

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือวิเคราะห์

การตรวจวัดคุณภาพสิ่งแวดล้อม
โครงการโรงงานผลิตขวดเหล็กเคลือบสังกะสี บริษัท ที เอส เอ็น ไวร์ จำกัด
ระหว่างเดือนกรกฎาคม-ธันวาคม พ.ศ. 2567

List of Instruments Certification for Environmental Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration* | Remark |
|--------------------------------------|--|--|-------------------------|--|---|---|---------------------|--------------------------|--------|
| Equipment for Air Quality Analysis | | | | | | | | | |
| 1 | Analytical Balance (Readability 0.001 mg) | Total Dust, บอเรนส์เตตรา เกลือโซเดียม เพนตะ Respirable Dust | Mettler-Toledo | XP6 / B322373893 | National Food Institute, Ministry of Industry, Thailand | 2402420-002-01 | 19 Apr 24 | 18 Apr 25 | - |
| 2 | Gas Chromatography (GC) | Methyl ethyl ketone | Agilent Technologies | System ID:CN11021007 7890 / CN11021007 | Agilent Technologies (Thailand) Co.,Ltd. | Preventive Maintenance Checklist | 21 Feb 24 | 19 Feb 25 | - |
| 3 | Ion Chromatography Anion (IC) | Oxalic Acid Hydrogen Chloride | Dionex | DionexAquiionRFIC / 220380031 | Archemica Lab Co.Ltd. | Qualification Report Anion (ID#1047) | 23 Apr 24 | 22 Apr 25 | - |
| 4 | Atomic Absorption Spectrometer (AAS) | Zine Oxide Furne | Agilent Technologies | System ID:G8432A AA240FS / MY13160001 | Thailand Institute of Scientific and Technological Research(TISTR) | MTC. ACL. No. 358/67 | 11 Mar 24 | 10 Mar 25 | - |
| 5 | Inductively Coupled Plasma (ICP) | | Agilent Technologies | System ID:G8015A G8015AA / MY18030001 | Agilent Technologies (Thailand) Co.,Ltd. | Preventive Maintenance Checklist | 4 Nov 24 | 3 Nov 25 | - |
| Equipment for Water Quality Analysis | | | | | | | | | |
| 6 | pH Meter | pH | Mettler-Toledo | Seven Easy S20 / 1231155210 | National Food Institute, Ministry of Industry, Thailand | 2401718-001-01 | 11 Mar 24 | 10 Mar 25 | - |
| 7 | pH Meter | | Mettler-Toledo | Seven Easy S20 / 1230525212 | DKSH (Thailand) Ltd. | C07240167 | 9 Apr 24 | 8 Apr 25 | - |
| 8 | Turbidity Meter | Turbidity | Oakton | T100IR / 1120501017 | Technology Promotion Association (Thailand-Japan) | 24CH1115 | 6 Sep 24 | 5 Sep 25 | - |
| 9 | UV-VIS Spectrophotometer | Colour, Nitrate (NO3), Cyanide Sulphate (SO4) | Agilent Technologies | Cary60 G6860A / MY15410009 | DQE Services Co.,Ltd. | SP24-018 | 7 May 24 | 6 May 25 | - |
| 10 | Analytical Balance (Readability 0.01 mg) | Total Dissolved Solids | Mettler-Toledo | XSR205DU / C210685394 | National Food Institute, Ministry of Industry, Thailand | 2402283-002-01 | 2 Apr 24 | 1 Apr 25 | - |

List of Instruments Certification for Environmental Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration* | Remark |
|-----|---|---|----------------------|---|--|--|---------------------|--------------------------|--------|
| 11 | Hot Air Oven | | Memmert | UF55 / B216.1666 | National Food Institute, Ministry of Industry, Thailand | 2500116-001-01 | 8 Oct 24 | 7 Oct 25 | - |
| 12 | Atomic Absorption Spectrophotometer (AAS) | Iron, Copper, Zinc, Arsenic, Lead, Cadmium Selenium, Mercury | Agilent Technologies | System ID:G8432A AA240FS / MY13160001 | Thailand Institute of Scientific and Technological Research(TISTR) | MTC.ACL.No 358/67 | 11 Mar 24 | 10 Mar 25 | - |
| 13 | Atomic Absorption Spectrophotometer (AAS) | | Perkin Elmer | PinAAcle 900F / PFBS20031902 | Perkin Elmer Co.,Ltd. | PinAAcle 900F Preventive Maintenance Report | 14 May 24 | 13 May 25 | - |
| 14 | Inductively Coupled Plasma (ICP) | | Agilent Technologies | System ID:G8015A G8015AA / MY18030001 | Agilent Technologies (Thailand) Co.,Ltd. | Preventive Maintenance Checklist | 4 Nov 24 | 3 Nov 25 | - |
| 15 | Incubator | Standard plate count <i>most probable number of coliform organism (MPN)</i> Total Coliform Bacteria <i>E. coli</i> | Binder | KB400 / 20200000015535 | Technology Promotion Association (Thailand-Japan) | 24TM647 | 1 Apr 24 | 31 Mar 25 | - |
| 16 | Incubator | | Memmert | IPP 260 / V616.0066 | Technology Promotion Association (Thailand-Japan) | 24TM650 | 2 Apr 24 | 1 Apr 25 | - |
| 17 | Water Bath | | Memmert | WNE 14 / L416.0606 | Technology Promotion Association (Thailand-Japan) | 24TM29 | 10 Feb 24 | 8 Feb 25 | - |
| 18 | Water Bath | | Memmert | WNE 14 / L416.0612 | Technology Promotion Association (Thailand-Japan) | 24TM30 | 10 Feb 24 | 8 Feb 25 | - |
| 19 | Auto Clave | | ALP | CL-40L / 807298 | National Food Institute, Ministry of Industry, Thailand | 2403982-001-01 | 7 Aug 24 | 6 Aug 25 | - |
| 20 | Auto Clave | | ALP | CL-40L / 808763 | National Food Institute, Ministry of Industry, Thailand | 2402281-001-01 | 2 Apr 24 | 1 Apr 25 | - |
| 21 | Analytical Balance | | OHAUS | PX623 / C236754745 | DKSH (Thailand) Ltd. | 2402419-001-01 | 19 Apr 24 | 18 Apr 25 | - |

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

Calibration Certificate

Certificate No.: 2402420-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

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Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XP6

Serial No.: 8322373893

ID No.: UAE.AIR.019/2556

Order No.: 2402420

Operation No.: 2402420-002

Date of Receipt: 19 April 2024

Date of Calibration: 19 April 2024

Calibrated by Mr. Pheraphat Tuanjit
Scientist

Approved by *P. Pongphak*
(Miss Preeyaporn Jaengkarnkit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 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.: 2402420-002-01
Equipment: Electronic Balance
Model: XP6
Serial No.: 8322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.000001 g
ID No.: UAE.AIR.019/2556

Page 3 of 3

Date of Calibration: 19 April 2024

Calibration Results: (Continued)

Calibration Range: 0-6 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

| Nominal Value (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (+g) | Coverage Factor K |
|----------------------|-----------------------|------------------------|-------------------|---------------------|----------------------|
| Unload | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 2.98 |
| 0.01 | 0.0099970 | 0.0099999 | -0.000002 | 0.0000047 | 2.98 |
| 0.05 | 0.0500010 | 0.0500003 | -0.0000007 | 0.0000048 | 2.98 |
| 0.10 | 0.1000010 | 0.1000001 | -0.0000009 | 0.0000049 | 2.98 |
| 0.15 | 0.1500010 | 0.1500002 | -0.0000008 | 0.0000049 | 2.98 |
| 0.17 | 0.1700010 | 0.1700006 | -0.0000004 | 0.0000012 | 2.98 |
| 0.20 | 0.1999990 | 0.2000002 | -0.0000008 | 0.0000048 | 2.98 |
| 1.50 | 1.4999750 | 1.4999771 | 0.0000021 | 0.0000027 | 2.98 |
| 3.00 | 2.9999680 | 2.9999699 | 0.0000019 | 0.0000028 | 2.98 |
| 4.50 | 4.4999610 | 4.4999627 | 0.0000017 | 0.0000022 | 2.98 |
| 6.00 | 5.9999490 | 5.9999531 | 0.0000041 | 0.0000032 | 2.98 |

P. Pongphak
23 April 2024

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

Calibration Report

Certificate No.: 2402420-002-01
Equipment: Electronic Balance
Model: XP6
Serial No.: 8322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.000001 g
ID No.: UAE.AIR.019/2556

Page 2 of 3

Date of Calibration: 19 April 2024
Environment Condition: Ambient Temperature: 22.6 ± 1.8 °C Relative Humidity: 48 ± 6.0 %
Place of Calibration: Room 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-RA-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 | 1-500mg | 15880 | TCS | M2311815 | 28 November 2024 |
| Standard Weight Class E2 | 1-500g | 15882 | TCS | M2311825 | 28 November 2024 |
| Instrument | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
| Thermo-Hygro Meter | 606-H1 | NFL8TH 015/23 | Quality Return | QR24-0492 | 4 March 2025 |

3. This certification is traceable to SI UNIT

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

5. The result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

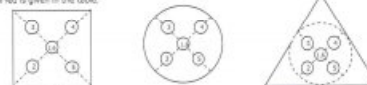
1. Repeatability of Reading:

| Nominal Value (g) | Standard Deviation of Reading (g) |
|-------------------|-----------------------------------|
| 3 | 0.00000057 |
| 6 | 0.0000019 |

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) |
| 1.999981 | 1.999983 | 1.999990 | 1.999984 | 1.999983 | 1.999981 | 0.000008 |

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

Calibration Report

Certificate No.: 2402420-002-01
Equipment: Electronic Balance
Model: XP6
Serial No.: 8322373893
Capacity: 6.1 g
Manufacturer: METTLER TOLEDO
Resolution: 0.000001 g
ID No.: UAE.AIR.019/2556

Page 3 of 3

Date of Calibration: 19 April 2024

Calibration Results: (Continued)

Calibration Range: 0-6 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

| Nominal Value (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (+g) | Coverage Factor K |
|----------------------|-----------------------|------------------------|-------------------|---------------------|----------------------|
| Unload | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 2.98 |
| 0.01 | 0.0099970 | 0.0099999 | -0.000002 | 0.0000047 | 2.98 |
| 0.05 | 0.0500010 | 0.0500003 | -0.0000007 | 0.0000048 | 2.98 |
| 0.10 | 0.1000010 | 0.1000001 | -0.0000009 | 0.0000049 | 2.98 |
| 0.15 | 0.1500010 | 0.1500002 | -0.0000008 | 0.0000049 | 2.98 |
| 0.17 | 0.1700010 | 0.1700006 | -0.0000004 | 0.0000012 | 2.98 |
| 0.20 | 0.1999990 | 0.2000002 | -0.0000008 | 0.0000048 | 2.98 |
| 1.50 | 1.4999750 | 1.4999771 | 0.0000021 | 0.0000027 | 2.98 |
| 3.00 | 2.9999680 | 2.9999699 | 0.0000019 | 0.0000028 | 2.98 |
| 4.50 | 4.4999610 | 4.4999627 | 0.0000017 | 0.0000022 | 2.98 |
| 6.00 | 5.9999490 | 5.9999531 | 0.0000041 | 0.0000032 | 2.98 |

P. Pongphak
23 April 2024

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

Agilent CrossLab Start Up Services Agilent 7890 Gas Chromatograph Preventive Maintenance Checklist

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 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 preventive maintenance activities.

Agilent CrossLab
PASS
NOT PASS
Remarks: *Agilent*
Signature: *Agilent*
Date: 8 Mar 24

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.

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>
- 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>.
- 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** <http://www.agilent.com/search/support>.
- Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- 7890B Manuals** are also available on Agilent.com:
 - Safety**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - Installation and First Startup**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Installation.pdf
 - Operation Manual**
https://www.agilent.com/cs/library/usermanuals/public/7890B_Operation.pdf
 - Maintaining Your GC**
https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf

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Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "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.**

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.

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System Information

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

| | |
|-------------------------------------|-----------------|
| Instrument System Name and ID | CN11021007 |
| Instrument System Site and Location | Instrument Room |

| List System Component Product Numbers | List the Serial Numbers of each Component |
|---------------------------------------|---|
| 1. G3440A | CN11021007 |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |
| 8. | |
| 9. | |
| 10. | |

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, settings as defined by current Service Notes.
- Check for required firmware updates and verify with customers if they would like them installed.
- Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.

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Preventive Maintenance Procedure

Clean and inspect GC

- Unplug power cord from the power source.
- Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- Inspect internal connectors for proper contact and placement.
- Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- Verify operation of all other fans - the inlet and EPC cooling fans.
- Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven.

Inlet and detector consumable replacement

- For the inlets installed, perform inlet maintenance as defined in the 7890 manual – "Maintaining Your GC" – for the inlet(s) installed.
- Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination – clean as necessary.

Zero Sensors and Leak test

- Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- Record if test passed or failed in the results table.

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ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support – clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values.
- ☒ Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout, if this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: 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.

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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 with the customer this service, parts replaced, and test results obtained.
- ☒ 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.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

| Detector Signal Outputs | Before PM Service | After PM Service |
|---------------------------------|----------------------|--------------------|
| Front detector output | NA. | NA. |
| Back detector output | NA. | 22.0 |
| AUX detector output | NA. | NA. |
| Pressure decay test | Expected test result | Actual test result |
| Front inlet pressure decay test | Pass | Pass |
| Back inlet pressure decay test | Pass | NA. |

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7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

| Part description | Part number | Product or model# where used | Quantity consumed |
|--|-------------|------------------------------|-------------------|
| SSL Capillary Inlet PM kit, Splitless | 5188-6497 | 7890A/B | 1 |
| SSL Capillary Inlet PM kit, split | 5188-6496 | 7890A/B | |
| SSL Capillary Ultra Inert Inlet Gold Seal with Washer | 5190-6144 | 7890A/B | |
| SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool | 5190-2293 | 7890A/B | |
| SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool | 5190-2295 | 7890A/B | |
| PP Inlet PM kit | 5188-6498 | 7890A/B | |
| Split vent trap PM kit, single cartridge (for MMI, PTV & V) | 5188-6495 | 7890A/B | |
| MMI Cleaning Kit | G3510-60820 | 7890A/B | |
| PTV Septumless Head Rebuild Kit | 5182-9747 | 7890A/B | |
| PTV Septumless Head Teflon Guide | 5182-9748 | 7890A/B | |
| Ignitor (glow plug) assembly with O-ring | 19231-60680 | 7890A/B | 1 |
| FID Collector Rebuild/Cleaning Kit | G1531-67000 | 7890A/B | |
| Standard .011-inch FID Jet for capillary FID base | G1531-80560 | 7890A/B | 1 |
| High Temperature .018-inch FID Jet for capillary FID base | G1531-80620 | 7890A/B | |
| Standard .018-inch FID Jet for packed column with packed FID base | 18710-20119 | 7890A/B | |
| Standard .011-inch FID Jet for capillary column with packed/adaptable FID base | 19244-80560 | 7890A/B | |
| High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base | 19244-80620 | 7890A/B | |
| NPD Jet, universal fit, .011-inch ID | G1534-80580 | 7890A/B | |
| NPD Jet, universal fit, .011-inch ID Extended tip | G1534-80590 | 7890A/B | |
| SSL Capillary Ultra Inert Inlet Gold Seal with Washer | 5190-6144 | 7890A/B | |
| SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool | 5190-2293 | 7890A/B | |
| **FID Collector Replacement Kit, if needed | G1531-67001 | 7890A/B | |

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Service Engineer Comments

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

Service Completion

Service request number 8006748380 Date service completed 21Feb2024

Agilent signature Phuwanal Yoktragul Customer signature

Total number of pages in this document 9

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Certificate of Calibration

Aquion: (Anion System ID#1047)

This certificate is to verify that instrument below are calibrated

By Archemica International Co., Ltd.

Aquion S/N: 220380031

AS-DV S/N: 2203880133

For

UAE Consultant Co., Ltd.



Operator Signature: *K. Channarong Khiao-un* Date: Apr 27, 2023

(Mr.Channarong Khiao-un)

Test Engineer

Uncontrolled Document

Qualification Report

PM Checklist: CM_OQ and PQ
Aquion: Anion (ID#1047)

For
UAE Consultant Co., Ltd.
(2nd Warranty)

Uncontrolled Document

PM

Preventive Maintenance Check List



Checklist ICS Preventive Maintenance

Dionex Ion Chromatography Preventive Maintenance Report

| Customer Organization | Name/ Department |
|--|------------------|
| United Analyst and Engineering Consultant Co.,Ltd. (2 nd Warranty) | Khun.Suwanna |
| Engineer | Date |
| Mr.Channarong Khiao-Un | 27/Apr/2023 |

Instrument Detail

| Instrument Model | Application |
|-----------------------|---------------|
| Aquion (ID#1047) | Anion |
| Instrument components | Serial Number |
| Aquion | 220380031 |
| AS-DV Autosampler | 2203880133 |
| | |
| | |

Consumable Detail

| Columns | Guard Columns | Suppressors | Concentrators | Etc. |
|-----------|---------------|-------------|---------------|-------------|
| AS18 | AG18 | ADRS600 | - | EGC III KOH |
| | | | | CR-ATC |
| | | | | |
| Remark: - | | | | |

Perform By
Archemica International Co.,Ltd

K. Channarong Khiao-un
Archemica International
Date 27/Apr/2023



Sumra
Customer
Date 27/Apr/2023

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General ICS Maintenance Checklist

| Item | Description | Result | | Recommended replacement | N.A. |
|------|--|-------------------------------------|--------------------------|------------------------------------|-------------------------------------|
| | | Check | Fail | | |
| 1 | Power line 220 Vac | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 2 | Pneumatic Line | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 3 | Pressure outlet 80-100 psi | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 4 | Barbed fitting and tee fitting | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 5 | Crimped and blocked tubing | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 6 | Check Rheodyne Valve for Leak • Stator face • Rotor Seal | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Every 12 months Every 12 months | <input type="checkbox"/> |
| 7 | Slider valve for leak | <input type="checkbox"/> | <input type="checkbox"/> | - | <input checked="" type="checkbox"/> |
| 8 | Inspect slider | <input type="checkbox"/> | <input type="checkbox"/> | - | <input checked="" type="checkbox"/> |
| 9 | Inspect port face | <input type="checkbox"/> | <input type="checkbox"/> | - | <input checked="" type="checkbox"/> |
| 10 | Inspect pressure bolt | <input type="checkbox"/> | <input type="checkbox"/> | - | <input checked="" type="checkbox"/> |
| 11 | Inspect fitting and ferrule | <input type="checkbox"/> | <input type="checkbox"/> | - | <input checked="" type="checkbox"/> |
| 12 | Suppressor for leak | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 13 | Cell for leak | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 14 | Electronic cable connected | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 15 | Column selection valve for leak | <input type="checkbox"/> | <input type="checkbox"/> | - | <input checked="" type="checkbox"/> |
| 16 | Inspect all fitting and line | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 17 | Check Eluent reservoir | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 18 | Inspect cap o-ring | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 19 | Inspect air for leak | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 20 | Pump Piston Rinse Seal | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Every 6 months | <input type="checkbox"/> |
| 21 | Piston Seals | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Every 6 months | <input type="checkbox"/> |
| 22 | Pump Lubricate | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Lubricate | <input type="checkbox"/> |
| 23 | Front panel test | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 24 | Low limit alarm | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 25 | Hi limit alarm | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 26 | Conductivity electronic test 180 \pm 1 uS | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 27 | Check noise for suppressor (pk to pk <0.005uS) | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 28 | Check column • Check bed support | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Every 6 months | <input type="checkbox"/> |
| 29 | Check pump | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 30 | Check suppressor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 31 | Check cell | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 32 | Check leak sensor | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 33 | Flow rate | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 34 | System pressure | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |
| 35 | Detector background | <input checked="" type="checkbox"/> | <input type="checkbox"/> | Check | <input type="checkbox"/> |

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CM OQ

Chromeleon

Operation Qualification

Seq: ChromeleonLocalArchemica\Warranty\2nd War 27-Apr-2023\Station Qual 2023-04-27
Page 1 of 12

