ 25.00	18.72	
Cu (327.395 nm)	≤ 14.20	11.09	
Sr (338.071 nm)	≤ 33.50	25.39	
Ba (455.403 nm)	≤ 44.00	33.09	
Sr (460.793 nm)	≤ 36.00	18.54	
Ba (493.408 nm)	≤ 36.00	25.74	
Ba (514.171 nm)	≤ 42.00	25.23	
Ar (675.283 nm)	≤ 74.00	58.92	
K (766.491 nm)	≤ 80.00	63.16	

Page 2 of 4

เอกสารไม่ควบคุม

Sensitivity Test						Pass
Radial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 46.0	SRBR	110.5	868.9	54.3	
Se (196.026 nm)	≥ 41.0	SRBR	88.3	934.7	91.3	
Zn (213.857 nm)	≥ 1421.0	SRBR	3535.4	44017.7	153.9	
Pb (220.353 nm)	≥ 46.0	SRBR	184.5	2492.3	159.8	
Mn (257.610 nm)	≥ 3518.0	SRBR	11099.6	249595.3	503.6	
Al (396.152 nm)	≥ 3.4	SBR	8.7	50274.4	5172.0	
Ba (493.408 nm)	≥ 34.0	SBR	124.5	1903184.1	15166.0	
K (766.491 nm)	≥ 1.8	SBR	6.9	110041.4	13991.2	
Axial						
Element Wavelength	Specification	Method	Ratio	Standard	Blank	
As (188.980 nm)	≥ 208.0	SRBR	253.3	3744.3	196.3	
Se (196.026 nm)	≥ 159.0	SRBR	206.7	4199.7	347.2	
Zn (208.200 nm)	≥ 234.0	SRBR	923.0	12282.3	172.1	
Zn (213.857 nm)	≥ 1743.0	SRBR	6398.3	157551.5	601.7	
Cd (214.439 nm)	≥ 4227.0	SRBR	5069.2	99873.7	385.2	
Pb (220.353 nm)	≥ 320.0	SRBR	389.0	10641.1	658.6	
Mn (257.610 nm)	≥ 10625.0	SRBR	21190.4	985528.7	2153.6	
Cr (267.716 nm)	≥ 1048.0	SRBR	3054.1	131797.6	1811.5	
Cu (324.754 nm)	≥ 19.0	SBR	36.3	301401.4	8082.9	
Al (396.152 nm)	≥ 6.0	SBR	10.8	228359.5	19280.5	
Ba (493.408 nm)	≥ 60.0	SBR	106.5	6460421.5	60122.8	
K (766.491 nm)	≥ 24.0	SBR	30.2	1639840.6	52562.1	

Page 3 of 4

เอกสารไม่ควบคุม

Precision Test			Pass
Radial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 2.60	1.56	
Se (196.026 nm)	≤ 2.60	1.16	
Zn (213.857 nm)	≤ 1.50	0.50	
Pb (220.353 nm)	≤ 2.60	0.74	
Mn (257.610 nm)	≤ 1.50	0.63	
Al (396.152 nm)	≤ 1.50	0.54	
Ba (493.408 nm)	≤ 1.50	0.78	
K (766.491 nm)	≤ 1.50	0.44	
Axial			
Element Wavelength	Specification	Measured Value % RSD	
As (188.980 nm)	≤ 1.50	0.82	
Se (196.026 nm)	≤ 1.50	0.82	
Zn (208.200 nm)	≤ 1.50	0.35	
Zn (213.857 nm)	≤ 1.50	0.34	
Cd (214.439 nm)	≤ 1.50	0.44	
Pb (220.353 nm)	≤ 1.50	0.48	
Mn (257.610 nm)	≤ 1.50	0.83	
Cr (267.716 nm)	≤ 1.50	0.53	
Cu (324.754 nm)	≤ 1.50	0.69	
Al (396.152 nm)	≤ 1.50	0.56	
Ba (493.408 nm)	≤ 1.50	1.29	
K (766.491 nm)	≤ 1.50	0.74	

Page 4 of 4

เอกสารไม่ควบคุม

Date: July 5, 2024
Job No.: 8315
Instrument: K9 Distiller

Start	Finish	Travel To Customer (Hrs)	Labour (Hrs)	Travel From Customer (Hrs)
08:30	09:30	1	09:30 14:30 5	14:30 16:00 1.5

Application	Special	Job Type	Standard
Distributor	Courtesy Visit	Installation	Training
Digital Service	PMA Onboarding	Quote	In House
Internal	Warranty	Repair	PM
Investigate	Sales Support	Remote	Health Check Visit

PMA Type	Smartcare	Smartcare Pro	Fosscore
	Smartcare Advance	Fosscore Pro	N/A

Details of Work / Test
- PM - - Visual Check - + No leak + No damage - Change PM kit x1 set - OK - Function Check - + Dilution 80 mL → + Alkali 50 mL → 51 mL } Pass + Receiver N/A → Notule + Steam / Drain Alkaline = Follow up, Recovery > 100% SD = Follow up
Instrument Ready for Use
OK
Not OK*

Part No.	Batch	Description	Qty
60100146	03-01-2020	PM kit Kjetter 9 Distiller	1

Signed FOSS	Signed Customer
Name: Anand / Saravit	Name: Max Kongsamran

Email: Customer Contact: เอกสารไม่ควบคุม

*Remark:



Certificate of Calibration

Cert.No.: 25CH408
Page.: 1 of 3

Equipment : pH Meter
 Manufacturer : EcoSense
 Model : pH100A
 Serial No. : JC04744
 ID No. : UAE.EFM.058/2566 (EFM,pH.01/66)
 Condition As-Received: Used Item
 Received Date : 01 April 2025
 Calibration Date : 03 April 2025
 Reference : 2504-0031WSC-1
 Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
 Phrakhanong, Bangkok 10260

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

Calibrated by : Walalak Sirithean

Approved by : Sathip
Approved Signatory

() Chakrit Waewwanjua
 () Ponpan Paipim
 (✓) Sathip Meangmai

Issue Date : 4 April 2025

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.Cert.No.: 25CH408
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials

The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
 Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
 The measurement results are traceable to SI through CPA chem Ltd.,
 ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading	Uncertainty of Measurement	Coverage factor
	pH	mV	mV	(±mV)	k
pH Meter	4.00	177.48	177	0.58	2.00
S/N: JC04744	7.00	0.00	0	0.58	2.00
	7.00	0.00	0	0.58	2.00
	10.00	-177.48	-177	0.58	2.00



Cert.No.: 25CH408
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: 240710SIA605377	4.007	4.01	173	0.0085	2.05
	6.999	7.00	-2	0.0095	2.00
	6.999	7.00	-2	0.0085	2.00
	10.010	10.00	-176	0.0095	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model :
- Serial No. : 240710SIA605377

Dimension of probe

- Length : 110 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.000	14.9	-0.100	0.13	2.00
30.0	30.001	29.9	-0.101	0.13	2.00
45.0	45.002	45.0	-0.002	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
53/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-0484



Cert.No.: 24CH399
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HAOA0007
ID No. : UAE.EFM.002/2563(EFM pH.02/63)
Condition As-Received: Used Item
Received Date : 01 April 2024
Calibration Date : 02 April 2024
Reference : 2404-0037WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

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

Calibrated by : Warakorn Lerngagrakul

Approved by :
Approved Signatory

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Sathip Meangmai

Issue Date : 06 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

A 0062139



Cert.No.: 24CH399
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (± mV)	Coverage factor k
	pH		mV	pH		
pH Meter S/N.: HAOA0007	4.00	177.48	177.5	4.01	0.058	2.00
	7.00	0.00	0.2	6.98	0.058	2.00
	7.00	0.00	0.2	6.98	0.058	2.00
	10.00	-177.48	-177.3	10.01	0.058	2.00



Cert.No.: 24CH399
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: Q92M0181	4.008	4.01	180.2	0.0079	2.00
	6.986	6.98	1.3	0.0099	2.00
	6.986	7.00	-0.9	0.0099	2.00
	9.997	10.00	-169.4	0.011	2.05

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D
- Serial No. : Q92M0181

Dimension of probe

- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.003	30.0	-0.003	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark - UUC* = Unit Under Calibration

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

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เอกสารไม่ควบคุม

a 1209881

เอกสารไม่ควบคุม

a 1209882



Certificate of Calibration

Cert.No.: 25CH353
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0A0007
ID No. : UAE,EFM.002/2563(EFM,pH.02/63)
Condition As-Received: Used Item
Received Date : 18 March 2025
Calibration Date : 20 March 2025
Reference : 2503-0612WSC-1
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard
Calibrated by : Uthen Kankawi
Approved by :
() Chakrit Waewwanjua
() Ponpan Paipim
(✓) Salthip Meangmai
Issue Date : 20 March 2025