SOFTWARE OQ

ThermoFisher
SCIENTIFIC

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>K. Channarong Khiao</i> | <i>Channarong Khiao</i> |
| Date: 27/Apr/2023 | Date: 27/Apr/2023 |

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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 |
|-----------------|---------------------|----|

Channarong Khiao 27/Apr/2023
Reviewer's Signature // Date*K. Channarong Khiao* 27/Apr/2023
Operator's Signature // Date

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Chromeleon Operational Qualification, Part 1
Verification of Selected Results

Detection Algorithm: Cobra
Calibration Type: Lin, WithOffset
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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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 (AJA) | 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

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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 |
| | ProcessingMethod | | ok |
| Chromatogram | 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 |

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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 |
| | Rel.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 |



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 |



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 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 |
| | | | |



Chromeleon Operational Qualification, Part 2

Most Frequently Used Parameters: Comparison with Expected Results

| Variable Category | Report Variable | Peak Name | Status |
|-------------------|-----------------|---------------|--------|
| Peak Purity | PP1 | Acetanilide | ok |
| | PP1 | Acetophenone | ok |
| | PP1 | Propiophenone | ok |
| | RSD PP1 | Acetanilide | ok |
| | RSD PP1 | Acetophenone | ok |
| | RSD PP1 | 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 Test Case | Number | ok |
| | Name | ok |
| | 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 |
| | Inj. Eval. Result | ok |
| System Suitability Test Case Result | 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 Result: Passed

PQ

Performance Qualification

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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 |

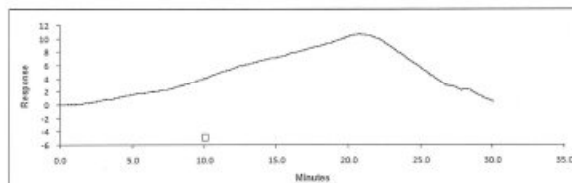
Standards/Chemicals

| Description | Manufacturer | Concentration | Part Number | Lot Number | Expiration Date |
|-------------|-------------------|---------------|-------------|------------|-----------------|
| Nitrate | Thermo Scientific | 5 ppm | 060254 | 220701 | Jul-2023 |
| Nitrate | Thermo Scientific | 10 ppm | 060254 | 220701 | Jul-2023 |
| Nitrate | Thermo Scientific | 25 ppm | 060254 | 220701 | Jul-2023 |
| Nitrate | Thermo Scientific | 50 ppm | 060254 | 220701 | Jul-2023 |
| Nitrate | Thermo Scientific | 100 ppm | 060254 | 220701 | Jul-2023 |
| Nitrate | Thermo Scientific | 1000 ppm | 060254 | 220701 | Jul-2023 |
| 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>K. Chuanabong</i> | <i>Simon</i> |
| Date: 27/Apr/2023 | Date: Apr 27, 2023 |

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Information

| | |
|-------------|--|
| System Name | AquionRFIC |
| Detector SN | 220360045 |
| Data Path | chrom://desktop-c4fs317/ChromleonLocal/Archemica/Warranty/2nd War 27-Apr-2023/Anion/IC OQ.seq/878.smp/ECD_1.channel/ECD_1.chm |

Noise and Drift

| Test | Measured (nS) | OQ Limit (nS) | Result | Conversion Factor |
|-------|---------------|---------------|--------|-------------------|
| Noise | 1.6 nS | ≤ 2.0 nS | PASS | 1000 |
| Drift | 10.9 nS/hr | ≤ 20.0 nS/hr | PASS | 1000 |

OVERALL TEST RESULT: PASS



| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>K. Chuanabong</i> | <i>Simon</i> |
| Date: 27/Apr/2023 | Date: Apr 27, 2023 |

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Information

| | |
|-------------|---|
| System Name | AquionRFIC |
| Detector SN | 220360045 |
| Data Path | ChromleonLocal/Archemica/Warranty/2nd War 27-Apr-2023/Anion/IC OQ |

Peak Results

| Sample Name | Injection Volume (µL) | Retention Time (min) | Area |
|--------------|-----------------------|----------------------|-------|
| Nitrate - CD | 25 | 0.27 | 2.903 |
| Nitrate - CD | 25 | 0.2683 | 2.905 |
| Nitrate - CD | 25 | 0.27 | 2.924 |
| Nitrate - CD | 25 | 0.27 | 2.908 |
| Nitrate - CD | 25 | 0.2683 | 2.905 |
| Nitrate - CD | 25 | 0.27 | 2.925 |

Repeatability

| Test | Measured (% RSD) | OQ Limit (% RSD) | Result |
|----------------|------------------|------------------|--------|
| Retention Time | 0.3 | ≤ 5.0 | PASS |
| Area | 0.3 | ≤ 1.0 | PASS |

OVERALL TEST RESULT: PASS



| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>K. Chuanabong</i> | <i>Simon</i> |
| Date: 27/Apr/2023 | Date: Apr 27, 2023 |

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Information

| | |
|-------------|---|
| System Name | AquionRFIC |
| Detector SN | 220360045 |
| Data Path | ChromleonLocal/Archemica/Warranty/2nd War 27-Apr-2023/Anion/IC OQ |

Peak Results

| Sample Name | Injection Volume (µL) | Retention Time (min) | Area |
|-----------------|-----------------------|----------------------|--------|
| Reference Blank | 25 | 0.2683 | 0.01 |
| High Standard | 25 | 0.27 | 55.572 |
| Carryover | 25 | 0.27 | 0.01 |

Results

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

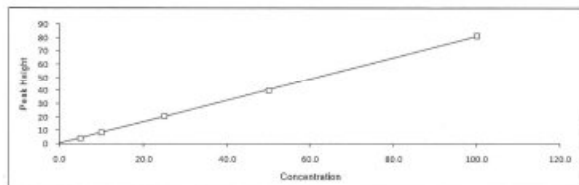
OVERALL TEST RESULT: PASS



| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>K. Chuanabong</i> | <i>Simon</i> |
| Date: 27/Apr/2023 | Date: Apr 27, 2023 |

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DETECTOR LINEARITY (CD)

ThermoFisher
SCIENTIFIC


Information

| | |
|-------------|--|
| System Name | AquionRFIC |
| Detector SN | 220360045 |
| Data Path | ChromleonLocal\Archemica\Warranty\2nd War 27-Apr-2023\ArionIC_OQ |

Peak Results

| Sample Name | Concentration | Peak Height | Calculated |
|-----------------------|---------------|-------------|------------|
| Detector Linearity 01 | 5 | 4.25 | 4.87 |
| Detector Linearity 02 | 10 | 8.475 | 10.10 |
| Detector Linearity 03 | 25 | 20.977 | 25.58 |
| Detector Linearity 04 | 50 | 40.049 | 49.19 |
| Detector Linearity 05 | 100 | 81.296 | 100.26 |

Linearity

| Test | Observed | OQ Limit | Result |
|-------|----------|--------------|--------|
| r^2 | 1.000 | ≥ 0.999 | PASS |

OVERALL TEST RESULT: PASS



| | |
|---|---------------------|
| Field Service Representative Signature: | Customer Signature: |
| <i>R. Guana</i> | <i>Sunon</i> |
| Date: 27/Apr/2023 | Date: Apr 27, 2023 |

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ELUENT GENERATOR TEST

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EG Current Test

| Set Point (mM) | Expected (mA) | Reading (mA) | Deviation (mA) | OQ Limit (mA) | Result |
|----------------|---------------|--------------|----------------|---------------|--------|
| 1.00 | 1.6082 | 1.6083 | 0.00 | ± 0.01 | PASS |
| 5.00 | 8.041 | 8.042 | 0.00 | ± 0.05 | PASS |
| 10.00 | 16.082 | 16.083 | 0.00 | ± 0.10 | PASS |
| 50.00 | 80.41 | 80.42 | 0.01 | ± 0.50 | PASS |
| 100.00 | 160.82 | 160.84 | 0.02 | ± 1.00 | PASS |

OVERALL TEST RESULT: PASS



| | |
|---|---------------------|
| Field Service Representative Signature: | Customer Signature: |
| <i>R. Guana</i> | <i>Sunon</i> |
| Date: 27/Apr/2023 | Date: Apr 27, 2023 |

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IC PUMP FLOW RATE ACCURACY

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IC Pump Flow Rate

| Set Point (mL) (mL/min) | Reading (mL/min) | Deviation (%) | OQ Limit (%) | Result |
|-------------------------|------------------|---------------|--------------|--------|
| 0.5 | 0.4999 | 0.020 | ± 2.0 | PASS |
| 1.0 | 0.9989 | 0.11 | ± 2.0 | PASS |

OVERALL TEST RESULT: PASS



| | |
|---|---------------------|
| Field Service Representative Signature: | Customer Signature: |
| <i>R. Guana</i> | <i>Sunon</i> |
| Date: 27/Apr/2023 | Date: Apr 27, 2023 |

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TEMPERATURE ACCURACY

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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>R. Guana</i> | <i>Sunon</i> |
| Date: 27/Apr/2023 | Date: Apr 27, 2023 |

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OQ EXCEPTIONS AND COMMENTS

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N/A

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| Field Service Representative Signature: | Customer Signature: |
|---|---------------------|
| <i>K. Channarong</i> | <i>Sutera</i> |
| Date: 07/Apr/2023 | Date: Apr 29, 2023 |

RPG Reports v2.058
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OQ Exceptions and Comments Report Page 1 of 1

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Certificate

Certificate of Standards and
Instruments for Qualification

OQ REVIEW AND COMPLETION

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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. Channarong</i> | <i>Sutera</i> |
| Date: 27/Apr/2023 | Date: Apr 29, 2023 |

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Certificate of Analysis

Better Separations Through
Better ChemistryDionex Nitrate OQ/PQ IC Standards Kit
(Set of 6)Product Number 660254
Certificate of Analysis

Lot Number 220701

Expiration of Certification
July 2023

The Dionex Nitrate Standard was developed to aid the analysis of anions by Ion Chromatography (IC). The single-ion standard was prepared by the dissolution of high-purity salt in ≥ 18.2 megohm deionized water, which was tested by IC for ionic contaminants. The bottle label states the nominal concentration value of the ionic component for informational purposes only. The actual ion concentration value was determined by Ion Chromatography. The IC system was standardized using the National Institute of Standards & Technology (NIST), Standard Reference Material, SRM 3185 (Nitrate Standard Solution). Actual concentration values determined for the single-ion is listed below.

Dionex Nitrate Standard

| Vial # | Concentration (mg/L) |
|--------|----------------------|
| 1 | 5.02 \pm 0.02 |
| 2 | 9.86 \pm 0.05 |
| 3 | 25.02 \pm 0.11 |
| 4 | 50.54 \pm 0.29 |
| 5 | 100.0 \pm 1 |
| 6 | 1014 \pm 5 |



The concentration value is based a proven reliable method of analysis. The estimated uncertainties are two standard deviations of the concentration value. The concentration value is warranted to be stable for one year from the date of manufacture.

The preparation and analyses of the Dionex Nitrate Standard was performed with extreme care by Thermo Scientific Corporation Consumables Manufacturing Department in Sunnyvale California.

Document No. 078990-01 20-Dec-2011

thermoscientific.com/dionex

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JCG1140-EN 03/05 03/10-10

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(408) 737-4700

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CALIBRATION CERTIFICATE

Certificate No. EL221989
Job No. 22120052
Page 1 of 5

Customer Name: Archemica Lab Co., Ltd.
Customer Address: 39 Soi Sukhumvit 63 (Ekkamai) Sukhumvit Rd.,
Nort Klongton, Wattana,
Bangkok 10110.

Instrument Description: TRUE RMS MULTIMETER
Manufacturer: FLUKE
Model No.: 289
Serial Number: 27970244

Received Date: 19 Dec 2022
Calibrated Date: 19 Dec 2022
Issued Date: 19 Dec 2022

Tag No.:
Service:
Condition As Received: Used

Calibration Procedure.
Calibration were conducted using in-house calibration procedure according to direct measurement with reference standard.

Procedure No.
CP-EL-01, 02, 03, 04, 05, 06, 07, 10.

Comment.

Reference Standards Instrument.


| Instrument Name | Model | Serial No. | Cert. No. | Due Date. |
|---------------------------|-------------|------------|------------|-------------|
| Multi-Function Calibrator | Fluke 5522A | 2177904 | EE-0011-22 | 01 Feb 2023 |

Traceability Information.
- Traceable to the International System of Units (SI) through the National Institute of Metrology (Thailand), NIMT.

Environmental Conditions.
Temperature: (23 ± 3) °C Relative Humidity: (50 ± 15) %

Calibration Information.
- The result of calibration was found accurate as show on date and place of calibration only.
- The reported uncertainty of measurement is based on standard uncertainty multiplied by a coverage factor k = 2, providing confidence level of approximately 95%.

Calibrated by: Mr.Suputthas Prapalai

Approved By: 
Approved Signatory:
() Mr. Phitsanu Wangchai
() Mr. Tanawat Sirpisalee

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CALIBRATION CERTIFICATE

Certificate No. EL221989
Page. 2 of 5

| Range | Standard Value | UUC* Reading | Error | (±) Uncertainty |
|---|----------------|-----------------|-----------|-----------------|
| Function : DC Voltage Measurement (Without Adjustment) | | | | |
| 50 mV | 0.0000 mV | 0.0000 mV | 0.000 mV | 0.0016 mV |
| 50 mV | 5.0000 mV | 5.0000 mV | 0.000 mV | 0.0016 mV |
| 50 mV | 45.0000 mV | 44.995 mV | -0.005 mV | 0.0022 mV |
| 50 mV | -45.0000 mV | -45.002 mV | -0.002 mV | 0.0022 mV |
| 500 mV | 50.0000 mV | 50.00 mV | 0.00 mV | 0.0061 mV |
| 500 mV | 450.000 mV | 450.01 mV | 0.01 mV | 0.0080 mV |
| 500 mV | -450.000 mV | -450.00 mV | 0.00 mV | 0.0080 mV |
| 5 V | 0.50000 V | 0.50000 V | 0.0000 V | 0.00059 V |
| 5 V | 4.50000 V | 4.5000 V | 0.0000 V | 0.00082 V |
| 5 V | -4.50000 V | -4.5002 V | -0.0002 V | 0.00082 V |
| 50 V | 5.00000 V | 5.000 V | 0.000 V | 0.00059 V |
| 50 V | 45.0000 V | 45.000 V | 0.000 V | 0.00095 V |
| 50 V | -45.0000 V | -45.001 V | -0.001 V | 0.00095 V |
| 500 V | 50.0000 V | 50.00 V | 0.00 V | 0.0059 V |
| 500 V | 450.000 V | 450.02 V | 0.02 V | 0.0095 V |
| 500 V | -450.000 V | -450.02 V | -0.02 V | 0.0095 V |
| 1000 V | 100.0000 V | 100.0 V | 0.0 V | 0.058 V |
| 1000 V | 900.000 V | 900.0 V | 0.0 V | 0.060 V |
| 1000 V | -900.000 V | -900.0 V | 0.0 V | 0.060 V |
| Function : DC Voltage Measurement LoZ (Without Adjustment) | | | | |
| 1000 V | 0.000000 V | 0.0 V | 0.0 V | 0.058 V |
| 1000 V | 100.0000 V | 100.0 V | 0.0 V | 0.058 V |
| 1000 V | 900.000 V | 900.6 V | 0.6 V | 0.060 V |
| 1000 V | -900.000 V | -900.6 V | -0.6 V | 0.060 V |
| Function : AC Voltage Measurement (Without Adjustment) | | | | |
| 50 mV | 5.000 mV | 50 Hz 5.008 mV | 0.008 mV | 0.0053 mV |
| 50 mV | 45.000 mV | 50 Hz 45.061 mV | 0.061 mV | 0.013 mV |
| 500 mV | 50.000 mV | 50 Hz 50.10 mV | 0.10 mV | 0.014 mV |
| 500 mV | 450.00 mV | 50 Hz 450.62 mV | 0.62 mV | 0.11 mV |
| 5 V | 0.50000 V | 50 Hz 0.5013 V | 0.0013 V | 0.00012 V |
| 5 V | 4.5000 V | 50 Hz 4.5086 V | 0.0086 V | 0.0011 V |
| 50 V | 5.0000 V | 50 Hz 5.014 V | 0.014 V | 0.0012 V |
| 50 V | 45.000 V | 50 Hz 45.080 V | 0.080 V | 0.0085 V |
| 500 V | 50.000 V | 50 Hz 50.13 V | 0.13 V | 0.011 V |
| 500 V | 450.00 V | 50 Hz 450.44 V | 0.44 V | 0.12 V |
| 1000 V | 100.000 V | 50 Hz 100.1 V | 0.1 V | 0.060 V |
| 1000 V | 900.00 V | 50 Hz 900.6 V | 0.6 V | 0.23 V |

Remark : (*) UUC : Unit Under Calibration

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CALIBRATION CERTIFICATE

Certificate No. EL221989
Page. 3 of 5

| Range | Standard Value | UUC* Reading | Error | (±) Uncertainty |
|---|----------------|-----------------|-----------|-----------------|
| Function : AC Voltage Measurement LoZ (Without Adjustment) | | | | |
| 1000 V | 100.000 V | 50 Hz 100.5 V | 0.5 V | 0.060 V |
| 1000 V | 900.00 V | 50 Hz 905.2 V | 5.2 V | 0.23 V |
| Function : DC Current Measurement (Without Adjustment) | | | | |
| 500 uA | 0.000 uA | 0.00 uA | 0.00 uA | 0.017 uA |
| 500 uA | 50.000 uA | 50.01 uA | 0.01 uA | 0.023 uA |
| 500 uA | 450.00 uA | 450.07 uA | 0.07 uA | 0.078 uA |
| 5000 uA | 500.00 uA | 500.1 uA | 0.1 uA | 0.097 uA |
| 5000 uA | 4500.0 uA | 4500.7 uA | 0.7 uA | 0.57 uA |
| 50 mA | 5.0000 mA | 5.0000 mA | 0.0000 mA | 0.00082 mA |
| 50 mA | 45.0000 mA | 45.003 mA | 0.003 mA | 0.0058 mA |
| 400 mA | 40.000 mA | 40.00 mA | 0.00 mA | 0.0077 mA |
| 400 mA | 360.00 mA | 360.00 mA | 0.00 mA | 0.090 mA |
| 5 A | 0.50000 A | 0.5015 A | 0.0015 A | 0.00013 A |
| 5 A | 4.5000 A | 4.5120 A | 0.0120 A | 0.0022 A |
| 10 A | 1.00000 A | 1.003 A | 0.003 A | 0.00061 A |
| 10 A | 9.0000 A | 9.022 A | 0.022 A | 0.0040 A |
| Function : AC Current Measurement (Without Adjustment) | | | | |
| 500 uA | 50.00 uA | 50 Hz 49.96 uA | -0.02 uA | 0.13 uA |
| 500 uA | 450.00 uA | 50 Hz 450.02 uA | 0.02 uA | 0.48 uA |
| 5000 uA | 500.00 uA | 50 Hz 500.7 uA | 0.7 uA | 0.51 uA |
| 5000 uA | 4500.0 uA | 50 Hz 4502.0 uA | 2.0 uA | 3.1 uA |
| 50 mA | 5.0000 mA | 50 Hz 5.002 mA | 0.002 mA | 0.0032 mA |
| 50 mA | 45.0000 mA | 50 Hz 44.982 mA | -0.018 mA | 0.031 mA |
| 400 mA | 40.000 mA | 50 Hz 40.03 mA | 0.03 mA | 0.029 mA |
| 400 mA | 360.00 mA | 50 Hz 360.08 mA | 0.08 mA | 0.22 mA |
| 5 A | 0.50000 A | 50 Hz 0.5020 A | 0.0020 A | 0.00028 A |
| 5 A | 4.5000 A | 50 Hz 4.5128 A | 0.0128 A | 0.0038 A |
| 10 A | 1.00000 A | 50 Hz 1.006 A | 0.006 A | 0.00075 A |
| 10 A | 9.0000 A | 50 Hz 9.031 A | 0.031 A | 0.0059 A |

Remark : (*) UUC : Unit Under Calibration

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CALIBRATION CERTIFICATE

Certificate No. EL221989
Page. 4 of 5

| Range | Standard Value | UUC* Reading | Error | (±) Uncertainty |
|---|----------------|--------------|------------|-----------------|
| Function : Resistance Measurement (Without Adjustment) | | | | |
| 500 Ω | 0.0000 Ω | 0.00 Ω | 0.00 Ω | 0.0075 Ω |
| 500 Ω | 50.0000 Ω | 49.99 Ω | -0.01 Ω | 0.0084 Ω |
| 500 Ω | 450.000 Ω | 449.83 Ω | -0.17 Ω | 0.017 Ω |
| 5 kΩ | 0.50000 kΩ | 0.5000 kΩ | 0.0000 kΩ | 0.00060 kΩ |
| 5 kΩ | 4.50000 kΩ | 4.4997 kΩ | -0.0003 kΩ | 0.00017 kΩ |
| 50 kΩ | 5.00000 kΩ | 5.000 kΩ | 0.000 kΩ | 0.00060 kΩ |
| 50 kΩ | 45.0000 kΩ | 45.006 kΩ | 0.006 kΩ | 0.0017 kΩ |
| 500 kΩ | 50.0000 kΩ | 50.00 kΩ | 0.00 kΩ | 0.0060 kΩ |
| 500 kΩ | 450.000 kΩ | 449.99 kΩ | -0.01 kΩ | 0.018 kΩ |
| 5 MΩ | 0.50000 MΩ | 0.5000 MΩ | 0.0000 MΩ | 0.00061 MΩ |
| 5 MΩ | 4.50000 MΩ | 4.5006 MΩ | 0.0006 MΩ | 0.00056 MΩ |
| 30 MΩ | 3.00000 MΩ | 3.000 MΩ | 0.000 MΩ | 0.00061 MΩ |
| 50 MΩ | 27.00000 MΩ | 26.990 MΩ | -0.010 MΩ | 0.0075 MΩ |
| 50 MΩ | 5.00000 MΩ | 5.00 MΩ | 0.00 MΩ | 0.0059 MΩ |
| 50 MΩ | 45.0000 MΩ | 44.98 MΩ | -0.02 MΩ | 0.021 MΩ |
| 100 MΩ | 10.00000 MΩ | 10.0 MΩ | 0.0 MΩ | 0.058 MΩ |
| 100 MΩ | 90.0000 MΩ | 89.9 MΩ | -0.1 MΩ | 0.069 MΩ |
| 500 MΩ | 250.0000 MΩ | 249.6 MΩ | -0.4 MΩ | 0.58 MΩ |
| 500 MΩ | 450.000 MΩ | 448.5 MΩ | -1.5 MΩ | 5.9 MΩ |
| Function : Resistance Measurement LoZ (Without Adjustment) | | | | |
| 50 Ω | 0.0000 Ω | 0.000 Ω | 0.000 Ω | 0.0050 Ω |
| 50 Ω | 5.0000 Ω | 4.997 Ω | -0.003 Ω | 0.0050 Ω |
| 50 Ω | 25.0000 Ω | 24.991 Ω | -0.009 Ω | 0.0050 Ω |
| 50 Ω | 45.0000 Ω | 44.968 Ω | -0.032 Ω | 0.0050 Ω |
| Function : Capacitance Measurement (Without Adjustment) | | | | |
| 1 nF | 0.0000 nF | 0.000 nF | 0.000 nF | 0.0078 nF |
| 1 nF | 0.5000 nF | 0.497 nF | -0.003 nF | 0.0098 nF |
| 1 nF | 0.9000 nF | 0.896 nF | -0.004 nF | 0.012 nF |
| 10 nF | 1.0000 nF | 1.00 nF | 0.00 nF | 0.013 nF |
| 10 nF | 9.0000 nF | 9.01 nF | 0.01 nF | 0.029 nF |
| 100 nF | 10.0000 nF | 10.0 nF | 0.0 nF | 0.064 nF |
| 100 nF | 90.000 nF | 90.0 nF | 0.0 nF | 0.29 nF |
| 1 μF | 0.100000 μF | 0.100 μF | 0.000 μF | 0.00064 μF |
| 1 μF | 0.900000 μF | 0.900 μF | 0.000 μF | 0.0029 μF |
| 10 μF | 1.00000 μF | 1.00 μF | 0.00 μF | 0.0064 μF |
| 10 μF | 9.00000 μF | 9.00 μF | 0.00 μF | 0.028 μF |
| 100 μF | 10.0000 μF | 10.0 μF | 0.0 μF | 0.064 μF |
| 100 μF | 90.0000 μF | 90.0 μF | 0.0 μF | 0.42 μF |
| 1000 μF | 100.000 μF | 100 μF | 0 μF | 0.72 μF |
| 1000 μF | 900.000 μF | 900 μF | 0 μF | 4.2 μF |
| 10 mF | 1.00000 mF | 1.00 mF | 0.00 mF | 0.0072 mF |
| 10 mF | 9.00000 mF | 8.99 mF | -0.01 mF | 0.043 mF |
| 100 mF | 10.0000 mF | 10.0 mF | 0.0 mF | 0.072 mF |
| 100 mF | 90.0000 mF | 89.9 mF | -0.1 mF | 0.89 mF |

Remark : (*) UUC : Unit Under Calibration

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CALIBRATION CERTIFICATE

Certificate No. **EL221989**
Page **5 of 5**

| Range | Standard Value | UUC* Reading | Error | (±) Uncertainty |
|--|----------------|--------------|------------|-----------------|
| Function : Frequency Measurement (Without Adjustment) | | | | |
| 100 Hz | 10.00 Hz | 10.00 Hz | 0.00 Hz | 0.0058 Hz |
| 100 Hz | 90.00 Hz | 90.00 Hz | 0.00 Hz | 0.0058 Hz |
| 1000 Hz | 100.00 Hz | 100.00 Hz | 0.00 Hz | 0.0058 Hz |
| 1000 Hz | 900.00 Hz | 900.00 Hz | 0.00 Hz | 0.0058 Hz |
| 10 kHz | 1.0000 kHz | 1.0000 kHz | 0.0000 kHz | 0.000058 kHz |
| 10 kHz | 9.0000 kHz | 9.0000 kHz | 0.0000 kHz | 0.000058 kHz |
| 100 kHz | 10.0000 kHz | 10.0000 kHz | 0.0000 kHz | 0.000058 kHz |
| 100 kHz | 90.0000 kHz | 90.0000 kHz | 0.0000 kHz | 0.000058 kHz |
| 1000 kHz | 100.0000 kHz | 100.0000 kHz | 0.0000 kHz | 0.0058 kHz |
| 1000 kHz | 500.00 kHz | 500.00 kHz | 0.00 kHz | 0.0058 kHz |

| Range | Standard Value | Required UUC* Reading | UUC* Reading | Error | (±) Uncertainty |
|--|----------------|-----------------------|--------------|--------|-----------------|
| Function : Thermocouple Measurement K Type (Without Adjustment) | | | | | |
| -200 to 1350 °C | -5.550 mV | -180.0 °C | -179.4 °C | 0.6 °C | 0.37 °C |
| -200 to 1350 °C | 0.000 mV | 0.0 °C | 0.2 °C | 0.2 °C | 0.24 °C |
| -200 to 1350 °C | 4.096 mV | 100.0 °C | 100.2 °C | 0.2 °C | 0.22 °C |
| -200 to 1350 °C | 24.905 mV | 600.0 °C | 600.3 °C | 0.3 °C | 0.22 °C |
| -200 to 1350 °C | 37.326 mV | 900.0 °C | 900.3 °C | 0.3 °C | 0.22 °C |
| -200 to 1350 °C | 48.838 mV | 1200.0 °C | 1200.4 °C | 0.4 °C | 0.23 °C |

Remark : (*) UUC : Unit Under Calibration

END OF CALIBRATION

ACQUICIA
19/11-12, Sukhumvit Rd., Nonthaburi, Muang Rayong, Rayong 21150, Thailand
Tel. +66(38) 694 145-8, Fax. +66(38) 694 149
29/Apr/2023

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CALIBRATION CERTIFICATE

Certificate No. **TL220241**
Job No. **22120052**
Page **1 of 2**

Customer Name : **Archimex Lab Co., Ltd.**
Customer Address : **39 Soi Sukhumvit 63 (Bamnet) Sukhumvit Rd., North Klongton, Whangthani, Bangkok 10110.**

Received Date : **19 Dec 2022**
Calibrated Date : **20 Dec 2022**
Issued Date : **20 Dec 2022**

Instrument Description : **Digital Thermometer with Sensor**
Manufacturer : **FLUKE**
Model No. : **289**
Serial Number : **2790244**

Tag No. : **-**
Service : **-**
Condition As Received : **Used Item**

Calibration Procedure.
Calibration were conducted using in-house calibration procedure according to comparison measurement with Platinum Resistance Thermometer (PRT) into temperature source.

Procedure No.
CP-TL-01

Comment.

| Reference Standards Instrument | Model | Serial No. | Cert No. | Due Date |
|---------------------------------|-------|------------|------------|-------------|
| Platinum Resistance Thermometer | 5645 | 565332 | TT-5075-22 | 15 Jun 2023 |
| Platinum Resistance Thermometer | 5609 | 09065 | 4500613872 | 01 Jun 2023 |
| Thermometer Readout | 1509 | 853280 | 22E2512 | 04 Aug 2023 |

Traceability Information.
The temperature scale used was based on ITS-90.
This certification is traceable to the International System of Units (SI).

Environmental Conditions
Temperature : **(23 ± 3) °C** Relative Humidity : **(50 ± 15) %RH**

Calibration Information.
The result of calibration was found accurate as show on date and place of calibration only.
The reported uncertainty of measurement is based on standard uncertainty multiplied by a coverage factor (k), providing confidence level of approximately 95%.

Calibrated by : **Nattapon Sirasoon**

ACQUICIA
19/11-12, Sukhumvit Rd., Nonthaburi, Muang Rayong, Rayong 21150, Thailand
Tel. +66(38) 694 145-8, Fax. +66(38) 694 149
29/Apr/2023

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SYSTRONICS CO., LTD.
19/11-12, Sukhumvit Rd., Nonthaburi, Muang Rayong, Rayong 21150, Thailand
Tel. +66(38) 694 145-8, Fax. +66(38) 694 149

CALIBRATION CERTIFICATE

Certificate No. **TL220241**
Page **2 of 2**

Result of Calibration: (Without Adjustment)

Parameter Setting : **OFFSET = 0.0**
Sensor of UUC* : **Thermocouple Wire** Type : **K** Serial No. : **-** ID/Tag No. : **22975244**
Dimension : Length : **1000** mm Diameter : **1.5** mm

| Immersion Depth mm | Standard Reading °C | UUC* Reading °C | Correction Value °C | Uncertainty of Measurement (u) °C | Coverage Factor k = |
|--------------------|---------------------|-----------------|---------------------|-----------------------------------|---------------------|
| 150 | 0.0000 | 1.9 | -1.9 | 0.50 | 2.00 |
| 150 | 48.9961 | 50.8 | -0.8 | 0.50 | 2.00 |
| 150 | 100.0015 | 100.5 | -0.5 | 0.50 | 2.00 |

UUC* : Unit Under Calibration

END OF CERTIFICATE

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Thermo SCIENTIFIC
CERTIFICATE OF CONFORMITY
IC QUALIFICATION TEST BOX II

This certificate validates that the product values referenced below meet or exceed all Thermo Scientific functional specifications and release requirements.

Instrument Serial Number : **21379153**
Instrument Part Number : **22000-00001**

TEST BOX LOADS AND FUNCTIONS

| TEST BOX LOADS AND FUNCTIONS | TEST BOX LOADS AND FUNCTIONS | TEST BOX LOADS AND FUNCTIONS | TEST BOX LOADS AND FUNCTIONS |
|------------------------------|------------------------------|------------------------------|------------------------------|
| [X] AES | [X] CR-TC 3-pin ANA INT | [X] 1.3kΩ | +/- 5% |
| [X] EGC CAP KOH | [X] CR-TC 3-pin CAP INT | [X] 13.05kΩ | +/- 1% |
| [X] EGC CAP NSA | [X] CR-TC 4-pin ANA INT | [X] 1.3kΩ | +/- 5% |
| [X] EGC ANA KOH | [X] CR-TC 4-pin CAP INT | [X] 13.05kΩ | +/- 1% |
| [X] EGC ANA NSA | [X] EGC - Memory Test | [X] 1.3kΩ | +/- 5% |
| [X] ERS (CV) | [X] ERS - Memory Test | [X] CR-TC - Memory Test | +/- 5% |

Tester : **L. K. K. K.** Date : **8-Sep-2021**

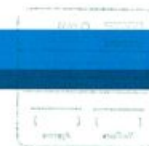
PN 22000-97001 C

ACQUICIA
19/11-12, Sukhumvit Rd., Nonthaburi, Muang Rayong, Rayong 21150, Thailand
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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.

Revision: A-02, Issued: 21 January 2022
Document Number: G8014-90075
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Certificate of Completion

This certifies that

Channarong Khiao-Un

Has successfully completed

eLearn: RPG IC-Specific Qualification Service Training

ThermoFisher
SCIENTIFIC

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Valid for 3 years from:

Nov/19/2021



Issued electronically and
approved by:
TTS - Learning Management
System, Training, Mentoring,
and Certification Group
tmc.training@thermofisher.com

The certificate is only valid during employment with the Thermo Fisher Scientific, including its subsidiaries and certified locations.

Agilent 5100, 5110 Preventive Maintenance Checklist



From Insight to Outcome

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](#)

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Service Engineer's Responsibilities

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

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 Analytical and Engineering Consultant |

| List System Component Product Numbers | List the Serial Numbers of each Component |
|---------------------------------------|---|
| 1. G 8015R | PM 19030001 |
| 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 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. ๖๖๖
- ☒ 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. ๖๖๖
- ☒ 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 if 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 FPC 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. 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.

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. % | 2219.4 | 4124. % | 6965.9 |
| Mn 257.610 nm SRBR | 3915.0 | 7442.2 | 13017. % | 31121.6 |
| Al 396.152 nm SBR | 3.9 | 10.9 | 9.9 | 21.1 |
| K 766.491 nm SBR | 5.9 | 23.1 | 4. % | 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 | 231.4 V | 226.6 V |
| Mains Current | 0.03 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 | 1.24 L/min |
| Water Flow Detector | 0.66 L/min | 0.61 L/min |
| Water Inlet Temperature | 19.3 °C | 19.3 °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 | 646.92 kPa | 591.55 kPa |
| Purge Gas Supply Pressure*1 | 646.66 kPa | 612.41 kPa |
| Option Gas Supply Pressure*1 | - | - |
| Nebulizer Flow | No measurement | 0.30 L/min |
| Nebulizer Back Pressure | No measurement | 126.43 kPa |
| Plasma Gas Flow | No measurement | 11.91 L/min |
| Auxiliary Gas Flow | No measurement | 1.00 L/min |
| RF Power | No measurement | 1204.3 W |
| RF Supply Current | No measurement | 3.953 A |
| RF Supply Voltage | No measurement | 204.41 V |

*1 If option installed

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Consumed PM Parts

| Part Description | Part Number | Product or Model# where used | Quantity consumed |
|---|-------------|-------------------------------|-------------------|
| Axial Pre-Optic Window | G8010-68014 | G8010A, G8011A, G8014A/G8015A | 1 |
| Radial Pre-Optic Window | G8010-68015 | All | 1 |
| Agilent Cool Clear Coolant Fluid | 5799-0037 | Agilent Water Recirculator | - |
| 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 AV56/7 | G8494-60002 | G8494A/G8495 | - |
| Rotor seal for 4 port valve for AV54 | 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:

6003197100

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 |

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| Resolution Test | | | Pass |
|--------------------|---------------|-------|------|
| Element Wavelength | Specification | Width | |
| N (174.213 nm) | ≤ 9.40 | 6.98 | |
| As (188.980 nm) | ≤ 6.20 | 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) | ≤ 6.50 | 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 (814.171 nm) | ≤ 42.00 | 25.54 | |
| Ar (875.283 nm) | ≤ 74.00 | 56.51 | |
| K (766.491 nm) | ≤ 80.00 | 65.86 | |

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| 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 | 1488.8 | 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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| Precision Test | | | Pass |
|--------------------|---------------|----------------------|------|
| Radial | | | |
| Element Wavelength | Specification | Measured Value % RSD | |
| As (188.980 nm) | ≤ 2.60 | 0.73 | |
| Se (196.026 nm) | ≤ 2.60 | 0.96 | |
| 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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| 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 11:07:24 AM |
| Result Summary | |
| Subsystem Communications Test | Pass |
| Air Flow Test | Skipped |
| Water Flow Test | Skipped |
| Gas Flows Test | Skipped |
| Pressure Verifier | 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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| 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 (480.793 nm) | ≤ 36.00 | 17.31 | |
| Ba (493.408 nm) | ≤ 36.00 | 25.44 | |
| Ba (514.171 nm) | ≤ 42.00 | 25.16 | |
| Ar (675.263 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 | 108.0 | 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 | 271940.0 | 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 | 1596.7 | 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) | ≥ 10825.0 | 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 | 4345.8 | |
| Al (396.152 nm) | ≥ 6.0 | SBR | 21.1 | 218771.0 | 9992.3 | |
| 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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| Precision Test | | | Pass |
|--------------------|---------------|----------------------|------|
| Radial | | | |
| Element Wavelength | Specification | Measured Value % RSD | |
| As (188.980 nm) | ≤ 2.60 | 0.81 | |
| Se (196.026 nm) | ≤ 2.60 | 0.98 | |
| 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 | 0.35 | |
| 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 10:35:26 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 (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 (614.171 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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| 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 (267.610 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 | 6398.3 | 157551.5 | 601.7 |
| Cd (214.439 nm) | ≥ 4227.0 | SRBR | 5069.2 | 99873.7 | 386.2 |
| 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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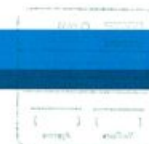
| Precision Test | | | Pass |
|--------------------|---------------|----------------------|------|
| Radial | | | |
| Element Wavelength | Specification | Measured Value % RSD | |
| As (188.980 nm) | ≤ 2.60 | 1.56 | |
| Se (196.026 nm) | ≤ 2.60 | 1.16 | |
| Zn (213.857 nm) | ≤ 1.50 | 0.50 | |
| Pb (220.353 nm) | ≤ 2.60 | 0.74 | |
| Mn (257.610 nm) | ≤ 1.50 | 0.63 | |
| Al (306.152 nm) | ≤ 1.50 | 0.54 | |
| Ba (493.406 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 (306.152 nm) | ≤ 1.50 | 0.56 | |
| Ba (493.406 nm) | ≤ 1.50 | 1.29 | |
| K (766.491 nm) | ≤ 1.50 | 0.74 | |

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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.

เอกสารไม่ควบคุม

Introduction

Customer Information

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

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](#)

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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.

เอกสารไม่ควบคุม

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 Analytical and Engineering Consultant |

| List System Component Product Numbers | List the Serial Numbers of each Component |
|---------------------------------------|---|
| 1. G 8015R | PM 19030001 |
| 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 Demountable) Fully Demountable Other |
| Injector Diameter | 2.4mm (1.8mm) 1.4mm 0.8mm Other |
| Injector Material | Quartz Ceramic Other |

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Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components and implementation of Service Notes
- ☒ Check for required firmware/software updates and verify with customers if they would like them installed.
- ☐ For HF application systems, if standard sample introduction system was not installed, ask the customer to install it. ๖๖๖
- ☒ Ask the customer to remove any samples from the ICP-OES sample introduction area, auto sampler or around the ICP-OES.