The Uncertainties are for a confidence probability of approximately 95%

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

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	43160066	130RC092	24E1320	22 Apr 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 July 2025

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

2. Certified Reference Materials :The measurement results are traceable to SI through Hach Lenge GmbH Ltd.,
Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.007	CPA chem	1066665	18 Jan 2027
pH 6.999	Hach Lenge GmbH	C03220	29 Oct 2026
pH 10.010	CPA chem	1066669	18 Jan 2026

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (±mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA0A0007	4.00	177.48	177.6	4.01	0.058	2.00
	7.00	0.00	0.3	6.98	0.058	2.00
	7.00	0.00	0.3	6.98	0.058	2.00
	10.00	-177.48	-177.1	10.01	0.058	2.00



Cert.No.: 25CH353
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: 992H0385	4.007	4.00	150.1	0.0085	2.05
	6.999	7.00	-26.1	0.0095	2.00
	6.999	7.00	-26.7	0.011	2.05
	10.010	10.01	-202.4	0.010	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652
- Serial No. : 992H0385
Dimension of probe
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.006	15.0	-0.006	0.13	2.00
30.0	29.998	30.0	0.002	0.13	2.00
45.0	44.993	45.0	0.007	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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Cert.No.: 24CH725
Page.: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0E0041
ID No. : UAE,EFM.069/2564(EFM,pH.02/64)
Condition As-Received: Used Item
Received Date : 18 June 2024
Calibration Date : 19 June 2024
Reference : 2406-0570WSC-3
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage
standard and direct measurement with
certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lernagatrakul

Approved by :
Salthip
Approved Signatory

() Unnopphol Harachai
() Ponpan Paipim
(✓) Salthip Meangmai
Issue Date : 20 June 2024

The Uncertainties are for a confidence probability of approximately 95%

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Cert.No.: 24CH725
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

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

2. Certified Reference Materials

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

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	970851	25 Apr 2026
pH 6.986	CPA chem	970852	25 Apr 2025
pH 9.997	CPA chem	970853	25 Apr 2025

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (\pm mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: HA0E0041	4.00	177.48	177.4	4.01	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	7.00	0.00	0.1	7.00	0.058	2.00
	10.00	-177.48	-177.2	10.01	0.058	2.00



Cert.No.: 24CH725
Page.: 3 of 3

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (\pm)	Coverage factor k
pH Electrode S/N.: Q9AA0001	4.008	4.01	177.6	0.0085	2.05
	6.986	7.00	2.5	0.012	2.05
	9.997	10.01	-170.8	0.0092	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : 9652-10D
- Serial No. : Q9AA0001

Dimension of probe

- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 80 mm.

Calibration Point ($^{\circ}$ C)	Standard Temperature ($^{\circ}$ C)	UUC* Reading ($^{\circ}$ C)	Error ($^{\circ}$ C)	Uncertainty of measurement (\pm $^{\circ}$ C)	Coverage factor k
25.0	25.004	25.0	-0.004	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.002	35.0	-0.002	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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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. : SP24-028

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 : Laboratory 315

Equipment : UV-Vis Spectrophotometer

Manufacturer : HITACHI

Model : U-5100

Serial No. : 23A4-008

ID No. : UAE.WAS.010/2567

Received Date : 10 September 2024

Calibration Date : 10 September 2024

Issue Date : 13 September 2024

Condition Instrument : Good

Calibrated by :

Approved by :

(Mr.Tanawut Ritidach)

(Ms.Chonthicha Sangnern)

Technical Manager

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.

เอกสารไม่ควบคุม

FNS-708-02 R01 0/11/2021

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

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 2 of 5

Environment Condition : Ambient Temperature 25 ± 5 $^{\circ}$ 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	115663	25 October 2025
Absorbance Standard set	25757	115638	25 October 2025
Wavelength Standard set	25806	115657	25 October 2025
Wavelength Standard set	25758	115665	25 October 2025

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.

เอกสารไม่ควบคุม
FNS-708-02 R01 0/11/2021


DQE

Services

DQE Services Co.,Ltd.

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

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



ISO-TIS-16949
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-028

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
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.044	0.0044	0.0029	2.00
	2.1876	2.190	-0.0024	0.0075	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.557	0.0025	0.0034	2.00
	1.0239	1.021	0.0029	0.0035	2.00
	2.1230	2.121	0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.519	0.0040	0.0029	2.00
	0.9633	0.961	0.0023	0.0028	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.515	0.0031	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.996	0.0013	0.0085	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.549	0.0027	0.0030	2.00
	1.0803	1.078	0.0023	0.0029	2.00
	2.0373	2.031	0.0063	0.0081	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.557	0.0021	0.0031	2.00
	1.0518	1.049	0.0028	0.0029	2.00
	1.9274	1.923	0.0044	0.0080	2.00

เอกสารไม่ควบคุม
PM-708-02 R01 1/11/2021


DQE

Services

DQE Services Co.,Ltd.

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

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



ISO-TIS-16949
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-028

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
	0.7469	0.743	0.0039	0.0056	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.291	0.0009	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.639	0.0040	0.0055	2.00

เอกสารไม่ควบคุม
PM-708-02 R01 1/11/2021


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ISO-TIS-16949
CALIBRATION DATA

REPORT OF CALIBRATION

Certificate No. : SP24-028

Page 5 of 5

Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.00	240.4	0.60	0.18	2.00
279.30	278.7	0.60	0.18	2.00
288.90	288.5	0.40	0.18	2.00
334.50	334.2	0.30	0.18	2.00
361.40	361.1	0.30	0.18	2.00
418.40	418.0	0.40	0.18	2.00
447.20	446.7	0.50	0.18	2.00
459.30	459.6	-0.30	0.18	2.00
537.00	536.6	0.40	0.18	2.00
638.00	637.4	0.60	0.18	2.00
441.29	440.8	0.49	0.18	2.00
479.88	479.6	0.28	0.18	2.00
513.75	513.5	0.25	0.18	2.00
528.59	528.6	-0.01	0.18	2.00
575.10	574.9	0.20	0.18	2.00
585.56	585.3	0.26	0.20	2.00
684.70	684.1	0.60	0.18	2.00
740.51	740.0	0.51	0.20	2.00
747.61	747.2	0.41	0.18	2.00
807.04	806.3	0.74	0.18	2.00
879.68	878.9	0.78	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%

- End of Certificate -

เอกสารไม่ควบคุม
PM-708-02 R01 1/11/2021

CERTIFICATE OF CALIBRATION

Customer	: United Analyst and Engineering Consultant Co., Ltd.
Address	: 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260
Description of Equipment	: Console meter
Manufacturer	: Apex Instrument
Model Number	: XC-572-V
Serial Number	: 1701019
ID/Control No.	: UAE.EFM 013/2560
Environment Conditions	: Temperature (25 ± 2) °C Humidity (50 ± 15) % RH
Cal. Date	: 18/06/2024
Issue Date	: 18/06/2024

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

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

Result of Calibration

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

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

Calibrated by : Mr. Sanya Sangnil

Approved by :

(Mr. Mana Fuchinda)

Technical Manager

เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factory/Conversions		
Console Model Number	XC-572-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91			K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

Calibration Data									
Run Time	Metering Console					Calibration Meter			
	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
Elapsed (Q)	(P _{at})	(V _{at})	(V _{at})	(t _{at})	(t _{at})	(V _{wt})	(V _{wt})	(t _{at})	(t _{at})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
11.82	13.0	2802.112	2802.252	32	32	222.03382	222.17160	29	29
11.85	13.0	2802.252	2802.392	32	32	222.17160	222.30948	29	29
8.42	26.0	2802.399	2802.539	32	32	222.31644	222.45472	29	29
8.43	26.0	2802.539	2802.679	32	32	222.45472	222.59264	29	29
13.80	40.0	2802.686	2802.966	32	32	222.59970	222.87558	28	28
13.78	40.0	2802.966	2803.246	32	32	222.87558	223.15024	27	27
10.32	70.0	2803.261	2803.541	33	33	223.16476	223.43840	27	27
10.33	70.0	2803.541	2803.821	33	33	223.43840	223.71148	27	27
9.00	90.0	2803.835	2804.115	33	33	223.72450	223.99668	27	27
9.00	90.0	2804.115	2804.395	33	33	223.99668	224.26896	27	27



เอกสารไม่ควบคุม

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

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91			K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	