เอกสารไม่ควบคุม

Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

- ☒ Look for any obvious external damage or problems.
- ☒ Inspect water cooling hoses, gas lines and power cord for excessive wear or damage.
- ☒ Perform a general internal inspection of the system for excessive dust accumulation, clean if necessary.
- ☒ Inspect sample introduction components and record any required maintenance in the Service Engineer Comments and notify the customer as the required actions required.
- ☒ Record the instrument operating conditions in the ICP-OES Status Results Table.
- ☒ Replace the polychromator purge filter.
- ☒ Replace the radial pre-optics window
- ☒ Replace the axial pre-optics window for SVDV and VDV instruments.
- ☒ Check exhaust flow for the correct positive extraction at the exhaust duct to insure they meet minimum specifications.
- ☒ Replace air inlet dust filter.
- ☐ Replace high capacity air inlet dust filter element if installed. ๖๖๖
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

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

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SPS 3 Auto Sampler

☒ Service not applicable

- ☐ Power cycle the autosampler and verify successful initialization.
- ☐ Inspect X and Z axis belts for wear. Replace if 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 FPC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ☐ Pump Tubing Replacement. Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles.
- ☐ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

☒ Service not applicable

- ☐ Replace valve rotor seal
- ☐ Check fittings for signs of leaks
- ☐ Check tubing including autosampler tubing for kinks or excessive wear
- ☐ Check high flow pump for signs of leaks

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ICP-OES adjustment

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

Record Post-PM instrument performance

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

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

- ☒ Record the result in the Instrument Test Results Table

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Restore Instrument

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

Service Review

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

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Test Results

Instrument Performance Test Results Table

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

| | Pre PM Sensitivity Check | | Post PM Sensitivity Check | |
|--------------------|--------------------------|---------|---------------------------|----------|
| | Radial | Axial * | Radial | Axial* |
| Zn 213.857 nm SRBR | 1500. % | 2219. 4 | 4124. % | 6965. 9 |
| Mn 257.610 nm SRBR | 3915. 0 | 7442. 2 | 13017. % | 31121. 6 |
| Al 396.152 nm SBR | 3. 9 | 10. 9 | 9. 9 | 21. 1 |
| K 766.491 nm SBR | 5. 9 | 23. 1 | 4. % | 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 ₉₅₅ |
| Air Flow | P ₉₅₅ |
| Water Flow | P ₉₅₅ |
| Gas Flows | P ₉₅₅ |
| RF Generator | P ₉₅₅ |
| Camera Test | P ₉₅₅ |
| Optics Test | P ₉₅₅ |
| Nebulizer test | P ₉₅₅ |

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ICP-OES Status Results Table

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

| Measurement | Standby Mode | Plasma On |
|------------------------------|----------------|-------------|
| Mains Voltage | 231.4 V | 226.6 V |
| Mains Current | 0.03 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 | 1.24 L/min |
| Water Flow Detector | 0.66 L/min | 0.61 L/min |
| Water Inlet Temperature | 19.3 °C | 19.3 °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 | 646.92 kPa | 591.55 kPa |
| Purge Gas Supply Pressure*1 | 646.66 kPa | 612.41 kPa |
| Option Gas Supply Pressure*1 | - | - |
| Nebulizer Flow | No measurement | 0.70 L/min |
| Nebulizer Back Pressure | No measurement | 126.43 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 | 3.953 A |
| RF Supply Voltage | No measurement | 204.41 V |

*1 If option installed

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Consumed PM Parts

| Part Description | Part Number | Product or Model# where used | Quantity consumed |
|---|-------------|-------------------------------|-------------------|
| Axial Pre-Optic Window | G8010-68014 | G8010A, G8011A, G8014A/G8015A | 1 |
| Radial Pre-Optic Window | G8010-68015 | All | 1 |
| Agilent Cool Clear Coolant Fluid | 5799-0037 | Agilent Water Recirculator | - |
| 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 AV56/7 | G8494-60002 | G8494A/G8495 | - |
| Rotor seal for 4 port valve for AV54 | 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 |
|------------------|-------------|------------------------------|-------------------|
| | | | |
| | | | |
| | | | |
| | | | |

เอกสารไม่ควบคุม

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:

6003197100

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) | ≤ 6.20 | 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) | ≤ 6.50 | 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 (814.171 nm) | ≤ 42.00 | 25.54 | |
| Ar (875.283 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 | 1488.8 | 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 | 0.96 | |
| 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 |
| Firmware Version | 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 |
| Pressure Verifier | 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 (460.793 nm) | ≤ 36.00 | 17.31 | |
| Ba (493.408 nm) | ≤ 36.00 | 25.44 | |
| Ba (514.171 nm) | ≤ 42.00 | 25.16 | |
| Ar (675.263 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 | 108.0 | 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 | 271940.0 | 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 | 1596.7 | 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) | ≥ 10825.0 | 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 | 4345.8 | |
| Al (396.152 nm) | ≥ 6.0 | SBR | 21.1 | 218771.0 | 9992.3 | |
| 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 | 0.98 | |
| 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 | 0.35 | |
| 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 10:35:26 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 (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 (614.171 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 | 184.5 | 2492.3 | 159.8 |
| Mn (267.610 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 | 6398.3 | 157551.5 | 601.7 |
| Cd (214.439 nm) | ≥ 4227.0 | SRBR | 5069.2 | 99873.7 | 386.2 |
| 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 | 0.83 | |
| Al (306.152 nm) | ≤ 1.50 | 0.54 | |
| Ba (493.406 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 (306.152 nm) | ≤ 1.50 | 0.56 | |
| Ba (493.406 nm) | ≤ 1.50 | 1.29 | |
| K (766.491 nm) | ≤ 1.50 | 0.74 | |

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เอกสารไม่ควบคุม

Calibration Certificate

Certificate No.: 2401718-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomek 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
ID No.: UAE.WAT.010/2553
Order No.: 2401718
Operation No.: 2401718-001
Date of Receipt: 27 February 2024
Date of Calibration: 11 March 2024

Calibrated by Mr.Manas Somsak Specialist
Approved by (Mr.Pharaphat Tuanjir) Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

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.: 2401718-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 11 March 2024
Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature: (23.4 ± 1.5) °C Relative Humidity: (51 ± 3) %
Condition of Equipment: Good Condition
Condition of this Results of Calibration
1. Calibration Method: W-CC-002: In house method based on direct measurement by using standard voltage calibrator and certified reference material (CRM)
2. Reference Standards: 1 Certified Reference Material
3. This certificate is traceable to The International System of Unit (SI Unit)
3.1 Instruments No.2.1 through NSC-TSI-1705 Laboratory Accreditation of Calibration No.0008
3.2 Instruments No.2.2 and 2.3 through NSC-TSI-1705 Laboratory Accreditation of Calibration No.0001
3.3 Certified Reference Material No.2.4 to 2.6 traceable to Primary measurement method: Titrated call using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.4 Certified Reference Material No.2.7 traceable to PTB Certificate No. PTB-PH04-063/0700423 and Certificate No. PTB-PH05-555/0002022 PTB-Physikalisch-Technische Bundesanstalt, Braunschweig, Germany)
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.

เอกสารไม่ควบคุม

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

Calibration Report

Certificate No.: 2401718-001-01
Equipment: pH Meter
Resolution: 0.01 pH ; 1 mV
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1231155210
Type: Bench top
ID No.: UAE.WAT.010/2553
Date of Calibration: 11 March 2024
Calibration Results: (Manual Temperature Compensation at 25 °C)
1. Calibration of pH Meter (offset value before adjust: -0.4 mV)
2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)
Equipment: pH Electrode Type: Combined Electrode
Manufacturer: METTLER TOLEDO Model: InLab Solids
Serial No.: 3055701 ID No: N/A
Performance of Electrode system: (Three-Point Calibration at pH 4, 7 and 10)
Certified Value (25 °C (pH)) Average Indicator Reading Relative Slope (%) Uncertainty (± pH) Coverage Factor (A)
4.008 4.01 188 - 0.0071 2.00
7.001 7.00 13 36.9 0.0086 2.00
10.019 10.01 -180 97.2 0.0085 2.00
6.865 6.87 21 - 0.0074 2.00

เอกสารไม่ควบคุม

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

Calibration Report

Calibration Report

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C **Model:** SevenEasy pH
Serial No.: 1231155210 **ID No.:** UAE.WAT.0102553
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024 **Page 4 of 5**

Location: Chemical Calibration Laboratory, National Food Institute
Environment Condition: Ambient Temperature 23 °C ± 1 °C
Relative Humidity 51 % ± 2 %

Condition of this results of Calibration:

1. Calibration Method:
 - In house method: W-TE-025 by comparison with standard thermometer.
 - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
 - The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument:

| Instrument | Model | Serial No. | Certificate No. | Due Date | Through |
|---------------------------------------|-------|------------|-----------------|-----------|---------|
| HANDHELD THERMOMETER | 1523 | 2118154 | PSL-T 087786 | 06-Jun-24 | TISTR |
| Platinum Resistance Thermometer (PRT) | 9627A | 877332 | | | |

Support Equipment: - Low Temperature Bath (SCCAL-6) Model: Europa-6 Plus Basic, S/N: 3415502

3. This certificate is traceable to International System of Units (SI Units).
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.
6. Condition of Calibrated item: ☒ Good
7. Result of Calibration: ☒ Without adjustment ☐ After adjustment

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

Certificate No.: 2401718-001-01
Equipment: Digital Thermometer with RTD (pH Meter)
Resolution: 0.1 °C **Model:** SevenEasy pH
Serial No.: 1231155210 **ID No.:** UAE.WAT.0102553
Manufacturer: METTLER TOLEDO
Date of Calibration: 11 March 2024 **Page 4 of 5**

Calibration point: 15.0, 25.0 and 35.0 °C
Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.
- Description of probe, model: N/A S/N: N/A
- Dimension of probe: Diameter 4 mm, Length 120 mm.
- Sheath material: Stainless Steel

| UUC Reading (°C) | Standard Temperature (°C) | Correction Value (°C) | Uncertainty ± (°C) |
|------------------|---------------------------|-----------------------|--------------------|
| 15.1 | 14.998 | 0.1 | 0.099 |
| 25.1 | 24.998 | 0.1 | 0.099 |
| 35.1 | 34.997 | 0.1 | 0.099 |

Note

- UUC: Unit Under Calibration

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

End

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



Certificate of Calibration

Equipment: pH METER **Certificate No.:** C07240167
Model: SevenEasy **Issued Date:** 9 April 2024
Serial No. (or ID.): 1230525212 (UAE.WAS.003/2553) **Job No.:** WO-00024208
Manufacturer: METTLER TOLEDO **Page:** 1 of 3
Electrode Serial No.: 1156883 **Model:** InLab Solids **Brand:** METTLER TOLEDO
Condition: In Condition

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

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

Calibration By: Miss.Orawan Khlaiphloi
Calibration Date: 9 April 2024

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

Traceability: This certificate is traceable to SI Units, Sample Test is assured through primary measurement method Harned cell, through CPAchem Ltd. (ISO/IEC 17034) Certificate No. 938377, 931985, 931984 And pH Scale traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. CA20230350EA

Orawan Khlaiphloi
(Miss Orawan Khlaiphloi)
Person in charge

Nitinun Srihawan
(Mr. Nitinun Srihawan)
Authorized signatory

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



Certificate No.: C07240167 Page 2 of 3

Calibration Results:

pH Scale

| Input | pH Meter Reading | | | Uncertainty of Measurement (mV) | Coverage Factor (k) |
|---------|------------------|------------|-------|---------------------------------|---------------------|
| | (mV) | Error (mV) | (pH) | | |
| 414.12 | 414 | -0.12 | 0.00 | 0.58 | 2.00 |
| 354.96 | 355 | 0.04 | 1.00 | 0.58 | 2.00 |
| 295.8 | 296 | 0.20 | 2.00 | 0.58 | 2.00 |
| 236.64 | 237 | 0.36 | 3.00 | 0.58 | 2.00 |
| 177.48 | 178 | 0.52 | 4.00 | 0.58 | 2.00 |
| 118.32 | 118 | -0.32 | 5.00 | 0.58 | 2.00 |
| 59.16 | 59 | -0.16 | 6.00 | 0.58 | 2.00 |
| 0 | 0 | 0.00 | 7.00 | 0.58 | 2.00 |
| -59.16 | -59 | 0.16 | 8.00 | 0.58 | 2.00 |
| -118.32 | -118 | 0.32 | 9.00 | 0.58 | 2.00 |
| -177.48 | -177 | 0.48 | 10.00 | 0.58 | 2.00 |
| -236.64 | -236 | 0.64 | 11.00 | 0.58 | 2.00 |
| -295.8 | -296 | -0.20 | 12.00 | 0.58 | 2.00 |
| -354.96 | -355 | -0.04 | 13.00 | 0.58 | 2.00 |
| -414.12 | -414 | 0.12 | 14.00 | 0.58 | 2.00 |

Practical slope and zero point*

The three-point calibration using three standard buffer solutions; pH 4.008 , pH 6.985 and pH 9.997
-During calibration, display of pH meter reading: pH 4.00 , pH 7.00 and pH 10.01
The practical slope of the pH electrode; 57.01 (mV/pH), 96.37%
The zero point of the pH electrode; 6.88 (pH)

Sample Test Results

| Standard Buffer Solution (pH) | Unit Under Calibration (pH) | Difference (pH) | Uncertainty of Measurement (pH) | Coverage Factor (k) |
|-------------------------------|-----------------------------|-----------------|---------------------------------|---------------------|
| 4.008 | 3.99 | -0.018 | 0.0070 | 2.00 |
| 6.985 | 7.00 | 0.015 | 0.0091 | 2.00 |
| 9.997 | 10.02 | 0.023 | 0.0074 | 2.00 |

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

The End of Certificate

Reference standard equipment:

| Equipment | Certificate no | Cal. date | Next Cal. date |
|--------------------------------|----------------|-----------|----------------|
| Digital Thermometer with Probe | QR23-1073 | 2 May 23 | 2 May 24 |

Calibration Results:

Without Adjustment

| Sensor Type: RTD | | | Channel: - | |
|---------------------|-------------------|-------------------|------------------------|--------------------|
| Diameter (mm) 4 | | Length (mm): 135 | Immersion (mm): 110 | |
| Calibrate Point(°C) | STD. Reading (°C) | UUC. Reading (°C) | Correction of UUC (°C) | Uncertainty (± °C) |
| 15.0 | 15.010 | 15.1 | -0.090 | 0.076 |
| 25.0 | 25.006 | 25.1 | -0.094 | 0.076 |
| 35.0 | 35.004 | 35.0 | 0.004 | 0.076 |

The End of Certificate



Certificate of Calibration

Equipment: Digital Thermometer with Probe
Model: SevenEasy pH
Serial No.: 1230525212
Manufacturer: METTLER TOLEDO
ID No.: UAE.WAS.003/2553
Certificate No.: C15240373
Issued Date: 09 April 2024
Job No.: WO-00024208
Page: 1 of 2
Condition: In Condition

Customer: United Analyst and Engineering Consultant Company Limited
3 Soi Udomsuk 41 Sukhumvit Road,
Bangkok, Prakanong, Bangkok 10260 Thailand

Environment Condition: Temperature: 22 °C ± 3 °C
Humidity: 50 %RH ± 20 %RH
Voltage: 220 VAC ± 10 %

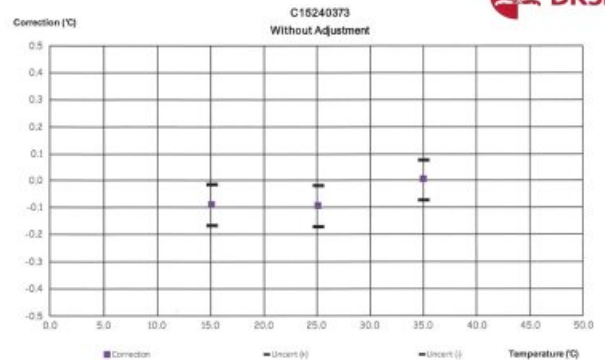
Calibration Place: Thermo-Hygro Laboratory, DKSH Technology Limited,
2533 Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260 Thailand

Calibration By: Mr. Nateekam Mitjit
Calibration Date: 09 April 2024
The Method used: In house method, CAL-WI-19, by comparison with standard thermometer
Traceability: This certificate is traceable to the International System of Unit maintained by
Quality Reborn Co.,Ltd. (QR) Certificate No. QR23-1073

(Mr. Nateekam Mitjit)
Person in charge

(Mr. Pramote Ramrong)
Authorized signatory

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





Certificate of Calibration

Cert.No.: 24CH1115
Page: 1 of 2

Equipment : Turbidity Meter
Manufacturer : Oakton
Model : T100IR
Serial No. : 1120501017
ID No. : UAE.WAT.056/2563
Condition As-Received: Used Item
Received Date : 05 September 2024
Calibration Date : 06 September 2024
Reference : 2409-0177DSC-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 ± 20) %
Calibration Procedure : In - house method : CP-CH11
Direct measurement by
using Formazin standard solution
Calibrated by : Walalak Sirinthean
Approved by :
Approved Signatory
{ } Unnopphol Harachai
{ } Ponpan Palpin
{✓} Sathip Meangmai
Issue Date : 9 September 2024

Condition of this calibration result

1. Reference Standard Instruments :

| Instruments | Serial No. | ID No. | Certificate No. | Due date |
|-----------------------|------------|----------|-----------------|--------------|
| 1) Thermo-Hygograph | 1103328 | 130EC010 | 24H1372 | 12 July 2025 |
| 2) Electronic Balance | 1126143764 | 140RC004 | 22MM22 | 20 Feb 2025 |

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

2. Standard Material : The Formazin suspension has been prepared gravimetric from

| Material | Manufacturer | Lot No. | Assay |
|---------------------------|--------------|-----------|--------|
| 1) Hexamethylenetetramine | HIMEDIA | 000493947 | 99.65% |
| 2) Hydrazinium Sulfate | HIMEDIA | 000522014 | 99.40% |

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

Calibration result

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

| Standard Formazine suspension (NTU) | UUC* Reading (NTU) | Uncertainty of Measurement (± NTU) | Coverage Factor k |
|---|-------------------------|--|-------------------------|
| 0 | 0.00 | 0.0081 | 2.06 |
| 20 | 20.2 | 0.39 | 2.00 |
| 100 | 100 | 0.75 | 2.00 |
| 400 | 401 | 1.5 | 2.06 |
| 800 | 801 | 2.1 | 2.17 |

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

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

-00-

The Uncertainties are for a confidence probability of approximately 95%

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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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

CERTIFICATE OF CALIBRATION

Certificate No. : SP24-018 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 : Agilent Technologies
Model : Cary 60
Serial No. : MY15410009
ID No. : UAE.WAT.020/2558
Received Date : 7 May 2024
Calibration Date : 7 May 2024
Issue Date : 9 May 2024
Condition Instrument : Good

Calibrated by :
(Mr.Tanawat Rittidach)
Technical Manager
Approved by :
(Ms. Chonticha Sengngern)
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

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

REPORT OF CALIBRATION

Certificate No. : SP24-018 Page 2 of 5
Environment Condition : Ambient Temperature 25 ± 5 °C
Relative humidity 55 ± 20 %RH
Calibration method : In-house method CP-01 Based on ASTM E275-08
Certified Reference Materials :

| Material | Serial No. | Certificate No. | Due date |
|-------------------------|------------|-----------------|-----------------|
| Absorbance Standard set | 25760 | 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 : 1.5 nm.
Scan Speed of UUC : 60 nm/min
Scan Interval of UUC : 0.15 nm.
Resolution of UUC : Photometric 0.0001 Abs.
Wavelength 0.1 nm.

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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. : SP24-018

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 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5780 | 0.5747 | 0.0033 | 0.0031 | 2.00 |
| | 1.0484 | 1.0438 | 0.0046 | 0.0029 | 2.00 |
| | 2.1876 | 2.1832 | 0.0044 | 0.0080 | 2.00 |
| 440 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5595 | 0.5581 | 0.0014 | 0.0034 | 2.00 |
| | 1.0239 | 1.0231 | 0.0008 | 0.0035 | 2.00 |
| | 2.1230 | 2.1219 | 0.0011 | 0.0080 | 2.00 |
| 465 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5230 | 0.5184 | 0.0046 | 0.0030 | 2.00 |
| | 0.9633 | 0.9614 | 0.0019 | 0.0029 | 2.00 |
| | 1.9753 | 1.9731 | 0.0022 | 0.0070 | 2.00 |
| 546.1 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5181 | 0.5150 | 0.0031 | 0.0031 | 2.00 |
| | 1.0002 | 0.9964 | 0.0038 | 0.0033 | 2.00 |
| | 1.9973 | 1.9914 | 0.0059 | 0.0088 | 2.00 |
| 590 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5517 | 0.5485 | 0.0032 | 0.0030 | 2.00 |
| | 1.0803 | 1.0772 | 0.0031 | 0.0030 | 2.00 |
| | 2.0373 | 2.0293 | 0.0080 | 0.0080 | 2.00 |
| 635 | 0.0000 | 0.0000 | 0.0000 | 0.0028 | 2.00 |
| | 0.5591 | 0.5565 | 0.0026 | 0.0031 | 2.00 |
| | 1.0518 | 1.0482 | 0.0036 | 0.0030 | 2.00 |
| | 1.9274 | 1.9202 | 0.0072 | 0.0079 | 2.00 |

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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. : SP24-018

Page 4 of 5

Photometric Accuracy :

| Wavelength (nm.) | CRMs Values (Abs) | UUC Reading (Abs) | Correction (Abs) | Uncertainty (Abs) | Coverage factor k |
|---------------------|----------------------|----------------------|---------------------|----------------------|----------------------|
| 235 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.7469 | 0.7435 | 0.0034 | 0.0057 | 2.00 |
| 257 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.8674 | 0.8639 | 0.0035 | 0.0060 | 2.00 |
| 313 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.2919 | 0.2907 | 0.0012 | 0.0051 | 2.00 |
| 350 | 0.0000 | 0.0000 | 0.0000 | 0.0050 | 2.00 |
| | 0.6430 | 0.6402 | 0.0028 | 0.0055 | 2.00 |

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DQE

Services

DQE Services Co.,Ltd.

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

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



ISO 9001:2015

CALIBRATION 100%

REPORT OF CALIBRATION

Certificate No. : SP24-018

Page 5 of 5

Wavelength Accuracy :

| CRMs Values (nm.) | UUC Reading (nm.) | Correction (nm.) | Uncertainty (nm.) | Coverage factor k |
|----------------------|----------------------|---------------------|----------------------|----------------------|
| 241.72 | 242.0 | -0.28 | 0.18 | 2.00 |
| 279.45 | 279.5 | -0.05 | 0.18 | 2.00 |
| 287.81 | 287.9 | -0.09 | 0.18 | 2.00 |
| 334.06 | 333.9 | 0.16 | 0.18 | 2.00 |
| 360.93 | 360.5 | 0.43 | 0.18 | 2.00 |
| 418.59 | 418.1 | 0.49 | 0.18 | 2.00 |
| 445.94 | 445.6 | 0.34 | 0.18 | 2.00 |
| 453.66 | 453.3 | 0.36 | 0.18 | 2.00 |
| 460.02 | 459.8 | 0.22 | 0.18 | 2.00 |
| 536.59 | 536.0 | 0.59 | 0.18 | 2.00 |
| 637.98 | 638.7 | -0.72 | 0.18 | 2.00 |
| 431.38 | 430.8 | 0.58 | 0.18 | 2.00 |
| 472.50 | 472.4 | 0.10 | 0.18 | 2.00 |
| 513.47 | 513.7 | -0.23 | 0.18 | 2.00 |
| 528.88 | 529.1 | -0.22 | 0.18 | 2.00 |
| 573.17 | 573.5 | -0.33 | 0.18 | 2.00 |
| 585.35 | 585.2 | 0.15 | 0.20 | 2.00 |
| 684.40 | 685.1 | -0.70 | 0.18 | 2.00 |
| 740.72 | 741.4 | -0.68 | 0.20 | 2.00 |
| 748.55 | 749.1 | -0.55 | 0.18 | 2.00 |
| 807.03 | 807.3 | -0.27 | 0.18 | 2.00 |
| 879.28 | 879.3 | -0.02 | 0.18 | 2.00 |

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

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

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

- * Indicate non TISI accredited

- End of Certificate -

เอกสารไม่ควบคุม



nfi
national food institute
ministry of industry

จุฬาลงกรณ์มหาวิทยาลัย
ศูนย์บริการทดสอบปฏิบัติการอุตสาหกรรมอาหาร
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center



NAC-MRA



NAC-TISI-TIS 17025
CALIBRATION 5051

Calibration Certificate

Certificate No.: 2402283-002-01
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.: 2402283
Operation No.: 2402283-002
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

Date of Issue: 9 April 2024

Responsible for the Technical Management Team

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.

FCS-009 Revision: 01 Date: 20-04-65

เอกสารไม่ควบคุม

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 220 g

Date of Calibration: 2 April 2024

Page 2 of 4

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: NIST Method W-14-001 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 | 8595567572 | TCS | M23040535 | 8 April 2024 |
| Instrument | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
| Thermo-Hygro Meter | 608-H1 | NP18TH 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 | 0.000042 |
| 80 | 0.000052 |
| 100 | 0.000048 |
| 200 | 0.000049 |

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) |
| 100.0000 | 100.0001 | 99.9999 |
| 4 (g) | 5 (g) | 6 (g) |
| 99.9999 | 100.0001 | 100.0000 |
| (Maximum Difference) | | |
| 0.0001 | | |

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

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 220 g

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 k |
|-------------------|--------------------|---------------------|----------------|-------------------|-------------------|
| 99 | 99.000032 | 99.00001 | 0.00002 | 0.00015 | 2.00 |
| 100 | 100.00006 | 100.00001 | 0.00005 | 0.00015 | 2.00 |
| 110 | 110.00007 | 110.00001 | 0.00006 | 0.00016 | 2.00 |
| 120 | 120.00009 | 120.00000 | 0.00009 | 0.00017 | 2.00 |
| 130 | 130.00010 | 130.00000 | 0.00010 | 0.00019 | 2.00 |
| 140 | 140.00014 | 140.00000 | 0.00014 | 0.00020 | 2.00 |
| 150 | 150.00009 | 150.00001 | 0.00008 | 0.00020 | 2.00 |
| 160 | 160.00010 | 160.00001 | 0.00009 | 0.00022 | 2.00 |
| 170 | 170.00012 | 170.00001 | 0.00011 | 0.00023 | 2.00 |
| 200 | 200.00016 | 200.00002 | 0.00014 | 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

Calibration Report

Certificate No.: 2402283-002-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Resolution: 0.00001 g / 0.0001 g

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Capacity: 220 g

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 |
|-------------------|--------------------|---------------------|----------------|-------------------|-------------------|
| Unloaded | 0.000000 | 0.000000 | 0.000000 | 0.0000386 | 2.00 |
| 0.001 | 0.001003 | 0.001001 | -0.000002 | 0.0000389 | 2.00 |
| 0.005 | 0.005003 | 0.005000 | -0.000003 | 0.0000392 | 2.00 |
| 0.01 | 0.010003 | 0.010000 | -0.000003 | 0.0000389 | 2.00 |
| 0.05 | 0.049996 | 0.050000 | 0.000004 | 0.0000396 | 2.00 |
| 0.1 | 0.100011 | 0.100000 | -0.000011 | 0.0000411 | 2.00 |
| 0.5 | 0.500016 | 0.500001 | -0.000015 | 0.0000414 | 2.00 |
| 1 | 1.000003 | 1.000002 | -0.000001 | 0.0000416 | 2.00 |
| 2 | 2.000023 | 2.000001 | -0.000022 | 0.0000417 | 2.00 |
| 5 | 5.000017 | 5.000002 | -0.000015 | 0.0000420 | 2.00 |
| 10 | 10.000009 | 10.000000 | -0.000009 | 0.0000426 | 2.00 |
| 20 | 20.000031 | 20.000000 | -0.000031 | 0.0000437 | 2.00 |
| 30 | 30.000040 | 30.000001 | -0.000039 | 0.0000450 | 2.00 |
| 50 | 50.000028 | 50.000002 | -0.000026 | 0.0000468 | 2.00 |
| 80 | 80.000068 | 80.000002 | -0.000066 | 0.000111 | 2.00 |

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

Calibration Certificate

Certificate No.: 2500116-001-01

Client name:

UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address:

3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10260

Equipment:

CHAMBER (Hot Air Oven)

Manufacturer:

MEMMERT

Model:

UF55

Serial No.:

8216.1666

ID No.:

UAE.WAO.027/2559

Order No.:

2500116

Operation No.:

2500116-001

Date of Receipt:

8 October 2024

Date of Calibration:

8 October 2024

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:

15 October 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.: Z500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55 **Serial No.:** B216.1666
Resolution: 0.1 °C **ID No.:** UAE.WAO.027/2559
Manufacturer: MEMMERT
Date of Calibration: 8 October 2024 **Page 2 of 3**

Location: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition:
Ambient Temperature (30.3 ± 1) °C
Relative Humidity (55 ± 1) %
Line Voltage (230 ± 3) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
- The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

| Instrument | Model | Serial No./ID No. | Certificate No. | Due Date | Through |
|---------------------------------|--------|--------------------------|-----------------|-------------|-------------------------|
| Digital Thermometer with sensor | 34972A | MY57003188 | TE 670486-01 | 8 June 2025 | NATIONAL FOOD INSTITUTE |
| | RTD | (014201-200) RTD#201-200 | | | |

3. This certificate is traceable to International System of Units (SI Units).

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.

6. Condition of Calibrated item : Good

UUC Description :

| Time of Record | 1 | Hour | 9 | Minute | At | 104.0, 140.0 and 180.0 °C |
|------------------|---|---------------|----------|--------|----|---------------------------|
| Fresh air Damper | - | Open | Position | - | | |
| | X | Close | Fan | 40% | | |
| | - | Not Available | | | | |

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment

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

ขอสงวนลิขสิทธิ์ในเอกสารฉบับนี้ หากมีการนำเอกสารฉบับนี้ไปใช้โดยไม่ได้รับอนุญาต
ขอสงวนลิขสิทธิ์ในเอกสารฉบับนี้ หากมีการนำเอกสารฉบับนี้ไปใช้โดยไม่ได้รับอนุญาต
Tel: +662 2577 9000 Fax: +662 2577 9009

เอกสารไม่ควบคุม



Calibration Report

Certificate No.: Z500116-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF55 **Serial No.:** B216.1666
Resolution: 0.1 °C **ID No.:** UAE.WAO.027/2559
Manufacturer: MEMMERT
Date of Calibration: 8 October 2024 **Page 3 of 3**

Calibration point: 104.0, 140.0 and 180.0 °C

Calibration result:

| Calibration Condition | Temperature (°C) | Relative Humidity (%) | Line Voltage (Volt) |
|-----------------------|------------------|-----------------------|---------------------|
| MIN | 29.3 | 54 | 227.0 |
| MAX | 31.2 | 56 | 232.0 |

Table 1 : Reporting of Temperature

| Calibration point (°C) | Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF) | | | | | | | | | Uncertainty ± (°C) |
|------------------------|---|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|
| | # 1 | # 2 | # 3 | # 4 | # 5 | # 6 | # 7 | # 8 | # 9 | |
| 104.0 | 103.89 | 103.66 | 103.88 | 103.89 | 104.40 | 103.98 | 103.70 | 104.10 | 104.15 | 0.53 |
| 140.0 | 139.85 | 139.53 | 139.87 | 139.88 | 140.67 | 140.00 | 139.60 | 140.25 | 140.23 | 0.73 |
| 180.0 | 179.63 | 179.22 | 179.71 | 179.76 | 181.03 | 180.06 | 179.41 | 180.87 | 180.39 | 0.90 |

Table 2 : Reporting of Characterization Result

| UUC* Setting (°C) | UUC* Reading (°C) | | | Stability ± (°C) | Uniformity (°C) | Overall Variation (°C) |
|-------------------|-------------------|-------|---------|------------------|-----------------|------------------------|
| | MIN | MAX | Average | | | |
| 104.0 | 104.0 | 104.0 | 104.0 | 0.15 | 0.49 | 0.88 |
| 140.0 | 140.0 | 140.0 | 140.0 | 0.13 | 0.71 | 1.2 |
| 180.0 | 180.0 | 180.0 | 180.0 | 0.13 | 1.2 | 1.9 |

Note: The quoted uncertainty include * Stability * and * Loading effect (20% of Temp Uniformity) *

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

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.

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

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

----- End -----

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

ขอสงวนลิขสิทธิ์ในเอกสารฉบับนี้ หากมีการนำเอกสารฉบับนี้ไปใช้โดยไม่ได้รับอนุญาต
ขอสงวนลิขสิทธิ์ในเอกสารฉบับนี้ หากมีการนำเอกสารฉบับนี้ไปใช้โดยไม่ได้รับอนุญาต
Tel: +662 2577 9000 Fax: +662 2577 9009

เอกสารไม่ควบคุม



Request No. 25-67 / 0275

MTC. ACL.No. 358 / 67

CALIBRATION CERTIFICATE

NOMENCLATURE : 1. Atomic Absorption Spectrophotometer *Agilent Technologies*

Model AA240FS, Serial No. MY13160001

2. Working standard solution "Inorganic Ventures"

Multi Analyte Custom Grade Solution, Lot No. S2-MEB675610

SUBMITTED BY : United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260

CALIBRATION PROCEDURE : 1. Performance Verification of Atomic Absorption Spectrophotometer

(W-500-02-30)

2. Estimation Uncertainty of Measurement in Analytical Chemistry (QP-513)

CALIBRATION RANGE: 0.02, 0.10, 0.30, 0.50, 0.70 mg/L at 228.8 nm.Cd, 0.10, 0.20, 0.30, 0.50, 0.70 mg/L at 357.9 nm.Cr, 0.05, 0.10, 0.30, 0.50, 0.70 mg/L at 324.7 nm.Cu, 0.10, 0.30, 0.50, 0.70, 1.00 mg/L at 248.3 nm.Fe, 0.20, 0.50, 0.70, 1.00, 1.50 mg/L at 217.0 nm.Pb, 0.05, 0.10, 0.30, 0.50, 0.70 mg/L at 279.5 nm.Mn, 0.10, 0.30, 0.50, 0.70, 1.00 mg/L at 232.0 nm.Ni, 0.05, 0.10, 0.30, 0.50, 0.70 mg/L at 213.9 nm.Zn

CALIBRATION DATE : 2 February 2024

REFERENCE MATERIAL : Traceable to NIST "Agilent Technologies", "CARLO ERBA"

Cadmium Lot No. 0006589926, Chromium Lot No. 0112384886, Copper Batch No. T117098A, Iron Batch No. T126087A,

Lead Lot No. 1227873, Manganese Batch No. T109228A, Nickel Batch No. T270178A, Zinc Batch No. T820140A

AMBIENT CONDITIONS : Temperature 25 ± 5 °C Relative humidity 50 ± 20 %

The Atomic Absorption Spectrophotometer has been calibrated against Reference Material traceable to National Institute of Standards and Technology (NIST) by The Analytical Chemistry Laboratory. The results are attached herewith.

Calibrated by Atipat
(Mr. Atipat Ratana)

Approved by Sulda
(Miss Sulda Deawong)
Director of Analytical Chemistry Laboratory
Ref. 2015267020100454001
Issued Date : 11 March 2024

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

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Continue 2 / 5

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Request No. 25-67 / 0275 2 / 5 MTC. ACL. No. 358 / 67

2. Precision

| Element | Conc. (mg/l) | Absorbance | | | | | | | | | | Ave. Abs. | SD | %RSD |
|---------|-----------------|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|--------|------|
| Cd | 0.02 | 0.0078 | 0.0076 | 0.0069 | 0.0075 | 0.0071 | 0.0070 | 0.0076 | 0.0074 | 0.0077 | 0.0067 | 0.007 | 0.0004 | 5.15 |
| | 0.30 | 0.1008 | 0.1007 | 0.0999 | 0.0997 | 0.1000 | 0.0996 | 0.1008 | 0.1002 | 0.1005 | 0.0999 | 0.100 | 0.0005 | 0.86 |
| | 0.70 | 0.2301 | 0.2306 | 0.2277 | 0.2305 | 0.2310 | 0.2295 | 0.2290 | 0.2293 | 0.2305 | 0.2296 | 0.230 | 0.0010 | 0.42 |
| Cr | 0.10 | 0.0094 | 0.0093 | 0.0093 | 0.0098 | 0.0094 | 0.0095 | 0.0090 | 0.0090 | 0.0094 | 0.0090 | 0.009 | 0.0003 | 2.75 |
| | 0.30 | 0.0241 | 0.0236 | 0.0221 | 0.0238 | 0.0231 | 0.0226 | 0.0231 | 0.0223 | 0.0230 | 0.0231 | 0.023 | 0.0006 | 2.75 |
| | 0.70 | 0.0500 | 0.0500 | 0.0500 | 0.0524 | 0.0499 | 0.0511 | 0.0509 | 0.0512 | 0.0515 | 0.0504 | 0.051 | 0.0008 | 1.63 |
| Cu | 0.05 | 0.0061 | 0.0062 | 0.0064 | 0.0061 | 0.0069 | 0.0069 | 0.0061 | 0.0062 | 0.0064 | 0.0061 | 0.006 | 0.0003 | 5.00 |
| | 0.30 | 0.0419 | 0.0411 | 0.0402 | 0.0407 | 0.0405 | 0.0404 | 0.0399 | 0.0400 | 0.0399 | 0.0400 | 0.040 | 0.0006 | 1.58 |
| | 0.70 | 0.0960 | 0.0960 | 0.0960 | 0.0959 | 0.0947 | 0.0953 | 0.0952 | 0.0952 | 0.0951 | 0.0953 | 0.096 | 0.0005 | 0.48 |
| Fe | 0.10 | 0.0096 | 0.0101 | 0.0103 | 0.0100 | 0.0099 | 0.0096 | 0.0106 | 0.0099 | 0.0105 | 0.0102 | 0.010 | 0.0003 | 3.38 |
| | 0.50 | 0.0424 | 0.0413 | 0.0428 | 0.0427 | 0.0421 | 0.0426 | 0.0413 | 0.0430 | 0.0421 | 0.0419 | 0.042 | 0.0006 | 1.33 |
| | 1.00 | 0.0830 | 0.0839 | 0.0847 | 0.0834 | 0.0832 | 0.0820 | 0.0839 | 0.0838 | 0.0837 | 0.0845 | 0.084 | 0.0008 | 0.92 |
| Pb | 0.20 | 0.0078 | 0.0074 | 0.0078 | 0.0078 | 0.0076 | 0.0078 | 0.0077 | 0.0078 | 0.0077 | 0.0078 | 0.008 | 0.0001 | 1.71 |
| | 0.70 | 0.0278 | 0.0273 | 0.0271 | 0.0267 | 0.0270 | 0.0264 | 0.0274 | 0.0273 | 0.0269 | 0.0269 | 0.027 | 0.0004 | 1.45 |
| | 1.50 | 0.0551 | 0.0548 | 0.0552 | 0.0555 | 0.0547 | 0.0546 | 0.0544 | 0.0544 | 0.0549 | 0.0547 | 0.055 | 0.0004 | 0.64 |
| Mn | 0.05 | 0.0116 | 0.0107 | 0.0110 | 0.0103 | 0.0108 | 0.0108 | 0.0112 | 0.0107 | 0.0109 | 0.0108 | 0.011 | 0.0003 | 3.15 |
| | 0.30 | 0.0650 | 0.0649 | 0.0649 | 0.0651 | 0.0646 | 0.0646 | 0.0649 | 0.0646 | 0.0640 | 0.0648 | 0.065 | 0.0003 | 0.48 |
| | 0.70 | 0.1463 | 0.1465 | 0.1459 | 0.1471 | 0.1475 | 0.1474 | 0.1487 | 0.1473 | 0.1462 | 0.1468 | 0.147 | 0.0008 | 0.56 |
| Ni | 0.10 | 0.0095 | 0.0100 | 0.0096 | 0.0103 | 0.0102 | 0.0096 | 0.0100 | 0.0095 | 0.0097 | 0.0096 | 0.010 | 0.0003 | 3.04 |
| | 0.50 | 0.0443 | 0.0433 | 0.0438 | 0.0444 | 0.0430 | 0.0437 | 0.0444 | 0.0437 | 0.0438 | 0.0434 | 0.044 | 0.0005 | 1.09 |
| | 1.00 | 0.0812 | 0.0820 | 0.0834 | 0.0829 | 0.0818 | 0.0829 | 0.0831 | 0.0835 | 0.0816 | 0.0819 | 0.082 | 0.0008 | 0.99 |
| Zn | 0.05 | 0.0374 | 0.0377 | 0.0373 | 0.0377 | 0.0374 | 0.0377 | 0.0373 | 0.0371 | 0.0371 | 0.0374 | 0.037 | 0.0002 | 0.61 |
| | 0.30 | 0.1985 | 0.1993 | 0.1975 | 0.1992 | 0.1979 | 0.1988 | 0.1995 | 0.1985 | 0.1974 | 0.2004 | 0.199 | 0.0009 | 0.47 |
| | 0.70 | 0.4027 | 0.4031 | 0.4019 | 0.4021 | 0.4023 | 0.3981 | 0.4042 | 0.4025 | 0.3993 | 0.3997 | 0.402 | 0.0019 | 0.48 |