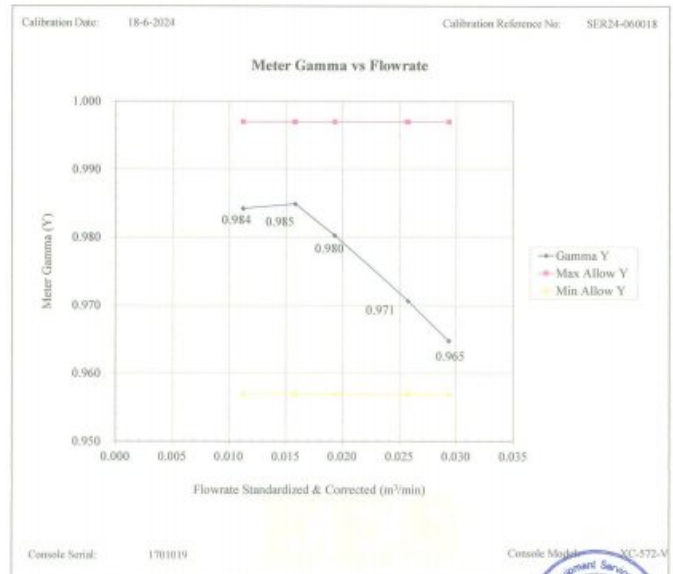
Calibration Data									
Results									
Standardized Data					Dry Gas Meter				
Dry Gas Meter		Calibration Meter		Calibration Factor	Flowrate		Std & Corr	.0212 m ³ /min	Variation
(V _{std})	(Q _{std})	(V _{wet})	(Q _{wet})		Value	Variation			
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	(Q _{std/corr})	(ΔH _g)	(ΔH _g)	(ΔH _g)
0.135	0.011	0.133	0.011	0.984	0.007	0.011	44.706	-1.370	
0.135	0.011	0.133	0.011	0.985	0.008	0.011	44.893	-1.182	
0.135	0.016	0.134	0.016	0.986	0.009	0.016	45.148	-0.928	
0.135	0.016	0.133	0.016	0.984	0.007	0.016	45.564	-0.512	
0.272	0.020	0.267	0.019	0.982	0.005	0.019	46.883	0.808	
0.273	0.020	0.267	0.019	0.978	0.001	0.019	47.030	0.954	
0.274	0.027	0.266	0.026	0.972	-0.005	0.026	46.723	0.648	
0.274	0.027	0.266	0.026	0.970	-0.007	0.026	47.067	0.991	
0.274	0.030	0.265	0.029	0.965	-0.012	0.029	46.388	0.313	
0.274	0.030	0.265	0.029	0.965	-0.012	0.029	46.354	0.279	
				0.977	Y Average			46.075	ΔH _g Average

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

For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1mm) H₂O.

เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91			K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	18/06/2024	10:00 AM	Std Temp	293	K
Console Serial Number	1701019	Calibration Reference No.	SER24-060018			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	755.91			K ₁	0.386	
DGM Serial Number	00002028	Calibration Meter Gamma	1.001			Console Leak Check	PASS	



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions	
Console Model Number	XC-572-V	Date	Time
Console Serial Number	1701019	18/06/2024	00:20 PM
DGM Model Number	SK25EX	Calibration Reference No.	SER24-060018
DGM Serial Number	00002028	Reference Thermometer	DIGICON
Meter Box Model Number	JENCO 765 KF	Serial Number	183169105
Meter Box Serial Number	JC 19777		

Results	
Console Thermocouple Simulator	
Channel and test point	Meter Box Channel Temperature Reading (°C)
	-18.0 25.0 38.0 93.0 149.0 260.0 371.0 482.0 593.0 816.0 1038.0
Stack	-17.0 25.0 38.0 93.0 149.0 257.0 368.0 477.0 587.0 806.0 1024.0
Aux	-17.0 25.0 38.0 93.0 149.0
Probe	-17.0 25.0 38.0 93.0 149.0
Filter	-17.0 25.0 38.0 93.0 149.0
Oven	-17.0 25.0 38.0 93.0 149.0
Exit	-17.0 25.0 38.0

Tolerance Range	
Stack	± 1.50% Absolute
Probe	± 3.0 °C
Filter	± 3.0 °C
Meter	± 3.0 °C
Exit	± 2.0 °C



เอกสารไม่ควบคุม

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Control unit serial no. : 03099401/701
Instrument serial no. : 60899615/701
ID no. or control no. : UAE.EFM, 006/2560
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : United Analyst and Engineering Consultant Co., Ltd.
Customer address : 81 Soi Udomsuk 41, Sukhumvit Rd., Bangchak, Phraekhanong, Bangkok 10260

Total pages of certificate : 2 Pages
Receiving no. : L-242678
Receiving date : 15-Jul-24
Parameter of calibration : Gas Calibration (Oxygen 2.50, 10.04, 21.02 %vol, Carbon Monoxide 80.18, 302, 1007 ppm, Nitrogen Dioxide 30.34, 81.32, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

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

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsoonghong, Lakki, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-2B-C

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

Date of calibration : 17-Jul-24

Mr. Kwanchai Khamdoun
Calibration Technician

Mrs. Nongluk Wongsettee
Technical Manager

เอกสารไม่ควบคุม

Standard References (Table 1)

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

Measured room conditions

Temperature : 23.1 °C Humidity : 66.3 %RH Pressure : 1010.2 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1014.5 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty
O ₂ (%Vol)	2.50	2.55	0.05	0.15
O ₂ (%Vol)	10.04	10.12	0.08	0.20
O ₂ (%Vol)	21.02	21.13	0.11	0.30
CO (ppm)	80.18	81	0.82	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1007	1009	2	12
NO ₂ (ppm)	30.34	32.5	2.16	8.0
NO ₂ (ppm)	81.32	82.7	1.38	8.0
NO ₂ (ppm)	201.9	202.8	0.9	12
NO (ppm)	30.01	31	0.99	8.0
NO (ppm)	151.5	153	1.5	8.0
NO (ppm)	322.5	324	1.5	12
SO ₂ (ppm)	50.36	50	-0.36	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	600.8	603	2.2	13

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

End of Report

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No : 25-AFM-013

Request No : Req-2024-2865

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udonasuk 41, Sukhumvit Road, Bangkok, Prakanong,
Bangkok 10260

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI Accuracy : 2% of Reading
Model : 4146 Sensor Model : -
Serial Number : 41461922008 Sensor Serial Number : -
ID : UAE.FM.224/2562 Instrument Status : Used

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 20 December 2024
Calibration Date : 15 January 2025

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


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


Traceability :

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

Note :

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

Calibration By : 
Mr. Noppadon Laungant
Service Calibration Engineer

Approved By : 
Mr. Paitit Muthavon
Calibration Engineer Supervisor

Issue Date : 15 January 2025

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.04 Issue date 17/6/24

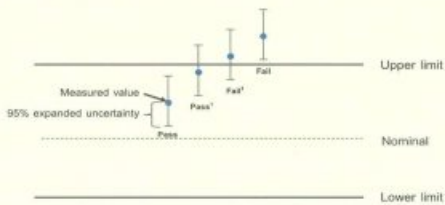
Certificate No : 25-AFM-013

Request No : Req-2024-2865

Decision Rule for Statements of Conformity

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

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.
Pass¹ - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.
Fail¹ - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.
Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



End of Certificate

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.04 Issue date 17/6/24

Certificate No : 25-AFM-013

Request No : Req-2024-2865

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)	MPE (l/min)	Result
22.00	101.49	0.021	0.020	-0.001	0.0013	0.005	N/A
22.00	101.48	0.050	0.050	0.000	0.0033	0.005	N/A
22.00	101.49	0.100	0.100	0.000	0.0028	0.005	N/A
22.00	101.49	0.199	0.200	0.00	0.0056	0.005	N/A
22.00	101.50	0.501	0.500	0.0	0.0073	0.010	N/A
22.10	101.51	1.004	1.000	0.0	0.015	0.020	N/A
22.50	101.52	1.712	1.700	0.0	0.025	0.034	N/A
22.60	101.53	2.021	2.000	0.0	0.029	0.040	N/A
22.70	101.89	3.034	3.000	-0.03	0.044	0.060	N/A
22.80	102.00	4.032	4.000	-0.03	0.059	0.080	N/A
23.10	102.15	5.071	5.000	-0.07	0.073	0.100	N/A

Note

STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : 21.1 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

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

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

* Indicates non accredited

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

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

เอกสารไม่ควบคุม

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.04 Issue date 17/6/24

ขอมอบประกาศนียบัตรนี้เพื่อแสดงว่า

นายณัฐพงษ์ เมืองชัย

ได้ผ่านการฝึกอบรมและทดสอบผู้ตรวจวัดความที่บแสดงของเขม่าควันด้วยสายตา

และการใช้แผนภูมิเขม่าควันของจริงเกิดมานัน ประจำปี ๒๕๖๑

ระหว่างวันที่ ๒๒ - ๒๓ มีนาคม ๒๕๖๑

จัดโดย สำนักจัดการคุณภาพอากาศและเสียง กรมควบคุมมลพิษ

ให้ใช้ ณ วันที่ ๒๓ มีนาคม ๒๕๖๑

(นางสุณี ปิยะพันธุ์พงศ์)

อธิบดีกรมควบคุมมลพิษ



กรมควบคุมมลพิษ
POLLUTION CONTROL DEPARTMENT

ขอขอบพระกำสัถย์บัตรนี้เพื่อแสดงว่า

นายรณภพ ภูตระกูลพัฒนา

ได้ผ่านการฝึกอบรมและทดสอบผู้ตรวจวัดความที่บแสดงของเขมาด้วยสายตายดา
และการใช้แผนภูมิเขมาด้วยเครื่องกลลมานัน ประจ้ปี ๒๕๖๑

ระหว่างวันที่ ๒๒ - ๒๓ มีนาคม ๒๕๖๑

จัดโดย สำนักจัดการคุณภาพอากาศและเสียง กรมควบคุมมลพิษ
ให้ไว้ ณ วันที่ ๒๓ มีนาคม ๒๕๖๑

(นางสุณี ปิยะพันธุ์พงศ์)
อธิบดีกรมควบคุมมลพิษ



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 25P1359
Page: 1 of 2

Equipment: Aneroid Barometer
Manufacturer: Barigo
Model: 111MS
Serial No.: -
ID No.: UAE.EMA2.067/2552
Condition As-Received: Used Item
Received Date: 10 April 2025
Calibration Date: 17 April 2025
Reference: 2504-0319WSG
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1009 mbar

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsak 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP142	1422505046	MP-0133-24	15 May 2025
2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.				
3. This result of calibration was made on requested at the point specified by customer.				
4. Scale and conversion factor is 1 kPa = 7.50062 mmHg				
5. This result of calibration instrument was in absolute pressure.				
6. This instrument was used clean air as pressure media.				
7. The certificate is valid only to the item calibrated on date and place of calibration.				
8. This Certification is traceable to the International System of Unit maintained through:-				
-National Institute of Metrology Thailand (NIMT)				

Calibrated by: Kaeripon Saivichai
Issue Date: 21 April 2025

Approved Signatory: *Attapol P.*
[] Phallinee Prabpai
[] Sura Suwanasari
[✓] Attapol Panurach

เอกสารไม่ควบคุม



Cert.No.: 25P1359
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement

Range: 720 mmHg to 785 mmHg
Scale Interval: 1 mmHg (The Fifth Estimate)

Applied Pressure (mmHg)	717.92	728.95	739.74	750.28	761.55	773.52	784.47
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	2.08	1.05	0.26	-0.28	-1.55	-3.52	-4.47

Decreasing Pressure

Applied Pressure (mmHg)	784.47	773.53	761.51	750.35	738.81	729.05	718.10
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-4.47	-3.53	-1.51	-0.35	0.19	0.95	1.90

The uncertainty of measurement was ± 0.24 mmHg

* UUC = Unit Under Calibration

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

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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: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No.: 24H1487
Page: 1 of 2

Equipment: Digital Thermo-Hygrometer
Manufacturer: Digicon
Model: TH-02A
Serial No.: 435031148
ID No.: UAE.EFM.006/2567
Condition As-Received: New Item
Received Date: 10 July 2024
Calibration Date: 15 July 2024
to 17 July 2024
Reference: 2407-0393WSG
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsak 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H03 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Chilled Mirror Hygrometer Sensor	Dew Prime II	31863	21819	25 Sep 2024
2) Handheld Thermometer With Sensor	1523	5717096	231321	06 Nov 2024
2. The certificate is valid only to the item calibrated on date and place of calibration.				
3. This Certification is traceable to the International System of Unit maintained through:-				
-Thunder Scientific Corporation, NVLAB Accreditation No. Calibration 200582-0				
-Technology Promotion Association (Thailand-Japan), NSC-ONS Accredited No. Calibration 0008				

Calibrated by: Sunsit Phansudhol
Issue Date: 17 July 2024

Approved Signatory: *Viporn*
[] Chakrit Wawwanjua
[✓] Viporn Tantiyawatt
[] Unnopphol Harachai

เอกสารไม่ควบคุม



Cert. No.: 24H1487
Page: 2 of 2

Result of Calibration: Without Adjustment
Function: Humidity Measurement.

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (%R.H.)
25.0	40.1	39	-1.1	1.4
25.0	50.1	48	-2.1	1.6
25.0	60.0	58	-2.0	1.6
25.0	70.2	68	-2.2	1.6

Result of Calibration: Without Adjustment
Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (°C)
20.014	20.3	0.286	0.42
24.984	25.2	0.216	0.42
30.050	30.1	0.050	0.42
40.027	40.0	-0.027	0.42

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING
CONSULTANT CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong,
Bangkok 10260

Certificate No : 24-ACT-077
Request No : Req-2024-1138

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 1
Manufacturer : SVANTEK Range : 94 , 114 dB / 1000Hz
Model : SV 35A Instrument Status : Used
Serial Number : 73246
ID : UAE.EFM.104/2561

Calibration Environment and Details

Temperature : (23 ± 2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ± 10.0 hPa)
Received Date : 23 May 2024
Calibration Date : 30 May 2024
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	31 May 2024
THD Multimeter	2015	1047765	NIMT	16 January 2025

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

Note

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

Calibrated By :

Mr. Noppadon Luangart
Service Calibration Engineer

Approved By :

Mr. Paet Mathavorn
Calibration Engineer Supervisor

Issue Date : 30 May 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Calibration Laboratory.
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FM-708-ACT-02 Rev 01 Issue date:8/23

Certificate No : 24-ACT-077
Request No : Req-2024-1138

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty	Acceptance limit
	Measured	Deviated value	Measured	Deviated value	(± dB)	Class 1 (± dB)
94 dB / 1000 Hz	93.83	-0.17	-	-	0.13	0.25
114 dB / 1000 Hz	113.80	-0.20	-	-	0.13	0.25

Frequency of Sound pressure level

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

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

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.09	-	0.40	2.5
114 dB / 1000 Hz	0.28	-	0.40	2.5

Note :

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

- Acceptance limit was IEC60942:2017 Class 1

- The calibration results exclude the calibrator pressure correction

- The calibration results exclude the microphone volume correction

End of Calibration

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

401-401/1 Sirthiporn Road, Bangbunru, Bangkok, 10700 Thailand
Tel : 06 2433 5331 Email : calibration@sithiporn.com

Cert. No. : ACL25020
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00408979 / 156122 / 90424
ID No.: UAE.EFM.006/2564

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHAONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 03 JANUARY 2025
Calibration Date : 13 - 14 JANUARY 2025
Date of Issue : 15 JANUARY 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchur
(Thanakul Petchurai)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.
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Cert. No. : ACL25020
Job No. : VC68AC0056
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

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Cert. No. : ACL25020
Job No. : VC68AC0056
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม

Cert. No. : ACL25020
Job No. : VC68AC0056
Page : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Weighting (dB)
A - weight	12.0
C - weight	17.9
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.1	0.1	0.1	± 1.0
8000	-0.3	-0.3	-0.3	± 5.0

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Cert. No. : ACL25020
Job No. : VC68AC0056
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
63	-0.1	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.1

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Cert. No. : ACL25020
Job No. : VC68AC0056
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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Cert. No. : ACL25020
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8. Level linearity including the level range control

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

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

9. Tone burst response

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

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Cert. No. : ACL25020
Job No. : VC68AC0056
Pages : 8 of 8

10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม

Cert. No. : ACL24156
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No. : 00321441 / 139083 / 11461
ID No. : UAE.EMA2.090/2555

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 10 MAY 2024
Calibration Date : 30 - 31 MAY 2024
Date of Issue : 04 JUNE 2024

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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Cert. No. : ACL24156
Job No. : VC67AC0071
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-24	05-FEB-25
Waveform Generator	33511B	MY52302742	EF-0007-24	05-FEB-25
Digital Multimeter	33461A	MY53220104	EEL_BP 21/0267	13-FEB-25
Digital Multimeter	33461A	MY53220076	EEL_BP 20/0267	15-FEB-25
Digital Multimeter	34461A	MY60024273	EEL_BP 22/0267	15-FEB-25
Programmable Attenuator	MAT-1070	62100114	EF-0008-24	05-FEB-25
Condenser Microphone	4180	2977900	AA-1001-24	12-FEB-25
Measuring Amplifier	NA-42KA1	34560495	AA-3001-24	05-FEB-25

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

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

3.1 National Institute of Metrology (Thailand).

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

เอกสารไม่ควบคุม
T. KehnCert. No. : ACL24156
Job No. : VC67AC0071
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
16.6

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

Frequency Weighting	Measured value (dB)
A - weight	14.2
C - weight	20.2
Flat	26.0