Continue 3 / 5

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FB.ML.MTC.002 Rev.4



Request No. 25-67 / 0275 4 / 5 MTC. ACL. No. 358 / 67

3.4 Reading on wavelength- Iron (Fe) at 248.3 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---------|--------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|
| Fe | 0.100 | 0.104 | 0.005 | 4.60 | ± 0.014 |
| | 0.500 | 0.482 | -0.018 | 3.55 | ± 0.016 |
| | 1.006 | 0.968 | -0.038 | 3.75 | ± 0.029 |

3.5 Reading on wavelength- Lead (Pb) at 217.0 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---------|--------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|
| Pb | 0.201 | 0.202 | 0.001 | 0.34 | ± 0.014 |
| | 0.706 | 0.719 | 0.012 | 1.73 | ± 0.030 |
| | 1.513 | 1.459 | -0.054 | 3.57 | ± 0.061 |

3.6 Reading on wavelength- Manganese (Mn) at 279.5 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---------|--------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|
| Mn | 0.0505 | 0.050 | 0.000 | 0.83 | ± 0.005 |
| | 0.3031 | 0.306 | 0.003 | 1.12 | ± 0.007 |
| | 0.7023 | 0.698 | -0.004 | 0.62 | ± 0.014 |

Continue 5 / 5

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FB.ML.MTC.002 Rev.4

Request No. 25-67 / 0275 3 / 5 MTC. ACL. No. 358 / 67

3. Trueness

3.1 Reading on wavelength- Cadmium (Cd) at 228.8 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---------|--------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|
| Cd | 0.020 | 0.020 | 0.000 | 1.10 | ± 0.005 |
| | 0.301 | 0.301 | 0.000 | 0.11 | ± 0.005 |
| | 0.707 | 0.693 | -0.013 | 1.85 | ± 0.008 |

3.2 Reading on wavelength- Chromium (Cr) at 357.9 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---------|--------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|
| Cr | 0.1007 | 0.104 | 0.004 | 3.49 | ± 0.009 |
| | 0.3035 | 0.297 | -0.006 | 2.11 | ± 0.012 |
| | 0.7071 | 0.685 | -0.023 | 3.19 | ± 0.023 |

3.3 Reading on wavelength- Copper (Cu) at 324.7 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---------|--------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|
| Cu | 0.051 | 0.047 | -0.004 | 7.58 | ± 0.003 |
| | 0.303 | 0.296 | -0.007 | 2.19 | ± 0.009 |
| | 0.704 | 0.698 | -0.005 | 0.74 | ± 0.020 |

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FB.ML.MTC.002 Rev.4



Request No. 25-67 / 0275 5 / 5 MTC. ACL. No. 358 / 67

3.7 Reading on wavelength- Nickel (Ni) at 232.0 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---------|--------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|
| Ni | 0.101 | 0.098 | -0.003 | 2.90 | ± 0.013 |
| | 0.508 | 0.502 | -0.006 | 1.16 | ± 0.018 |
| | 1.012 | 0.962 | -0.051 | 5.02 | ± 0.032 |

3.8 Reading on wavelength- Zinc (Zn) at 213.9 nm.

| Element | Standard Value of RM (mg/l) | Reading (mg/l) | Error of Measurement (mg/l) | Error of Measurement (%) | Uncertainty (mg/l) |
|---------|--------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|
| Zn | 0.050 | 0.045 | -0.005 | 9.39 | ± 0.013 |
| | 0.303 | 0.324 | 0.021 | 7.04 | ± 0.013 |
| | 0.707 | 0.675 | -0.032 | 4.52 | ± 0.019 |

Remark : The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 (k = 2)
which gives a level of confidence of approximately 95%

Calibrated by Atipat
(Mr. Atipat Ratana)

Approved by Sumalee
(Miss Suladda Deawtong)
Director of Analytical Chemistry Laboratory
Issued Date : 11 March 2024

INDUSTRIAL METROLOGY AND TESTING SERVICE CENTRE
End of Certificate

The results relate only to the items tested/calibrated or value assigned.
Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

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FB.ML.MTC.002 Rev.4

PinAAcle 900F Preventive Maintenance Report

Company Name: UAE Consultant Co., LTD.

Instrument Location: 41 Sukumvit Rd.,


Phra Khanong, Bangkok 10260

Instrument Serial No.: PFB520031902

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: | PFB520031902 | 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-MMM-YYYY) | 14-May-2024 | Next PM Due Date: (DD-MMM-YYYY) | 14-Nov-2024 |
| Standard Labor Hours to Complete PM: | | 5 hours | |

| | | | |
|----------------|---------|------------------|---|
| Part Number | Release | Publication Date |  |
| 0937014S 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 | PFB520031902 | Syngistix V 4.0.1.1935 |
| Fias100(New Install) | 100524040501 | |
| | | |
| | | |

Parts Lists

| Parts Included with the PM | | |
|-----------------------------|---|----------|
| Part Number (if applicable) | Description | Quantity |
| 80501696 | Fan Filters | N/A |
| N3160156 | O-Ring Kits for Sampling Introduction (Stainless Steel's 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. Gases:

- ☒ Verify that the Gases 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.

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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 |

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8.4 D₂ 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.

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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: |
| Chayaman K. | 14-May-2024 (DD-MM-YY) |
| Authorized Customer Representative: | Date: |
| สุวิมล หอ | 14-May-2024 (DD-MM-YY) |

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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.

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

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.

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 6015B | MY 19030001 |
| 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 (OneJet) 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 |

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Preparation

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

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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. (ถ้า)
- ☒ Remove and clean instrument water inlet filter.

Agilent Water Recirculator

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

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SPS 3 Auto Sampler

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

SPS 4 Auto sampler

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

AVS 4, 6, 7 Advanced Valve System

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

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ICP-OES adjustment

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

Record Post-PM instrument performance

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

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

- ☒ Record the result in the Instrument Test Results Table

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.

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 | 1500.9 | 2219.4 | 4124.9 | 6965.9 |
| Mn 257.610 nm SRBR | 3919.0 | 7442.2 | 13017.9 | 31121.6 |
| Al 396.152 nm SBR | 9.9 | 10.9 | 9.9 | 21.1 |
| K 766.491 nm SBR | 5.9 | 29.1 | 4.9 | 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 ₉₅₅ |
| Air Flow | P ₉₅₅ |
| Water Flow | P ₉₅₅ |
| Gas Flows | P ₉₅₅ |
| RF Generator | P ₉₅₅ |
| Camera Test | P ₉₅₅ |
| Optics Test | P ₉₅₅ |
| Nebulizer test | P ₉₅₅ |

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 | 226.691 | 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 | 0.96 | L/min | 0.91 | L/min |
| Water Inlet Temperature | 19.9 | °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 | 649.92 | kPa | 591.55 | kPa |
| Purge Gas Supply Pressure*1 | 646.66 | kPa | 612.41 | kPa |
| Option Gas Supply Pressure*1 | — | kPa | — | kPa |
| Nebulizer Flow | No measurement | | 0.90 | L/min |
| Nebulizer Back Pressure | No measurement | | 158.43 | 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 | | 7.995 | A |
| RF Supply Voltage | No measurement | | 204.419 | 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[illegible]

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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:

6003193100

Service Engineer Name:

Konyakorn S.

Service Engineer Signature: _____

Kongkorn S.
Total number of pages in this document

Date Service Completed

04 Nov 2024

Customer Name:

Aphorn Onkong

Customer Signature: _____

Aphorn Onkong



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 (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 |

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 | 1496.8 | 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 | 0.96 |
| 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 |
| Firmware Version | 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 |

Page 1 of 4

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 | (213.837 nm) | ≤ 8.70 | 6.70 |
| Pb | (220.553 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 | (480.733 nm) | ≤ 36.00 | 17.31 |
| Ba | (493.408 nm) | ≤ 36.00 | 25.44 |
| Ba | (614.171 nm) | ≤ 42.00 | 25.16 |
| Ar | (675.263 nm) | ≤ 74.00 | 66.16 |
| 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 | 271946.0 | 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 | 1596.7 | 73.0 |
| Se (196.026 nm) | ≥ 159.0 | SRBR | 167.0 | 1863.4 | 110.2 |
| Zn (200.200 nm) | ≥ 234.0 | SRBR | 740.9 | 6836.0 | 83.1 |
| Zn (213.857 nm) | ≥ 1743.0 | SRBR | 6965.9 | 101598.1 | 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 | 0.98 |
| 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 (200.200 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 |

Page 1 of 2

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 | 11/6/2024 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 |

Page 1 of 4

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 (206.156 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 (614.171 nm) | ≤ 42.00 | 25.23 | |
| Ar (675.263 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 | 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 | 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 | 195.3 | |
| 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 | 6396.3 | 157551.5 | 601.7 | |
| Cd (214.439 nm) | ≥ 4227.0 | SRBR | 5059.2 | 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) | ≤ 2.80 | 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

Cert. No.: 24TM647
Page : 1 of 3

Equipment : Incubator
Manufacturer : Binder
Model : KB 400 E6
Serial No. : 2020000015535
ID No. : UAE.MIC.018/2564
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10250
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 01 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 April 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 : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-6
Procedure Used :-

Cert. No.: 24TM647
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.

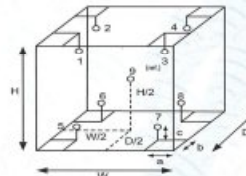
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (°) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 24 | 24 |
| REL.Humid. (%) | 54 | 57 |
| AC Supply (Volt) | 221 | 223 |



Probe Installation Details :

| | | |
|-----|----|----|
| a = | 10 | cm |
| b = | 10 | cm |
| c = | 10 | cm |

Dimension of Chamber :

| | | |
|------------|------|----------------|
| D = | 0.48 | m |
| W = | 0.65 | m |
| H = | 1.2 | m |
| Capacity = | 0.37 | m ³ |

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | 20-16RTD-01 |
| 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 |

Certificate of Calibration

Cert. No.: 24TM650
Page : 1 of 3



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-0003OC-6
Result of Calibration :- (°) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM647
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 | 0.035 | 0.19 | 0.22 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (± °C) |
|------------------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|----------|--------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 35.0 | 35.000 | 35.022 | 34.841 | 34.851 | 35.027 | 35.011 | 35.023 | 35.028 | 35.007 | 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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เอกสารไม่ควบคุม



Certificate of Calibration

Cert. No.: 24TM650
Page : 1 of 3

Equipment : Incubator
Manufacturer : Memmert
Model : IPP 260
Serial No. : V616.0066
ID No. : UAE.MIC.032/2569
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10250
Location : Microbiology Laboratory (302)
Received Order : 01 April 2024
Calibration Date : 02 - 03 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Man Pattanapongpaiboon
Approved by :
() Ponpan Paipim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 7 April 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 : Incubator
Condition As-Received : Used Item
Reference : 2404-003OC-2

Cert. No.: 24TM650
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 |

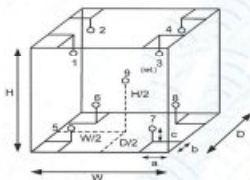
2. This certificate is valid only to the item calibrated on date and place of calibration.
3. This certification is traceable to the International System of Unit.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.64 m
H = 0.80 m
Capacity = 0.26 m³

| Environment during calibration | | |
|--------------------------------|-----------|----------|
| | Beginning | Finished |
| Temp. (°C) | 25 | 25 |
| REL.Humid. (%) | 57 | 54 |
| AC Supply (Volt) | 221 | 222 |

| 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 |



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2404-003OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM650
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 |
|--------------------------|---------------------|---------------------|--------------------------------|-------------------------------|--------------------------|-------------------|
| 25.0 | 25.0 | 25.0 | 0.053 | 0.78 | 1.3 | 2 |
| 36.0 | 36.0 | 36.0 | 0.14 | 0.57 | 0.93 | 2 |

| Calibration Point (°C) | Measured Temperature (°C) | | | | | | | | | Uncertainty (± °C) |
|--------------------------|-----------------------------|--------|--------|--------|--------|--------|--------|--------|----------|----------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 (ref.) | |
| 25.0 | 25.590 | 25.310 | 25.439 | 25.412 | 24.347 | 24.332 | 24.313 | 24.414 | 24.875 | 0.30 |
| 36.0 | 35.643 | 35.965 | 35.618 | 35.701 | 36.239 | 36.260 | 36.343 | 36.357 | 36.063 | 0.31 |

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
5344 PATTANAKARN ROAD SOI 14, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-3000-29 FAX: 0-2719-9484



Cert. No.: 24TM29
Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath
Manufacturer : Memmert
Model : WNE 14
Serial No. : L416.0606
ID No. : UAE.MIC.002/2560
Submitted by : United Adlyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Microbiology Laboratory
Received Order : 10 February 2024
Calibration Date : 10 February 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Pornthippa Tameyakul
() Unnopphol Harachai
() Suwit Imjai

Issue Date : 19 February 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 : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-2

Cert. No.: 24TM29
Page : 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|----------------------|------------|-----------|-----------|-------------|
| 1) Data Acquisition | MY49001451 | 23LM27 | TPA | 25 Feb 2024 |

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

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

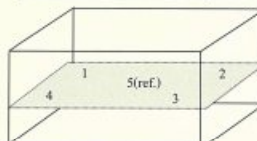
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

| | Environmental | | AC Voltage Supply |
|--------------------------|---------------|-----------|-------------------|
| | (°C) | (%R.H.) | (Volt) |
| Beginning of Calibration | 26 | 51 | 220 |
| Finished of Calibration | 25 | 50 | 221 |



Front

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | N37P301419 |
| 2 | N37P300732 |
| 3 | N37P301420 |
| 4 | N37P301421 |
| 5(ref.) | N37P301425 |

เอกสารไม่ควบคุม



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM29
Page : 3 of 3

| Calibration point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Average* Standard Reading (°C) | | | | | Uncertainty (± °C) |
|-----------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|-------------------------|
| | | | 1 | 2 | 3 | 4 | 5 (ref.) | |
| 44.5 | 44.4 | 44.4 | 44.508 | 44.489 | 44.502 | 44.521 | 44.527 | 0.15 |

| Calibration point (°C) | Uniformity (°C) | Stability (± °C) | Coverage Factor k |
|-----------------------------|----------------------|-----------------------|----------------------|
| 44.5 | 0.15 | 0.074 | 2 |

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration

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

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

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เอกสารไม่ควบคุม



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5345 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2719-3000-29 FAX. 0-2719-9484



Cert. No.: 24TM306/1
Page : 1 of 3

Certificate of Calibration

This Certificate was issued to replace to the Certificate No. 24TM308
Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 14

Serial No. : L416.0614

ID No. : UAE.MIC.020/2561

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10250

Location : Microbiology Laboratory

Received Order : 10 February 2024

Calibration Date : 10 - 11 February 2024

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Krisda Malee

Approved by : 
Approved Signatory

() Pongthippa Tameyakul
() Unnopphol Harachai
(✓) Suwit Imjai

Issue Date : 12 February 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.

A 0064399



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-4
Procedure Used :-

Cert. No.: 24TM306/1
Page : 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT04 Based on ASTM E715 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

| Instrument | Serial No. | Cert. No. | Traceable | Due Date |
|----------------------|------------|-----------|-----------|-------------|
| 1) Data Acquisition | MY49001451 | 23LM27 | TPA | 25 Feb 2024 |

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

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

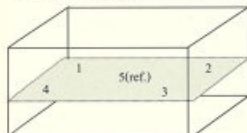
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Heat transfer medium used : Water

| | Environmental | | AC Voltage Supply |
|--------------------------|---------------|-----------|-------------------|
| | (°C) | (%R.H.) | (Volt) |
| Beginning of Calibration | 24 | 52 | 221 |
| Finished of Calibration | 23 | 54 | 220 |



Front

| Position : | Ref. Std. ID No.: |
|------------|-------------------|
| 1 | N37P301419 |
| 2 | N37P300732 |
| 3 | N37P301420 |
| 4 | N37P301421 |
| 5(ref.) | N37P301425 |



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2402-0232OC-4
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 24TM309/1
Page : 3 of 3

| Calibration point (°C) | UUC* Setting (°C) | UUC* Reading (°C) | Average* Standard Reading (°C) | | | | | Uncertainty (± °C) |
|-----------------------------|---------------------------|---------------------------|----------------------------------|--------|--------|--------|----------|-------------------------|
| | | | 1 | 2 | 3 | 4 | 5 (ref.) | |
| 44.5 | 44.5 | 44.5 | 44.516 | 44.483 | 44.481 | 44.506 | 44.504 | 0.15 |
| 50.0 | 50.0 | 50.0 | 50.062 | 50.016 | 50.006 | 50.035 | 50.044 | 0.15 |

| Calibration point (°C) | Uniformity (°C) | Stability (± °C) | Coverage Factor k |
|-----------------------------|----------------------|-----------------------|----------------------|
| 44.5 | 0.080 | 0.048 | 2 |
| 50.0 | 0.11 | 0.068 | 2 |

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

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

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.
UUC* : Unit Under Calibration

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

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

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a 1205492

Calibration Certificate

Certificate No.: 2403982-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Order No.: 2403982
Operation No.: 2403982-001
Date of Receipt: 7 August 2024
Date of Calibration: 7 August 2024

Calibrated by Mr. Manas Somsak Specialist
Approved by *P. Jenghant*
(Miss Preyaporn Jaengkarnkit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team
Date of Issue: 14 August 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.: 2403982-001-01
Equipment: Autoclave
Model: CL-40L
Resolution: 1 °C
Manufacturer: ALP
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Date of Calibration: 7 August 2024

Page 2 of 3

Location: MICROBIOLOGY LABORATORY (301), UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Environment Condition:
Ambient Temperature (29 ± 1) °C
Relative Humidity (60 ± 5) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard Data loggers with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1:2021, Autoclaves for sterilization in laboratories
Part 1: Design, construction, safety and performance - Specification.
- The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.
- Reference Standard Instrument :

| Instrument | Model | Serial No. | Certificate No. | Due Date | Through |
|--|------------------|------------|-----------------|-----------|-------------------------|
| Digital Thermometer with RTD (Data Logger) | QM-CP-HITEMP-140 | Q88555 | TE 670230-01 | 25-Feb-25 | NATIONAL FOOD INSTITUTE |
| | QM-CP-HITEMP-140 | R55951 | TE 670231-01 | 25-Feb-25 | NATIONAL FOOD INSTITUTE |
| | QM-CP-HITEMP-140 | R56916 | TE 670232-01 | 25-Feb-25 | NATIONAL FOOD INSTITUTE |

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated Item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL
Time of sterilization 15 Minute At 121 °C

8. Result of Calibration : ☒ Without adjustment
☐ After adjustment

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

Calibration Report

Certificate No.: 2403982-001-01
Equipment: Autoclave
Model: CL-40L
Resolution: 1 °C
Manufacturer: ALP
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Date of Calibration: 7 August 2024

Page 3 of 3

Calibration point: 121 °C

Calibration result:

| Calibration Condition | Temperature (°C) | Relative Humidity (%) | Line Voltage (Volt) |
|-----------------------|------------------|-----------------------|---------------------|
| Min | 28.0 | 55 | 224 |
| Max | 30.0 | 65 | 226 |

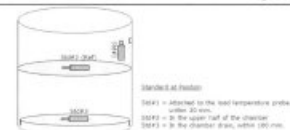


Table 1 : Reporting of Temperature

| Calibration Point (°C) | Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF) | | | Uncertainty ± (°C) |
|------------------------|---|---------------|---------|--------------------|
| | Std.# 1 | Std.# 2 (Ref) | Std.# 3 | |
| 121 | 122.43 | 122.44 | 122.44 | 0.65 |

Table 2 : Reporting of Characterization Result

| UUC* Setting (°C) | UUC* Reading | | | | Stability ± (°C) | Uniformity (°C) | Overall Variation (°C) |
|-------------------|--------------|----------|--------------|------|------------------|-----------------|------------------------|
| | Min (°C) | Max (°C) | Average (°C) | MPa | | | |
| 122 | 122 | 122 | 122 | 0.11 | 0.065 | 0.031 | 0.14 |

Note

The quoted uncertainty include " Stability " and " Loading effect (20% of Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

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.