3. Acoustical signal tests of frequency weightings

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

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

เอกสารไม่ควบคุม
T. KehnCert. No. : ACL24156
Job No. : VC67AC0071
Pages : 3 of 8

Summary of Measurement Result :

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

เอกสารไม่ควบคุม
T. KehnCert. No. : ACL24156
Job No. : VC67AC0071
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

เอกสารไม่ควบคุม
T. Kehn

Cert. No. : ACL24156
Job No. : VC67AC0071
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.1	0.1	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.1	0.1	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.0	0.0	± 1.1

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T. Petchur

Cert. No. : ACL24156
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	135.4	-1.0	±3.0

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

เอกสารไม่ควบคุม
T. Petchur

Cert. No. : ACL24156
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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.5	-0.2	±1.5

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม
T. Petchur

Cert. No. : ACL25022
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00408982 / 186172 / 00727
ID No.: UAE.EFM.009/2564

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

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

Received Date : 03 JANUARY 2025
Calibration Date : 13 - 14 JANUARY 2025
Date of Issue : 15 JANUARY 2025

Calibrated by : Nathakorn Pisutpaisan

Approved by : T. Petchur
(Thanakul Petchurai)

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

เอกสารไม่ควบคุม
T. Petchur

Cert. No. : ACL25022
Job No. : VC68AC0056
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

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

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

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

Condition of this result of calibration :

1. Reference Standard Instruments :

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

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

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

3.1 National Institute of Metrology (Thailand).

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

Cert. No. : ACL25022
Job No. : VC68AC0056
Pages : 3 of 8

Summary of Measurement Result :

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

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เอกสารไม่ควบคุม

Cert. No. : ACL25022
Job No. : VC68AC0056
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Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Weighting (dB)
A - weight	11.2
C - weight	17.1
Flat	22.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.4	0.4	± 1.5
1000	0.2	0.2	0.2	± 1.0
8000	2.1	2.1	2.2	±5.0

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Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

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

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เอกสารไม่ควบคุม

Cert. No. : ACL25022
Job No. : VC68AC0056
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7. Level linearity on the reference level range

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

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Cert. No. : ACL25022
Job No. : VC68AC0056
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8. Level linearity including the level range control

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

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.1	0.1	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

เอกสารไม่ควบคุม

Cert. No. : ACL25022
Job No. : VC68AC0056
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10. Peak C sound level

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

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

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

เอกสารไม่ควบคุม

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7/10 MOO 15, SOI SUTSINAKORN 11 TAMBON BANG KAO
AMPHOE BANG PHU SAKET PRACHIN PROVINCE 30140 THAILAND
TEL : 0669-2116-5900-1 FAX : 0669-2110-7140

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260Certificate No : 24-NDM-179
Request No : Req-2024-1546

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143227
ID : UAEFTM1452566
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 103025
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 9 July 2024
Calibrated Date : 16 July 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svante	Svan401	131	9 October 2024	WK Electric
Timer	EXTech	-	95-AC/T	14 March 2025	TPA

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.Calibrated By :
Mr. Noppadol Luangrat
Service Calibration EngineerApproved By :
Mr. Pavin Marhavom
Calibration Engineer Supervisor

Issue Date : 16 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of SITHIPORN ASSOCIATES.เอกสารไม่ควบคุม

ISA-708-02B-01 Rev.04 Issue Date 5/9/24

Certificate No : 24-NDM-179
Request No : Req-2024-1546

Certificate No : 24-NDM-179
Request No : Req-2024-1546

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)		(%)	
1000 Hz 114 dB	120	120	3.17	3.13	-1.3	3.1	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN: 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	A	C	(± dB)	Limit	
STD Setting	(dB)	(dB)	(± dB)	(± dB)	
95 Hz	0.1	0.2	0.40	2.0	Pass
125 Hz	0.0	0.1	0.40	1.5	Pass
250 Hz	-0.2	-0.2	0.40	1.5	Pass
500 Hz	-0.1	-0.1	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2500 Hz	0.4	0.3	0.40	2.0	Pass
4000 Hz	2.2	2.1	0.40	3.0	Pass
8000 Hz	0.0	-0.1	0.40	5.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
P34-708-NDM-01 Rev.04 Issue date 5/6/24

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting			FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0	
	Level A	(dB)	54.7	80.3	90.1	100.0	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	-0.3	0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Error	(dB)				0.0	0.0	0.0	0.0	-0.1	-0.1	
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8	
	Level A	(dB)						87.8	93.8	103.8	113.8	
	Error	(dB)							0.0	0.0	0.0	
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.3									
Result			Pass									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26	Pass
1000 Hz 110 dB	45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB	90	90	1.00	0.99	-1.00			Pass
1000 Hz 110 dB	180	180	2.00	1.98	-1.00			Pass
1000 Hz 120 dB	36	36	4.00	3.94	-1.50			Pass
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6		Pass
1000 Hz 120 dB	90	90	10.00	9.90	-1.00			Pass
1000 Hz 120 dB	180	180	20.00	19.76	-1.20			Pass
1000 Hz 120 dB	360	360	40.00	39.42	-1.45			Pass
1000 Hz 120 dB	720	720	80.00	78.66	-1.68			Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
P34-708-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-179
Request No : Req-2024-1546

Certificate No : 24-NDM-179
Request No : Req-2024-1546

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(Pa ² h)	(Pa ² h)	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)			
4000 Hz 95 dB	2846	2846	1.00	0.98	-0.02	0.052	-0.29 ~ +0.41	Pass

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)			
Burst 1 ms, 95 dB	2846	2846	1.00	0.98	-2.00	5.6	-21 ~ +26	Pass
Burst 1 ms, 100 dB	900	900	1.00	0.98	-2.00		-29 ~ +41	Pass
Burst 1 ms, 108 dB	143	143	1.00	0.99	-1.00		-29 ~ +41	Pass

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	UUC		UUC	Different	(%)	Limit	
Calibrator Setting	(s)		(Pa ² h)	(%)		(%)	
Continuous Rectangle +	29		10.13	0.00	3.7	-21 ~ +26	Pass
Continuous Rectangle -			10.13				Pass

* Indicates non accredited

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
P34-708-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-179
Request No : Req-2024-1546

Certificate No : 24-NDM-179
Request No : Req-2024-1546

Decision Rule for Statements of Conformity

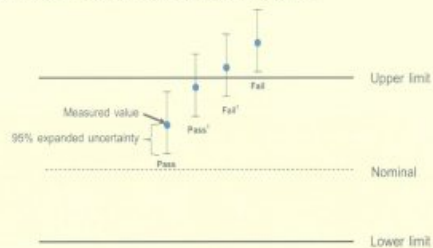
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:08-2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability, were within the limits.

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

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

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



End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
P34-708-NDM-01 Rev.04 Issue date 5/6/24

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD. Certificate No : 24-NDM-178
Address : RI Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260 Request No : Req-2024-1551

Unit Under Calibration Details

Measurement item : Noise Dosimeter Microphone Class : 2
Manufacturer : SVANTEK Microphone Model : SV27
Model : SV 104 Microphone S/N : 332041
Serial Number : 143233 Preamplifier Model : -
ID : UAE-ETM 151-2566 Preamplifier S/N : -
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 July 2024
Calibrated Date : 16 July 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svantek	Svan401	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By : 
Mr. Noppadol Luangrit
Service Calibration Engineer

Approved By : 
Mr. Paitit Mathavorn
Calibration Engineer Supervisor
Issue Date : 16 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

FSI-700-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-178

Request No : Req-2024-1551

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
	Ref	UUC	Ref	UUC	Error			
FAST / A / 55-140								
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	Limit	
1000 Hz 114 dB	120	120	3.17	3.13	-1.3	3.1	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various		UNCERTAINTY	Tolerances	Result
	Frequency Weighting				
FAST / 55-140	A	C	(± dB)	Limit	
STD Setting	(dB)	(dB)			
763 Hz	-0.3	0.3	0.40	2.0	Pass
125 Hz	0.0	0.3	0.40	1.5	Pass
250 Hz	-0.3	0.0	0.40	1.5	Pass
500 Hz	0.0	0.3	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	-0.2	-0.1	0.40	2.0	Pass
4000 Hz	0.8	0.9	0.40	3.0	Pass
8000 Hz	-1.9	-1.7	0.40	5.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

FSI-700-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-178

Request No : Req-2024-1551

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High											
	Ref	(dB)	55.0	80.0	80.0	100.0	130.0	134.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	54.6	80.4	80.1	100.0	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	-0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
8000 Hz	Ref	(dB)				88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)				88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)				0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
63 Hz	Ref	(dB)							87.8	93.8	103.8	113.8
	Level A	(dB)							87.8	93.8	103.8	113.8
	Error	(dB)							0.0	0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0									
UNCERTAINTY		(±dB)	0.3									
Result			Pass									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
	Ref	UUC	Ref	UUC	Error			
FAST / A / 55-140								
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	Limit	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26	Pass
1000 Hz 110 dB	45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB	90	90	1.00	0.99	-1.00			Pass
1000 Hz 110 dB	180	180	2.00	1.98	-1.00			Pass
1000 Hz 120 dB	36	36	4.00	3.94	-1.50			Pass
1000 Hz 120 dB	72	72	8.00	7.87	-1.63	5.6	-21, +26	Pass
1000 Hz 120 dB	90	90	10.00	9.90	-1.00			Pass
1000 Hz 120 dB	180	180	20.00	19.76	-1.20			Pass
1000 Hz 120 dB	360	360	40.00	39.42	-1.45			Pass
1000 Hz 120 dB	720	720	80.00	78.66	-1.68			Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

FSI-700-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-178

Request No : Req-2024-1551

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
	Ref	UUC	Ref	UUC	Error			
FAST / A / 55-140								
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.20 ~ -0.41	Pass

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
	Ref	UUC	Ref	UUC	Error			
FAST / A / 55-140								
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	Limit	
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26	Pass
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ +41	Pass
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 ~ +41	Pass

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
	Ref	UUC	Ref	UUC	Different			
FAST / A / 55-140								
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	Limit	
Continuous Rectangle +	28		10.13		0.00	3.7	-21 ~ +26	Pass
Continuous Rectangle -			10.13					Pass

* Indicates non accredited

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.

เอกสารไม่ควบคุม

FSI-700-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-178
Request No : Req-2024-1551

Decision Rule for Statements of Conformity

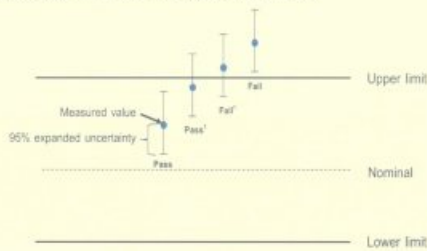
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09-2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

เอกสารไม่ควบคุม

FM-708-NDM-01 Rev.04 Issue date 5/6/24

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 24-NDM-170
Request No : Req-2024-1469

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143229
ID : UAE-ETM-147-2566
Resolution : 0.1 dB
Calibration Environment and Details
Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 July 2024
Calibrated Date : 15 July 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 136867
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 5 July 2024
Calibrated Date : 15 July 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	EFA000234	25 July 2024	TSI
Standard Microphone	GRAS	40AN	186273	21 August 2024	GRAS
Sine Generator	Svanick	Svan401	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By : 
Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pait Mahavom
Calibration Engineer Supervisor
Issue Date : 15 July 2024

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FM-708-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-170
Request No : Req-2024-1469

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)		(%)	
1000 Hz 114 dB	120	120	3.17	3.13	-1.3	3.1	-21, +26	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, S/N. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances	Result
FAST / 55-140	A	C	(± dB)	Limit	
STD Setting	(dB)	(dB)	(± dB)	(± dB)	
963 Hz	-0.6	-0.1	0.40	2.0	Pass
125 Hz	-0.4	-0.2	0.40	1.5	Pass
250 Hz	-0.4	-0.3	0.40	1.5	Pass
500 Hz	-0.2	-0.1	0.40	1.5	Pass
1000 Hz	0.0	0.0	0.40	-	-
2000 Hz	0.1	0.1	0.40	2.0	Pass
4000 Hz	1.5	1.5	0.40	3.0	Pass
8000 Hz	-1.3	-1.1	0.40	5.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

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FM-708-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-170
Request No : Req-2024-1469

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	140.0
	Level A	(dB)	54.6	80.2	90.1	100.0	110.0	114.0	120.0	140.0
	Error	(dB)	-0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)	88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Level A	(dB)	88.9	98.9	108.9	112.9	118.9	128.9	138.9	
	Error	(dB)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
63 Hz	Ref	(dB)	87.8	93.8	103.8	113.8				
	Level A	(dB)	87.8	93.8	103.8	113.8				
	Error	(dB)	0.0	0.0	0.0	0.0				
Tolerances Limit		(±dB)	1.0							
UNCERTAINTY		(±dB)	0.3							
Result			Pass							

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit	
Calibrator Setting	(s)	(s)	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26	Pass
1000 Hz 110 dB	45	45	0.50	0.50	0.00			Pass
1000 Hz 110 dB	90	90	1.00	1.01	+1.00			Pass
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			Pass
1000 Hz 120 dB	36	36	4.00	4.03	+0.75	5.6		Pass
1000 Hz 120 dB	72	72	8.00	8.05	+0.63			Pass
1000 Hz 120 dB	90	90	10.00	10.13	+1.30			Pass
1000 Hz 120 dB	180	180	20.00	20.22	+1.10			Pass
1000 Hz 120 dB	360	360	40.00	40.34	+0.85			Pass
1000 Hz 120 dB	720	720	80.00	80.49	+0.61			Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

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FM-708-NDM-01 Rev.04 Issue date 5/6/24

Certificate No : 24-NDM-170
Request No : Req-2024-1469

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 ~ -0.41	Pass

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)	Limit	
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)		(%)	
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ -26	Pass
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ -41	Pass
Burst 1 ms, 108 dB	143	143	1.00	1.01	-1.00		-29 ~ -41	Pass

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY	Tolerances	Result
FAST / A / 55-140	UUC		UUC	Different		Limit	
Calibrator Setting	(s)		(Pa ² h)	(%)	(%)	(%)	
Continuous Rectangle +	29		10.37	0.00	3.7	-21 ~ -26	Pass
Continuous Rectangle -			10.37				Pass

* Indicates non accredited

Certificate No : 24-NDM-170
Request No : Req-2024-1469

Decision Rule for Statements of Conformity

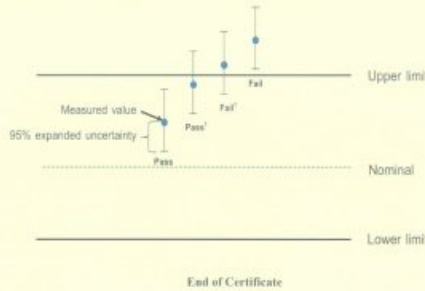
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2015. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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

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

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

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



The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the

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INA-708-NDM-01 Rev.04 Issue date: 5/9/24

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the

เอกสารไม่ควบคุม

INA-708-NDM-01 Rev.04 Issue date: 5/9/24

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : R1 Soi Luangsuak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Certificate No : 24-NDM-108
Request No : Req-2024-0833

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 117694
ID : UAE-ETM-116-2565
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 112805
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 10 April 2024
Calibrated Date : 26 April 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	EFA000214	25 July 2024	TSL
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Saramk	Scan401	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-ACT	14 March 2025	TPA

Note

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

Calibrated By :
Mr. Noppadol Luangart
Service Calibration Engineer

Approved By :
Mr. Pait Mathavorn
Calibration Engineer Supervisor
Issue Date : 26 April 2024

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the

เอกสารไม่ควบคุม

INA-708-NDM-01 Rev.02 Issue date: 11/11/23

Certificate No : 24-NDM-108
Request No : Req-2024-0833

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN: 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances
FAST / 55-140	A	C		Limit
STD Setting	(dB)	(dB)	(± dB)	(± dB)
763 Hz	0.1	0.1	0.40	2.0
125 Hz	-0.2	-0.1	0.40	1.5
250 Hz	-0.2	-0.1	0.40	1.5
500 Hz	-0.2	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.2	0.2	0.40	2.0
4000 Hz	2.1	2.1	0.40	3.0
8000 Hz	0.6	0.6	0.40	5.0

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the

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INA-708-NDM-01 Rev.02 Issue date: 11/11/23

Certificate No : 24-NDM-108
Request No : Req-2024-0833

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting		FAST / A / High										
Ref	(dB)	55.0	80.0	90.0	100.0	110.0	120.0	130.0	140.0			
1000 Hz	Level A (dB)	54.4	80.1	90.1	100.1	110.0	120.0	130.0	140.0			
	Error (dB)	-0.6	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref (dB)			88.9	98.9	108.9	118.9	128.9	138.9			
	Level A (dB)			88.9	98.9	108.9	118.9	128.9	138.9			
	Error (dB)			0.0	0.0	0.0	0.0	0.0	0.0	-0.1		
63 Hz	Ref (dB)					87.8	93.8	103.8	113.8			
	Level A (dB)					87.8	93.8	103.8	113.8			
	Error (dB)					0.0	0.0	0.0	0.0			
Tolerances Limit (±dB)		1.0										
UNCERTAINTY (±dB)		0.3										