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

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

----- End -----

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

Calibration Certificate

Certificate No.: 2402281-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 808763
ID No.: UAE.MIC.026/2563
Order No.: 2402281
Operation No.: 2402281-001
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr. Jerawut Prapawuttipong Scientist
Approved by *P. Jenghant*
(Mr. Phraphat Tunjit)
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.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L **Serial No.:** 808763
Resolution: 0.1 °C **ID No.:** UAE.MIC.026/2563
Manufacturer: ALP
Date of Calibration: 2 April 2024 **Page 2 of 3**

Location: LABORATORY, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (25 ± 1) °C
Relative Humidity (55 ± 7) %
Line Voltage (225 ± 5) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.
- The temperature scale used was based on ITS - 90 .
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

| Instrument | Model | Serial No. | Certificate No. | Due Date | Through |
|--|-------------|------------|-----------------|-----------------|-------------------------|
| Digital Thermometer with RTD (Data Logger) | HiTemp140-2 | 854918 | TE 660383-01 | 8 April 2024 | NATIONAL FOOD INSTITUTE |
| | HiTemp140-2 | S25601 | TE 670033-01 | 9 November 2024 | MADETECH INC. |
| | HiTemp140-2 | S25602 | TE 670034-01 | 9 November 2024 | MADETECH INC. |

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good
- UUC Description : Setting program function sterilization : STERILIZE/NORMAL
Time of sterilization 15 Minute At 115.0 and 121.0 °C
- Result of Calibration : ☒ Without adjustment
☐ After adjustment

FCS-012 Revision: 01 Date: 20-04-65

2008 ๒๕๕๒-๒๕๖๕ 35 หมู่๖ ต.บึงนาราง อ.บึงนาราง จ.พิจิตร ๓๖๐๐๐
2008 Soi 35, Anur Achin Road, Bang Yi Khan Subdistr, Bang Phli District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8688 Fax : +66(0) 2422 8505

Calibration Certificate

Certificate No.: 2402419-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance

Manufacturer: OHAUS

Model: PX623

Serial No.: C236754745

ID No.: UAE.MIC.055/2565

Order No.: 2402419

Operation No.: 2402419-001

Date of Receipt: 19 April 2024

Date of Calibration: 19 April 2024

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by *P. Pheraphat*
(Miss Pheraphat Jaengkarnkit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team

Date of Issue: 23 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.

FCS-009 Revision: 01 Date: 20-04-65

2008 ๒๕๕๒-๒๕๖๕ 35 หมู่๖ ต.บึงนาราง อ.บึงนาราง จ.พิจิตร ๓๖๐๐๐
2008 Soi 35, Anur Achin Road, Bang Yi Khan Subdistr, Bang Phli District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8688 Fax : +66(0) 2422 8505

Calibration Report

Certificate No.: 2402281-001-01
Equipment: Autoclave
Model: CL-40L **Serial No.:** 808763
Resolution: 0.1 °C **ID No.:** UAE.MIC.026/2563
Manufacturer: ALP
Date of Calibration: 2 April 2024 **Page 3 of 3**

Calibration point: 115.0 and 121.0 °C

Calibration result:

| Calibration Condition | Temperature (°C) | Relative Humidity (%) | Line Voltage (Volt) |
|-----------------------|------------------|-----------------------|---------------------|
| Min | 24.4 | 48.6 | 220 |
| Max | 25.5 | 62.1 | 230 |

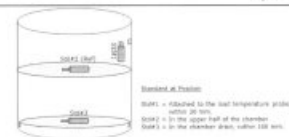


Table 1 : Reporting of Temperature

| Calibration Point (°C) | Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF) | | | Uncertainty ± (°C) |
|------------------------|---|---------------|---------|--------------------|
| | Std.# 1 | Std.# 2 (Ref) | Std.# 3 | |
| 115.0 | 115.28 | 115.35 | 115.38 | 0.64 |
| 121.0 | 121.28 | 121.36 | 121.37 | 0.64 |

Table 2 : Reporting of Characterization Result

| UUC* Setting (°C) | UUC* Reading | | | | Stability ± (°C) | Uniformity (°C) | Overall Variation (°C) |
|-------------------|--------------|----------|--------------|------|------------------|-----------------|------------------------|
| | Min (°C) | Max (°C) | Average (°C) | MPa | | | |
| 115.0 | 115.0 | 115.1 | 115.0 | 0.08 | 0.19 | 0.13 | 0.48 |
| 121.0 | 121.0 | 121.1 | 121.0 | 0.12 | 0.17 | 0.10 | 0.38 |

Note

- The quoted uncertainty include " Stability " and " Loading effect (20% of Uniformity) "
- UUC* = Unit, under Calibration
- Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.
- 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.
- Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.
- The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

FCS-012 Revision: 01 Date: 20-04-65

2008 ๒๕๕๒-๒๕๖๕ 35 หมู่๖ ต.บึงนาราง อ.บึงนาราง จ.พิจิตร ๓๖๐๐๐
2008 Soi 35, Anur Achin Road, Bang Yi Khan Subdistr, Bang Phli District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8688 Fax : +66(0) 2422 8505

Calibration Report

Certificate No.: 2402419-001-01
Equipment: Electronic Balance
Model: PX623 **Manufacturer:** OHAUS
Serial No.: C236754745 **Resolution:** 0.001 g
Capacity: 620 g **ID No.:** UAE.MIC.055/2565
Date of Calibration: 19 April 2024 **Page 2 of 3**

Environment Condition: Ambient Temperature: 26.0 ± 0.3 °C Relative Humidity: 57 ± 8.4 %
Place of Calibration: Room 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Condition of Equipment: Good Condition

Condition of This Results of Calibration:

- 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 | 1-500g | 15882 | TCS | M23111825 | 28 November 2024 |
- | Instrument | Model | Serial No. | Calibrated By | Certificate No. | Due Date |
|--------------------|--------|----------------|----------------|-----------------|--------------|
| Thermo-Hygro Meter | 608-H1 | NFI.8TH 010/23 | Quality Reason | QK24-0452 | 4 March 2025 |
- This certification is traceable to SI UNIT
 - This certificate was certified only for the instrument we calibrated.
 - 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) |
|---------------------|-------------------------------------|
| 300 | 0.00067 |
| 600 | 0.0019 |

2. Off-Center Error:

A mass of 200 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) |
| 200.000 | 200.002 | 200.001 | 199.999 | 200.000 | 200.000 | 0.002 |

FCS-012 Revision: 01 Date: 20-04-65

2008 ๒๕๕๒-๒๕๖๕ 35 หมู่๖ ต.บึงนาราง อ.บึงนาราง จ.พิจิตร ๓๖๐๐๐
2008 Soi 35, Anur Achin Road, Bang Yi Khan Subdistr, Bang Phli District, Bangkok 10700, Thailand
Tel : +66(0) 2422 8688 Fax : +66(0) 2422 8505

Calibration Report

Certificate No.: 2402419-001-01

Equipment: Electronic Balance
Model: P8223
Serial No.: C236754745
Capacity: 620 g

Manufacturer: OHAUS
Resolution: 0.001 g
ID No.: UAE.MIC.055/2565

Date of Calibration: 19 April 2024

Page 3 of 3

Calibration Results: (Continued)

Calibration Range: 0-600 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

| Nominal Value (g) | Standard Value (g) | Average Reading (g) | Correction (g) | Uncertainty (g) | Coverage Factor k |
|----------------------|-----------------------|------------------------|-------------------|--------------------|----------------------|
| Unload | 0.0000 | 0.000 | 0.000 | 0.00093 | 2.00 |
| 1 | 1.0000 | 1.000 | 0.000 | 0.00093 | 2.00 |
| 5 | 5.0000 | 5.000 | 0.000 | 0.00093 | 2.00 |
| 10 | 10.0000 | 10.000 | 0.000 | 0.00093 | 2.00 |
| 20 | 20.0000 | 20.000 | 0.000 | 0.00093 | 2.00 |
| 50 | 50.0000 | 50.001 | -0.001 | 0.00093 | 2.00 |
| 100 | 100.0000 | 100.001 | -0.001 | 0.00094 | 2.00 |
| 200 | 200.0000 | 200.001 | -0.001 | 0.0011 | 2.00 |
| 300 | 300.0000 | 300.003 | -0.003 | 0.0013 | 2.00 |
| 400 | 400.0000 | 400.003 | -0.003 | 0.0012 | 2.00 |
| 500 | 500.0000 | 500.003 | -0.003 | 0.0013 | 2.00 |
| 600 | 600.0000 | 600.002 | -0.002 | 0.0014 | 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 -----

FCS-012 Revision: 01 Date: 20-06-65

ศูนย์อาหารเพื่อพัฒนาอุตสาหกรรมอาหาร
ศูนย์บริการและพัฒนาระบบการอาหารอุตสาหกรรม
Foundation for Industrial Development National Food Institute
Food Industrial Laboratory Service Center

เอกสารไม่ควบคุม
P8223

| Equipment: Electronic Balance | | | | | | | | | | |
|--------------------------------|----------------|-----------------|--------|--------|------------|-----------------|-------|----------------------------|-----------|-------------------------|
| Model: P8223 | | | | | | | | | | |
| ID No.: UAE.MIC.055/2565 | | | | | | | | | | |
| Nominal Value | Standard Value | Average Reading | | Error | Correction | Uncertainty (U) | | U + Error Total Error | Judgement | Result (Pass / Fail) |
| | | (g) | (g) | | | (g) | (g) | | | |
| 0 | 0.0000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00093 | 0.001 | 0.001 | 0.000 | Pass |
| 1 | 1.0000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.00093 | 0.001 | 0.001 | 0.000 | Pass |
| 5 | 5.0000 | 5.000 | 0.000 | 0.000 | 0.000 | 0.00093 | 0.001 | 0.001 | 0.000 | Pass |
| 10 | 10.0000 | 10.000 | 0.000 | 0.000 | 0.000 | 0.00093 | 0.001 | 0.001 | 0.000 | Pass |
| 20 | 20.0000 | 20.000 | 0.000 | 0.000 | 0.000 | 0.00093 | 0.001 | 0.001 | 0.000 | Pass |
| 30 | 50.0000 | 50.001 | -0.001 | -0.001 | -0.001 | 0.00093 | 0.002 | 0.002 | 0.000 | Pass |
| 100 | 100.0000 | 100.001 | -0.001 | -0.001 | -0.001 | 0.00094 | 0.002 | 0.002 | 0.000 | Pass |
| 200 | 200.0000 | 200.001 | -0.001 | -0.001 | -0.001 | 0.00110 | 0.002 | 0.002 | 0.000 | Pass |
| 300 | 300.0000 | 300.003 | -0.003 | -0.003 | -0.003 | 0.00110 | 0.004 | 0.004 | 0.000 | Pass |
| 400 | 399.9999 | 400.003 | -0.003 | -0.003 | -0.003 | 0.0012 | 0.004 | 0.004 | 0.000 | Pass |
| 500 | 499.9999 | 500.005 | -0.005 | -0.005 | -0.005 | 0.0013 | 0.004 | 0.004 | 0.000 | Pass |
| 600 | 599.9999 | 600.002 | -0.002 | -0.002 | -0.002 | 0.0014 | 0.003 | 0.003 | 0.000 | Pass |
| UC * 1. Line Under Calibration | | | | | | | | | | |
| Remarks: | | | | | | | | | | |

เอกสารไม่ควบคุม

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 |
|----------------|---|---|--------------|------------------|-----------------------------------|-------------------|---------------------|-------------------------|--------|
| Ambient | | | | | | | | | |
| 1 | Sound Level Calibrator (Acoustic Calibrator) | Calibrate Sound Level Meter | Larson Davis | CAL150 6855 | Innovative Instrument Co.,Ltd. | 24-ACT-121 | 10 Sep 24 | 9 Sep 25 | - |
| 2 | Sound Level Meter | L _{Aeq} 24 hrs ^a L _{A90} ^a L _{Amax} ^a L _{Ain} ^a | Larson Davis | LxT2 0006698 | Innovative Instrument Co.,Ltd. | 24-SLM-233 | 10 Jul 24 | 9 Jul 25 | - |

List of Instruments Certification for Water Quality Analysis

| No. | Instrument/Equipment | Parameter | Manufacturer | Model/Serial No. | Calibrator | Certification No. | Date of Calibration | Due date of Calibration | Remark |
|--------------|----------------------|-----------|--------------|-------------------------|--|-------------------|---------------------|-------------------------|--------|
| Water | | | | | | | | | |
| 1 | pH Meter | pH | Horiba | LAQUA-PH210 HA0F0026 | Technology Promotion Association (Thailand-Japan) | 24CH38 | 11 Jan 24 | 10 Jan 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 | | | | | | | | | |
| 1 | Thermal Environment Monitor | Heat Meter | TSI QUEST | QuesTemp 32 TPT030008 | Innovative Instrument Co.,Ltd. | 23-TPM-502 | 2 Nov 23 | 1 Nov 24 | - |
| 2 | Thermal Environment Monitor | Heat Meter | 3M | QuesTemp 32 TP5030007 | Innovative Instrument Co.,Ltd. | 24-TPM-048 | 23 Jan 24 | 22 Jan 25 | - |
| 3 | Thermal Environment Monitor | Heat Meter | 3M | QuesTemp 32 TPQ020024 | Innovative Instrument Co.,Ltd. | 24-TPM-148 | 21 Mar 24 | 20 Mar 25 | - |
| 4 | Thermal Environment Monitor | Heat Meter | TSI QUEST | QuesTemp 34 TEX040013 | Innovative Instrument Co.,Ltd. | 24-TPM-347 | 6 Aug 24 | 5 Aug 25 | - |
| 5 | Air Flow Meter | Calibrate personal pump | TSI,Inc | 4146 41461813030 | Innovative Instrument Co., Ltd. | 24-AFM-223 | 8 Nov 24 | 7 Nov 25 | - |
| 6 | Air Sampling Pump | Zinc Oxide Fume | Sensidyne | GilAir Plus 20230610200 | Innovative Instrument Co., Ltd. | 24-ASP-126 | 27 Aug 24 | 26 Aug 25 | - |
| 7 | Primary Flow Calibrator | Calibrate personal pump | TSI,Inc | 4146 41462327004 | Innovative Instrument Co., Ltd. | 24-AFM-157 | 19 Aug 24 | 18 Aug 25 | - |
| 8 | Air Sampling Pump | Zinc Oxide Fume | Sensidyne | GilAir Plus 20230610201 | Innovative Instrument Co., Ltd. | 24-ASP-121 | 26 Aug 24 | 25 Aug 25 | - |

Certificate of Calibration

Customer

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

Certificate No : 24-ACT-121
Request No : Req-2024-1897

Unit Under Calibration Details

Measurement Item : Acoustic Calibrator Class : 2
Manufacturer : LARSON DAVIS Range : 94 - 114 dB / 1000 Hz
Model : CAL150 Instrument Status : Used
Serial Number : 6855
ID : UAE.EFM.046/2566

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 26 August 2024
Calibration Date : 10 September 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 | EEL | 12 June 2025 |
| THD Multimeter | 2015 | 1047765 | NIMT | 16 January 2025 |

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

Note

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

Calibrated By : 
Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pait Mahavom
Calibration Engineer Supervisor

Issue Date : 10 September 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
PM-708-ACT-02 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-ACT-121

Request No : Req-2024-1897

Sound pressure level

Calibration Results : Without Adjustment

| Calibration Range (dB) | Without Adjustment (dB) | | Adjustment (dB) | | Uncertainty (± dB) | Acceptance limit Class 2 (± dB) | Result |
|---------------------------|-------------------------|----------------|-----------------|----------------|------------------------|-------------------------------------|--------|
| | Measured | Deviated value | Measured | Deviated value | | | |
| 94 dB / 1000 Hz | 93.66 | -0.34 | - | - | 0.16 | 0.40 | Pass |
| 114 dB / 1000 Hz | 113.85 | -0.15 | - | - | 0.13 | 0.40 | Pass |

Frequency of Sound pressure level

| Calibration Range (Hz) | Without Adjustment | | Adjustment | | Uncertainty (± %) | Acceptance limit Class 2 (± %) | Result |
|---------------------------|--------------------|----------|---------------|----------|-----------------------|------------------------------------|--------|
| | Measured (Hz) | Deviated | Measured (Hz) | Deviated | | | |
| 94 dB / 1000 Hz | 1000.00 | 0.00 | - | - | 0.01 | 1.7 | Pass |
| 114 dB / 1000 Hz | 1000.00 | 0.00 | - | - | 0.01 | 1.7 | Pass |

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

| Calibration Range (Hz) | Without Adjustment | Adjustment | Uncertainty (± %) | Acceptance limit Class 2 (± %) | Result |
|---------------------------|--------------------|--------------|-----------------------|------------------------------------|--------|
| | Measured (%) | Measured (%) | | | |
| 94 dB / 1000 Hz | 0.63 | - | 0.40 | 3.0 | Pass |
| 114 dB / 1000 Hz | 0.24 | - | 0.40 | 3.0 | Pass |

Note :

| Function | Maximum-permitted Uncertainty of measurement |
|------------------------|---|
| Sound pressure level | 0.35 dB |
| Frequency | 0.20% |
| Total distortion+noise | 1.00% |

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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
PM-708-ACT-02 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-ACT-121

Request No : Req-2024-1897

Decision Rule for Statements of Conformity

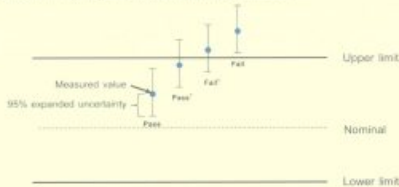
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC G8:09-2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

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 Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
PM-708-ACT-02 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-233

Request No : Req-2024-1452

Unit Under Calibration Details

Measurement Item : Sound Level Meter Microphone Class : 2
Manufacturer : Larson Davis Microphone Model : 375A04
Model : LxT2 Microphone S/N : 53789
Serial Number : 0006988 Pre-amplifier Model : PRMLAT2C
ID : UAE.EFM.138/2565 Pre-amplifier S/N : 071568
Resolution : 0.1 dB Instrument Status : Used

Calibration Environment and Details


Temperature : 25 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 1 July 2024
Calibrated Date : 10 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

| Instrument | Brand | Model | SN | Due calibration | Traceability |
|---------------------------|--------|-----------|------------|-----------------|---------------|
| Standard Microphone | GRAS | 40AN | 188273 | 20 August 2024 | GRAS |
| Multifrequency Calibrator | Quest | Quest-cal | ETAS000234 | 26 July 2024 | TSL |
| Audio Generator | Svante | Scan401 | 131 | 8 October 2024 | W.K. Electric |

Note

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

Calibrated By : 
Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By : 
Mr. Pait Mahavom
Calibration Engineer Supervisor

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 body.
PM-708-SLM-01 Rev.03 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-SLM-233
Request No : Req-2024-1452