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140		Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting		60	60	(Pa ² ·h)	(Pa ² ·h)	(%)	(%)	(%)
1000 Hz 110 dB		27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB		45	45	0.50	0.50	0.00		
1000 Hz 110 dB		90	90	1.00	1.01	+1.00		
1000 Hz 110 dB		180	180	2.00	2.02	+1.00		
1000 Hz 120 dB		36	36	4.00	4.03	+0.75		
1000 Hz 120 dB		72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB		90	90	10.00	9.90	-1.00		
1000 Hz 120 dB		180	180	20.00	19.76	-1.20		
1000 Hz 120 dB		360	360	40.00	39.42	-1.45		
1000 Hz 120 dB		720	720	80.00	78.66	-1.68		

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.
P36-708-NDM-01 Rev.02 Issue date 9/11/23

เอกสารไม่ควบคุม

Certificate No : 24-NDM-108
Request No : Req-2024-0833

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 55-140		Ref	UUC	Ref (Pa h)	UUC (Pa h)	Error (%)		
Calibrator Setting		60	60					
4000 Hz 95 dB		2846	2846	1.00	1.00	0.00	0.952	-0.29 ~ -0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 55-140		Ref	UUC	Ref (Pa h)	UUC (Pa h)	Error (%)		
Calibrator Setting		60	60					
Burst 1 ms, 95 dB		2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB		900	900	1.00	1.00	0.00		-29 ~ +41
Burst 1 ms, 108 dB		143	143	1.00	1.01	+1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting		Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
FAST / A / 55-140		UUC		UUC (Pa h)	Different (%)			
Calibrator Setting		60						
Continuous Rectangle +				10.13			3.7	-21 ~ +26
Continuous Rectangle -		29		10.37	+2.37			

* Indicates non accredited

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.
P36-708-NDM-01 Rev.02 Issue date 9/11/23

เอกสารไม่ควบคุม

Certificate of Calibration

Certificate No : 25-LXM-074

Request No : Req-2025-0461

Page : 1/3

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

Unit Under Calibration Details

Instrument Name : Light Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A037351
Resolution : 1, 10 lx
ID Number : UAE.EFM.096/2561

Range Calibration : 2000, 20000 lx
Accuracy : 4 % of Reading ± 2 digits
Instrument Status : Used

Calibration Environment and Details


Temperature : 25 °C ± 2 °C
Humidity : 60 %RH ± 20 %RH
Received Date : 19 February 2025
Calibrated Date : 11 March 2025
Calibration Procedure : The measurement was done in accordance with CP-LXM-01

Reference Standard : Photometer and Illuminance Sensor, Serial No.: 30662/2, 30592/2, which was calibrated on 17 September 2024, Certificate No.: TP-1027-24

Traceability : This Certificate is traceable to International System of Unit (SI) Unit through National Institute of Metrology (Thailand)

Note

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

Approved By : 
Mr. Paiti Mathavorn
Calibration Engineer Supervisor
Issue Date : 11 March 2025

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.
P36-708-LXM-01 Rev.02 Issue date 9/7/24

เอกสารไม่ควบคุม

Calibration Note : Zero adjustment before use

Certificate No : 25-LXM-074

Request No : Req-2025-0461

Page : 2/3

Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (±lx)	MPE (lx)	Result
2000	* 0	0	0	0.56	2	Pass
	50	50	0	2.5 % of Reading	4	Pass
	100	101	-1	2.3 % of Reading	6	Pass
	200	203	-3	2.2 % of Reading	10	Pass
	300	302	-2	2.2 % of Reading	14	Pass
	400	404	-4	2.2 % of Reading	18	Pass
	600	604	-4	2.2 % of Reading	26	Pass
	800	802	-2	2.2 % of Reading	34	Pass
	1000	999	1	2.2 % of Reading	42	Pass
	1200	1198	2	2.2 % of Reading	50	Pass
	1400	1395	5	2.2 % of Reading	58	Pass
	1600	1590	10	2.2 % of Reading	66	Pass
	1800	1790	10	2.2 % of Reading	74	Pass
	2000	1988	12	2.2 % of Reading	82	Pass
20000	3000	2970	30	2.2 % of Reading	122	Pass
	4000	3950	50	2.2 % of Reading	162	Pass
	5000	4930	70	2.2 % of Reading	202	Pass

* Indicates non accredited

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

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

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Calibration Laboratory.
P36-708-LXM-01 Rev.02 Issue date 1/7/24

เอกสารไม่ควบคุม



Certificate No : 25-UXM-074
Request No : Req-2025-0461
Page : 3/3

Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09 2019.

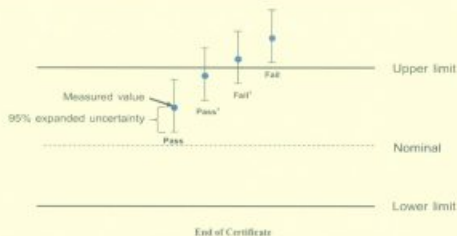
Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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

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

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

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



Calibrated By :
Mr. Noppadon Luangart

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-UXM-01 Rev.02 Issue date 1/7/24

เอกสารไม่ควบคุม

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Address : 10260
Certificate No : 24-TPM-315
Request No : Req-2024-1482
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-34
Serial Number : TEX040016
Resolution : 0.1 °C
ID Number : UAE.EFM.120/2566
Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 3 July 2024
Calibrated Date : 9 July 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 0800057, ID: 02-TPM
Which was calibrated on 1 March 2024, Calibration Certificate No.: QR24-0478

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :
Mr. Noppadon Luangart
Technical Manager
Issue Date : 10 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม



Calibration No : 24-TPM-315
UUC Adjustment : No Adjust
Request No : Req-2024-1482
Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
WET	20.032	19.9	+ 0.1	0.13
	25.032	25.0	0.0	0.13
	30.031	30.1	- 0.1	0.13
	35.037	35.0	0.0	0.13
	40.040	40.0	0.0	0.13
	45.038	45.1	- 0.1	0.13
	50.042	50.1	- 0.1	0.13
DRY	60.045	60.0	0.0	0.13
	20.033	20.0	0.0	0.13
	25.030	25.1	- 0.1	0.13
	30.033	30.1	- 0.1	0.13
	35.034	35.1	- 0.1	0.13
	40.039	40.2	- 0.2	0.13
	45.038	45.2	- 0.2	0.13
GLOBE	50.042	50.2	- 0.2	0.13
	60.046	60.2	- 0.2	0.13
	20.033	19.9	+ 0.1	0.13
	25.030	25.0	0.0	0.13
	30.033	30.1	- 0.1	0.13
	35.038	35.1	- 0.1	0.13
	40.038	40.2	- 0.2	0.13
	45.041	45.3	- 0.3	0.13
	50.040	50.2	- 0.2	0.13
	60.045	60.3	- 0.3	0.13

End of Certificate

Calibrated By :
Mr. Srirachak Rongphadussakul



Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Name : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Address : 10260
Certificate No : 25-TPM-050
Request No : Req-2024-2855
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : 3M
Model : QT-32
Serial Number : TP5010008
Resolution : 0.1 °C
ID Number : UAE.EFM.083/2561
Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 20 December 2024
Calibrated Date : 28 January 2025
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 0800057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No.: QR24-0478

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :
Mr. Noppadon Luangart
Technical Manager
Issue Date : 28 January 2025

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-TPM-01 Rev.01 Issue date 13/02/20

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 25-TPM-050

Request No : Req-2024-2855

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (u=2)
WET	20.030	20.0	0.0	0.15
	25.032	25.0	0.0	0.15
	30.034	30.0	0.0	0.15
	35.037	35.0	0.0	0.15
	40.037	40.1	-0.1	0.15
	45.040	45.1	-0.1	0.15
	50.042	50.1	-0.1	0.15
	60.045	60.1	-0.1	0.15
DRY	20.032	20.2	-0.2	0.15
	25.032	25.2	-0.2	0.15
	30.036	30.2	-0.2	0.15
	35.036	35.2	-0.2	0.15
	40.038	40.2	-0.2	0.15
	45.040	45.2	-0.2	0.15
	50.042	50.2	-0.2	0.15
	60.046	60.2	-0.2	0.15
GLOBE	20.031	20.1	-0.1	0.15
	25.033	25.1	-0.1	0.15
	30.033	30.1	-0.1	0.15
	35.035	35.1	-0.1	0.15
	40.038	40.1	-0.1	0.15
	45.040	45.1	-0.1	0.15
	50.042	50.1	-0.1	0.15
	60.046	60.1	-0.1	0.15

End of Certificate

Calibrated By :

Mr. Sittichok Jangpholrasat

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the instrument manufacturer Co., Ltd.

TPM-708-TPM-01 Rev.01 Issue date 13/02/23

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING

CONSULTANT CO.,LTD.

Address

81 Soi Udomsak 41, Sukhumvit Road, Bangkok,

Prakanong, Bangkok 10260

Certificate No : 25-TPM-052

Request No : Req-2024-2853

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : 3M

Model : QT-32

Serial Number : TPS030007

Resolution : 0.1 °C

ID Number : UAE.EFM.082/2561

Range Calibration : 20 °C to 60 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 4.5

Calibration Position (mm) : 67.5

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 20 December 2024

Calibrated Date : 28 January 2025

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/RTD100, SN:

08000057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No. : QR24-0478

Traceability

This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSAC Accreditation No.:

Calibration 0292

Note

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

Approved By :

mp

Mr. Noppadol Luangart

Technical Manager

Issue Date :

28 January 2025

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the instrument manufacturer Co., Ltd.

TPM-708-TPM-01 Rev.01 Issue date 13/02/23

เอกสารไม่ควบคุม



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 25-TPM-052

Request No : Req-2024-2853

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (u=2)
WET	20.030	20.1	-0.1	0.15
	25.032	25.1	-0.1	0.15
	30.034	30.0	0.0	0.15
	35.037	35.0	0.0	0.15
	40.037	40.2	-0.2	0.15
	45.040	45.2	-0.2	0.15
	50.042	50.1	-0.1	0.15
	60.045	60.1	-0.1	0.15
DRY	20.032	20.1	-0.1	0.15
	25.032	25.1	-0.1	0.15
	30.036	29.9	+0.1	0.15
	35.036	34.9	+0.1	0.15
	40.038	40.1	-0.1	0.15
	45.040	45.1	-0.1	0.15
	50.042	50.0	0.0	0.15
	60.046	60.0	0.0	0.15
GLOBE	20.031	20.0	0.0	0.15
	25.033	25.0	0.0	0.15
	30.033	30.0	0.0	0.15
	35.035	35.0	0.0	0.15
	40.038	40.0	0.0	0.15
	45.040	45.0	0.0	0.15
	50.042	50.0	0.0	0.15
	60.046	60.0	0.0	0.15

End of Certificate

Calibrated By :

Mr. Sittichok Jangpholrasat

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the instrument manufacturer Co., Ltd.

TPM-708-TPM-01 Rev.01 Issue date 13/02/23

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING

CONSULTANT CO.,LTD.

Address

81 Soi Udomsak 41, Sukhumvit Road, Bangkok,

Prakanong, Bangkok 10260

Certificate No : 24-TPM-349

Request No : Req-2024-1621

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature

Instrument Name : Thermal Environment Monitor

Manufacturer : 3M

Model : QT-32

Serial Number : TPQ020023

Resolution : 0.1 °C

ID Number : UAE.EFM.006/2559

Range Calibration : 20 °C to 60 °C

Type of Sensor : RTD

Sensor Diameter (mm) : 4.5

Calibration Position (mm) : 67.5

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 15 %RH

Received Date : 19 July 2024

Calibrated Date : 6 August 2024

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard

Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/RTD100, SN:

08000057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No. : QR24-0478

Traceability

This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSAC Accreditation No.:

Calibration 0292

Note

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

Approved By :

mp

Mr. Noppadol Luangart

Technical Manager

Issue Date :

6 August 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the instrument manufacturer Co., Ltd.

TPM-708-TPM-01 Rev.01 Issue date 13/02/23

เอกสารไม่ควบคุม

Calibration Note: Certificate No: 24-TPM-349
UUC Adjustment: Not Adjust Request No: Roy-2024-1621
Page: 2/2

Result of Calibration:

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (k=1)
WET	20.039	19.9	+0.1	0.13
	25.033	24.9	+0.1	0.13
	30.034	29.9	+0.1	0.13
	35.037	34.9	+0.1	0.13
	40.039	39.9	+0.1	0.13
	45.039	44.9	+0.1	0.13
	50.042	49.9	+0.1	0.13
DRY	20.032	19.9	+0.1	0.13
	25.034	24.9	+0.1	0.13
	30.035	29.9	+0.1	0.13
	35.036	34.9	+0.1	0.13
	40.037	39.9	+0.1	0.13
	45.041	44.9	+0.1	0.13
	50.043	49.9	+0.1	0.13
GLOBE	20.031	19.9	+0.1	0.13
	25.033	24.9	+0.1	0.13
	30.034	29.9	+0.1	0.13
	35.037	34.9	+0.1	0.13
	40.038	39.9	+0.1	0.13
	45.040	44.9	+0.1	0.13
	50.042	49.9	+0.1	0.13

End of Certificate

Calibrated By: 
Mr. Sirichok Jongsakornakul

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the head of Corporate Services 3: Equipment Calibration and Testing Services.
เอกสารไม่ควบคุม

Certificate of Calibration

Cert.No.: 24CH1422
Page.: 1 of 3

Equipment : pH Meter
Manufacturer : EcoSense
Model : pH100A
Serial No. : 24H005160JEN
ID No. : UAE.EFM.042/2567(EFM.pH.05/67)
Condition As-Received: Used Item
Received Date : 13 November 2024
Calibration Date : 14-15 November 2024
Reference : 2411-0421WSC-5
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

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

Calibrated by : Warakorn Lemgagtrakul

Approved by : 
Approved Signatory

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

Issue Date : 20 November 2024

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

Cert.No.: 24CH1422
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	24E2759	25 Aug 2025
2) Ref. Standard Thermometer	4982054	110RC044	24I757	14 Jul 2025

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

2. Certified Reference Materials : The measurement results are traceable to SI through Hach Lenge GmbH Ltd., Deutsche Akkreditierungsstelle, Accredited No.D-RM-15184-01-00
: The measurement results are traceable to SI through CPA chem Ltd., ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	1034203	27 Sep 2026
pH 6.999	Hach Lenge GmbH	C03145	28 Feb 2026
pH 10.010	CPA chem	1034205	27 Sep 2025

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input	Actual Reading		Uncertainty of Measurement (± mV)	Coverage factor k
	pH	mV	mV	pH		
pH Meter S/N.: 24H005160JEN	4.00	177.48	177	4.01	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	7.00	0.00	0	7.00	0.58	2.00
	10.00	-177.48	-177	10.01	0.58	2.00

Calibration Results

Function : pH Measurement

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

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement (±)	Coverage factor k
pH Electrode S/N.: 240904SIA605377	4.008	4.01	173	0.0071	2.00
	6.999	7.00	0	0.0092	2.00
	6.999	7.00	0	0.0085	2.00
	10.010	10.01	-173	0.0085	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No. : 240904SIA605377
Dimension of probe
- Length : 110 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
15.0	15.002	15.1	0.098	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
45.0	45.003	44.8	-0.203	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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Certificate of Testing

Cert.No.: 24TW258
Page.: 1 of 2

Equipment : DO Meter
Manufacturer : YSI Environmental
Model : Pro 20i
Serial No. : 24F101579
ID No. : UEA.EFM.048/2567(EFM.DO.03/67)
Received Date : 04 December 2024
Test Date : 06 December 2024
Reference : 2412-0102WSC-5
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 : Warakorn Lerngagtrakul
Approved by : 
Approved Signatory
() Unnopphol Harachai
() Ponpan Paipim
(✓) Saithip Meangmai
Issue Date : 09 December 2024



Cert.No.: 24TW258
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :
This certification is traceable to the International System of Unit through the reference standards
Laboratory of Industrial Calibration Center, Technology Promotion Association (Thailand-Japan).
- | Instruments | Serial No. | ID No. | Certificate No. | Due Date |
|-------------|------------|----------|-----------------|--------------|
| 1. Burette | - | 130BU10 | 23CG1172 | 22 Mar 2025 |
| 2. Balance | 14233821 | 110RC001 | 24MM131 | 04 July 2025 |

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.: 24E100431

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.20	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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
เอกสารไม่ควบคุม

เอกสารไม่ควบคุม



Certificate of Calibration

Cert. No.: 24LM189
Page.: 1 of 2

Equipment : DO Meter with Sensor
Manufacturer : YSI Environmental
Model : Pro 20i
Serial No. : 24F101579
ID No. : UAE.EFM.048/2567(EFM.DO.03/67)
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : TPA On Site Calibration Laboratory
Received Order : 04 December 2024
Calibrated Date : 06 December 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Warakorn Lerngagtrakul
Approved by : 
Approved Signatory
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat
Issue Date : 09 December 2024

The Uncertainties are for a confidence probability of approximately 95%

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.

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Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2412-0102WSC-6
Procedure Used :-

Cert. No.: 24LM189
Page.: 2 of 2

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

Condition of this result of calibration

1. Reference standard instrument:-
- | Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|------------------------|------------|-----------|-----------|-------------|
| 1) Digital Thermometer | 3240076 | 24I317 | TPA | 21 Mar 2025 |
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N.: 24E100431

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
15.0	80	15.003	15.0	-0.003	0.16	2.00
30.0	80	30.005	29.9	-0.105	0.16	2.00
45.0	80	45.004	44.9	-0.104	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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