1. Indication at the calibration check frequency

| UUC Setting | Nominal | Before Adjust | | After Adjust | | UNCERTAINTY | Acceptance Limit | Result |
|--------------------|---------|---------------|------|--------------|-------|-------------|------------------|--------|
| FAST / A / 37-139 | | UUC | ERR | UUC | ERR | | | |
| Calibrator Setting | (dB) | (dB) | (dB) | (dB) | (dB) | (\pm dB) | (\pm dB) | |
| 1000 Hz 114 dB | 113.76 | 114.6 | 0.84 | 113.8 | +0.04 | 0.20 | 0.30 | Pass |

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

2. Self-generated noise, Microphone installed

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 | | |
| UUC Weighting | (dB) | (\pm dB) |
| A | 29.3 | 0.10 |

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

| UUC Setting | Measured | UNCERTAINTY |
|---------------|----------|-------------|
| FAST / 37-139 | | |
| UUC Weighting | (dB) | (\pm dB) |
| A | 29.0 | 0.10 |
| C | 28.7 | 0.10 |
| Z | 33.1 | 0.10 |

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

| UUC Setting | Deviation from various Frequency Weighting Response curve | UNCERTAINTY | Acceptance Limit | Result |
|---------------|---|-------------|------------------|--------|
| FAST / 37-139 | A C Z | (\pm dB) | (\pm dB) | |
| STD Setting | (dB) (dB) (dB) | (\pm dB) | (\pm dB) | |
| 125 Hz | -0.1 0.1 0.0 | 0.00 | 1.5 | Pass |
| 1000 Hz | 0.0 0.0 0.0 | 0.00 | 1.0 | Pass |
| 4000 Hz | 0.7 0.7 0.7 | 0.00 | 3.0 | Pass |
| 8000 Hz | 0.9 0.9 1.0 | 0.70 | 5.0 | Pass |

The results related only to the item addressed. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
File: 100-01-01 Rev.03 Issue date: 5/6/24

Certificate No : 24-SLM-233
Request No : Req-2024-1452

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

| UUC Setting | Deviation from various Frequency Weighting Response curve | UNCERTAINTY | Acceptance Limit | Result |
|---------------|---|-------------|------------------|--------|
| FAST / 37-139 | A (dB) C (dB) Z (dB) | (\pm dB) | (\pm dB) | |
| STD Setting | (dB) (dB) (dB) | (\pm dB) | (\pm dB) | |
| 63 Hz | -0.1 0.0 0.0 | 0.20 | 2.0 | Pass |
| 125 Hz | -0.1 0.1 0.0 | | 1.5 | Pass |
| 250 Hz | -0.1 0.0 0.0 | | 1.5 | Pass |
| 500 Hz | 0.0 0.1 0.0 | | 1.5 | Pass |
| 1000 Hz | 0.0 0.0 0.0 | | 1.0 | Pass |
| 2000 Hz | 0.1 0.1 0.0 | | 2.0 | Pass |
| 4000 Hz | 0.0 0.1 0.1 | | 3.0 | Pass |
| 8000 Hz | 0.0 0.0 0.1 | | 5.0 | Pass |
| 16000 Hz | 0.0 0.0 -0.1 | | +5, -8% | Pass |

6. Frequency and time weightings at 1kHz

| UUC Setting | STD | Measured | UNCERTAINTY | Acceptance Limit | Result |
|---------------|--------|-------------------|-------------|------------------|--------|
| FAST / 37-139 | REF | UUC (dB) ERR (dB) | (\pm dB) | (\pm dB) | |
| UUC Weighting | (dB) | (dB) (dB) | (\pm dB) | (\pm dB) | |
| A | 114.00 | 114.0 0.0 | 0.20 | 0.20 | Pass |
| C | 114.00 | 114.0 0.0 | | 0.20 | Pass |
| Z | 114.00 | 114.0 0.0 | | 0.20 | Pass |

| UUC Setting | STD | Measured | UNCERTAINTY | Acceptance Limit | Result |
|-------------------|--------|-------------------|-------------|------------------|--------|
| 37-139 / A | REF | UUC (dB) ERR (dB) | (\pm dB) | (\pm dB) | |
| UUC Time Response | (dB) | (dB) (dB) | (\pm dB) | (\pm dB) | |
| Fast | 114.00 | 114.0 0.0 | 0.20 | 0.10 | Pass |
| Slow | 114.00 | 114.0 0.0 | | 0.10 | Pass |
| Log | 114.00 | 114.0 0.0 | | 0.10 | Pass |

The results related only to the item addressed. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
File: 100-01-01 Rev.03 Issue date: 5/6/24

Certificate No : 24-SLM-233
Request No : Req-2024-1452

7. Long Term Stability

| UUC Setting | Measured | UNCERTAINTY | Acceptance Limit | Result |
|-------------------|----------|-------------|------------------|--------|
| FAST / A / 37-139 | UUC | (\pm dB) | (\pm dB) | |
| STD Setting | (dB) | | | |
| Initial | 114.0 | | | |
| Final | 114.0 | | | |
| Deviated | 0.0 | 0.10 | 0.30 | Pass |

8. Level linearity on the reference level range

| UUC Setting | Anticipated | Deviation | UNCERTAINTY | Acceptance Limit | Result |
|-------------------|-------------|-------------------|-------------|------------------|--------|
| FAST / A / 37-139 | REF | UUC (dB) ERR (dB) | (\pm dB) | (\pm dB) | |
| STD dB | (dB) | (dB) (dB) | (\pm dB) | (\pm dB) | |
| 138.00 | 139 | 139.0 0.0 | 0.30 | 1.1 | Pass |
| 134.00 | 134 | 134.0 0.0 | | 1.1 | Pass |
| 129.00 | 129 | 129.0 0.0 | | 1.1 | Pass |
| 124.00 | 124 | 124.0 0.0 | | 1.1 | Pass |
| 119.00 | 119 | 119.0 0.0 | | 1.1 | Pass |
| 114.00 | 114 | 114.0 0.0 | | 1.1 | Pass |
| 109.00 | 109 | 109.0 0.0 | | 1.1 | Pass |
| 104.00 | 104 | 104.0 0.0 | | 1.1 | Pass |
| 99.00 | 99 | 99.0 -0.1 | | 1.1 | Pass |
| 94.00 | 94 | 93.9 -0.1 | | 1.1 | Pass |
| 89.00 | 89 | 88.9 -0.1 | | 1.1 | Pass |
| 84.00 | 84 | 83.9 -0.1 | | 1.1 | Pass |
| 79.00 | 79 | 78.9 -0.1 | | 1.1 | Pass |
| 74.00 | 74 | 73.9 -0.1 | | 1.1 | Pass |
| 69.00 | 69 | 68.9 -0.1 | | 1.1 | Pass |
| 64.00 | 64 | 63.9 -0.1 | | 1.1 | Pass |
| 59.00 | 59 | 58.9 -0.1 | | 1.1 | Pass |
| 54.00 | 54 | 53.9 -0.1 | | 1.1 | Pass |
| 49.00 | 49 | 49.0 0.0 | | 1.1 | Pass |
| 44.00 | 44 | 44.0 0.0 | | 1.1 | Pass |
| 39.00 | 39 | 39.3 0.3 | | 1.1 | Pass |

The results related only to the item addressed. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
File: 100-01-01 Rev.03 Issue date: 5/6/24

Certificate No : 24-SLM-233
Request No : Req-2024-1452

9. Level linearity including the level range control

| UUC Setting | STD | Measured | UNCERTAINTY | Acceptance Limit | Result |
|-------------|-------|-------------------|-------------|------------------|--------|
| FAST / A | REF | UUC (dB) ERR (dB) | (\pm dB) | (\pm dB) | |
| UUC Range | (dB) | (dB) (dB) | (\pm dB) | (\pm dB) | |
| 37-139 | 44.10 | 44.2 0.1 | 0.30 | 1.1 | Pass |
| | 114 | 114.0 0.0 | | 1.1 | Pass |

10. Tone burst response

| UUC Setting | STD | Anticipated | Measured | UNCERTAINTY | Acceptance Limit | Result |
|-------------------|-----------|-------------|-------------------|-------------|------------------|--------|
| A / 37-139 | Toneburst | Ref | UUC (dB) ERR (dB) | (\pm dB) | (\pm dB) | |
| UUC Time Response | (ms) | (dB) | (dB) (dB) | (\pm dB) | (\pm dB) | |
| Fast | 200 | 135.0 | 134.9 -0.1 | 0.20 | 1.0 | Pass |
| | 2 | 118.0 | 117.7 -0.3 | | +1.0, -2.5 | Pass |
| | 0.25 | 109.0 | 108.6 -0.4 | | +1.5, -5.0 | Pass |
| Slow | 200 | 128.6 | 128.5 -0.1 | | 1.0 | Pass |
| | 2 | 109.0 | 108.8 -0.2 | | +1.0, -5.0 | Pass |
| | 200 | 129.0 | 129.0 0.0 | | 1.0 | Pass |
| SRL | 2 | 109.0 | 108.9 -0.1 | | +1.0, -2.5 | Pass |
| | 0.25 | 100.0 | 99.8 -0.2 | | +1.5, -5.0 | Pass |

11. Peak C Sound level

| UUC Setting | Anticipated | Measured | UNCERTAINTY | Acceptance Limit | Result |
|---------------------|-------------|-------------------|-------------|------------------|--------|
| FAST / C / 95-142 | REF | UUC (dB) ERR (dB) | (\pm dB) | (\pm dB) | |
| STD Setting | (dB) | (dB) (dB) | (\pm dB) | (\pm dB) | |
| Complete cycle | 137.4 | 136.8 -0.80 | 0.20 | 3.0 | Pass |
| Positive half cycle | 136.4 | 136.2 -0.20 | | 2.0 | Pass |
| Negative half cycle | 136.4 | 136.2 -0.20 | | 2.0 | Pass |

The results related only to the item addressed. The certificate shall not be reproduced except in full, without written approval of **เอกสารไม่ควบคุม**
File: 100-01-01 Rev.03 Issue date: 5/6/24

Certificate No : 24-SLM-233
Request No : Req-2024-1452

12. Overload indication

| EUC Setting | Measured | UNCERTAINTY | Acceptance Limit | Result |
|-------------------------|----------|-------------|------------------|--------|
| FAST / A : 35-130 | EUC | (± 0.0) | (± 0.0) | Pass |
| STD Setting | (dB) | | | |
| Positive one-half cycle | 143.1 | | | |
| Negative one-half cycle | 143.0 | | | |
| Deviated | 0.1 | | | |

13. High Level Stability

| EUC Setting | Measured | UNCERTAINTY | Acceptance Limit | Result |
|-------------------|----------|-------------|------------------|--------|
| FAST / A : 35-130 | EUC | (± 0.0) | (± 0.0) | Pass |
| STD Setting | (dB) | | | |
| Initial | 138.0 | | | |
| Final | 138.0 | | | |
| Deviated | 0.0 | | | |

Note :

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

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

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

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File: 2024-01-15 Rec-036 Issue date: 24/24

Certificate No : 24-SLM-233
Request No : Req-2024-1452

Decision Rule for Statements of Conformity

The stated decision rule employed for the statements of conformity to each calibration result will be applied using IAC:08/09/2005 Guidelines on the

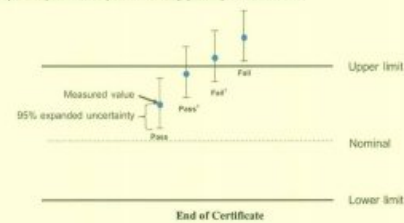
Reporting of Compliance with Specification as following Fig. and statements:

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

เอกสารไม่ควบคุม

File: 2024-01-15 Rec-036 Issue date: 24/24



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



Cert.No.: 24CH38
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA0F0026
ID No. : UAE.EFM.068/2564(EFM.pH.01/64)
Condition As-Received: Used Item
Received Date : 09 January 2024
Calibration Date : 11 January 2024
Reference : 2401-0219WSC-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 standard voltage calibrator and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with standard thermometer

Calibrated by : Warakorn Lerngagrakul

Approved by :
Approved Signatory

(✓) Saithip Meangmai
() Warakorn Lerngagrakul
() Ponpan Paipim

Issue Date : 15 January 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 & Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม
A 0062454



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 | 931959 | 01 Oct 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 Fluke 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 S/N: HA0F0026 | 4.00 | 177.48 | 177.6 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.2 | 0.058 | 2.00 |
| | 7.00 | 0.00 | 0.2 | 0.058 | 2.00 |
| | 10.00 | -177.48 | -177.2 | 0.058 | 2.00 |

เอกสารไม่ควบคุม
a 1197729



Cert.No.: 24CH38
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 : - | 4.008 | 4.01 | 171.6 | 0.0079 | 2.00 |
| | 6.986 | 7.01 | -2.4 | 0.0093 | 2.00 |
| | 6.986 | 7.01 | -2.2 | 0.0093 | 2.00 |
| | 9.997 | 10.00 | -176.2 | 0.0095 | 2.00 |

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe;

- Model : -
- Serial No : -
Dimension of probe;
- Length : 104 mm
- Diameter : 16 mm
- Immersion Depth : 90 mm

| Calibration Point (°C) | Standard Temperature (°C) | UUC* Reading (°C) | Error (°C) | Uncertainty of measurement (\pm °C) | Coverage factor k |
|------------------------|---------------------------|-------------------|------------|--|-------------------|
| 25.0 | 25.001 | 25.0 | -0.001 | 0.13 | 2.00 |
| 30.0 | 30.003 | 30.0 | -0.003 | 0.13 | 2.00 |
| 35.0 | 35.003 | 34.9 | -0.103 | 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 %

-000-

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a 1197728



Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : KI Soi Udonsak 41, Sukharnvit Road, Bangchak, Prakanong, Bangkok 10260
Page : 1/2
Certificate No : 23-TPM-582
Request No : Req-2023-2239
Unit Under Calibration Details
Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPT830088
Resolution : 0.1 °C
ID Number : UAEEFM.219/2562
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 \pm 3 °C
Humidity : 55 %RH \pm 15 %RH
Received Date : 18 October 2023
Calibrated Date : 2 November 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.
Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11/RTD180, SN: 0000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-0494
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. Noppadol Luangrat
Technical Manager
Issue Date : 2 November 2023

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.

เอกสารไม่ควบคุม



Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 23-TPM-582

Request No : Req-2023-2239

Page : 3/3

Result of Calibration :

| UUC Sensor | Standard Temperature (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (°C) |
|------------|---------------------------|------------------|-----------------|------------------|
| WET | 20.031 | 20.0 | 0.0 | 0.13 |
| | 25.033 | 25.0 | 0.0 | 0.13 |
| | 30.035 | 30.0 | 0.0 | 0.13 |
| | 35.036 | 35.0 | 0.0 | 0.13 |
| | 40.040 | 40.0 | 0.0 | 0.13 |
| | 45.040 | 45.0 | 0.0 | 0.13 |
| | 50.043 | 50.0 | 0.0 | 0.13 |
| DRY | 20.033 | 20.1 | -0.1 | 0.13 |
| | 25.036 | 25.1 | -0.1 | 0.13 |
| | 30.037 | 30.1 | -0.1 | 0.13 |
| | 35.039 | 35.1 | -0.1 | 0.13 |
| | 40.039 | 40.1 | -0.1 | 0.13 |
| | 45.041 | 45.1 | -0.1 | 0.13 |
| | 50.043 | 50.1 | -0.1 | 0.13 |
| GLDRE | 20.032 | 20.0 | 0.0 | 0.13 |
| | 25.033 | 25.0 | 0.0 | 0.13 |
| | 30.034 | 30.0 | 0.0 | 0.13 |
| | 35.035 | 35.0 | 0.0 | 0.13 |
| | 40.039 | 40.0 | 0.0 | 0.13 |
| | 45.040 | 45.0 | 0.0 | 0.13 |
| | 50.043 | 50.0 | 0.0 | 0.13 |

End of Certificate

Calibrated By :
Mr. Sirichok Rongphichokul

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.

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Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : KI Soi Udonsak 41, Sukharnvit Road, Bangchak, Prakanong, Bangkok 10260
Page : 1/2
Certificate No : 24-TPM-048
Request No : Req-2023-2087
Unit Under Calibration Details
Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : 3M
Model : QT-32
Serial Number : TPT830007
Resolution : 0.1 °C
ID Number : UAEEFM.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 \pm 3 °C
Humidity : 55 %RH \pm 15 %RH
Received Date : 21 December 2023
Calibrated Date : 23 January 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/RTD180, SN: 0000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-0494
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. Noppadol Luangrat
Technical Manager
Issue Date : 23 January 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.

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Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-048

Request No : Req 2023-2067

Page : 3/2

Result of Calibration :

| UUC Sensor | Standard Temperature (°C) | 11°C Reading (°C) | Correction (°C) | Uncertainty (°C) |
|------------|---------------------------|-------------------|-----------------|------------------|
| WET | 20.643 | 20.3 | -0.3 | 0.14 |
| | 25.835 | 25.3 | -0.5 | 0.13 |
| | 30.835 | 30.1 | -0.7 | 0.13 |
| | 35.837 | 35.3 | -0.5 | 0.13 |
| | 40.839 | 40.1 | -0.7 | 0.13 |
| | 45.839 | 45.2 | -0.6 | 0.13 |
| DRY | 50.043 | 50.2 | +0.2 | 0.13 |
| | 60.047 | 60.2 | +0.2 | 0.13 |
| | 70.052 | 70.0 | 0.0 | 0.13 |
| | 75.053 | 75.0 | 0.0 | 0.13 |
| | 80.055 | 80.0 | 0.0 | 0.13 |
| | 85.056 | 85.0 | 0.0 | 0.13 |
| GLOBE | 90.058 | 90.1 | +0.1 | 0.13 |
| | 95.062 | 95.1 | +0.1 | 0.13 |
| | 100.063 | 100.1 | +0.1 | 0.13 |
| | 105.064 | 105.1 | +0.1 | 0.13 |
| | 110.065 | 110.1 | +0.1 | 0.13 |
| | 115.066 | 115.1 | +0.1 | 0.13 |

End of Certificate

Calibrated By :

Mr. Sirichok Jengpuddeesat

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.

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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-148

Request No : Req-2024-0540

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPQ020024
Resolution : 0.1 °C
ID Number : UAE.EFM.007/2559
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 : 5 March 2024
Calibrated Date : 21 March 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermocouple.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11 RTD100, SN: 12080077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No. : QR23-2574

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 Luangtan
Technical Manager

Issue Date :

21 March 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.

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Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-TPM-148

Request No : Req 2024-0148

Page : 2/2

Result of Calibration :

| UUC Sensor | Standard Temperature (°C) | 11°C Reading (°C) | Correction (°C) | Uncertainty (°C) |
|------------|---------------------------|-------------------|-----------------|------------------|
| WET | 20.033 | 20.0 | 0.0 | 0.13 |
| | 25.033 | 25.0 | 0.0 | 0.13 |
| | 30.035 | 30.0 | 0.0 | 0.13 |
| | 35.036 | 35.0 | 0.0 | 0.13 |
| | 40.038 | 40.0 | 0.0 | 0.13 |
| | 45.041 | 45.0 | 0.0 | 0.13 |
| DRY | 50.044 | 50.0 | 0.0 | 0.13 |
| | 60.047 | 60.0 | 0.0 | 0.13 |
| | 70.052 | 70.0 | 0.0 | 0.13 |
| | 75.053 | 75.0 | 0.0 | 0.13 |
| | 80.054 | 80.0 | 0.0 | 0.13 |
| | 85.056 | 85.0 | 0.0 | 0.13 |
| GLOBE | 90.058 | 90.0 | 0.0 | 0.13 |
| | 95.059 | 95.0 | 0.0 | 0.13 |
| | 100.061 | 100.0 | 0.0 | 0.13 |
| | 105.064 | 105.0 | 0.0 | 0.13 |
| | 110.067 | 110.0 | 0.0 | 0.13 |
| | 115.068 | 115.0 | 0.0 | 0.13 |

End of Certificate

Calibrated By :

Mr. Sirichok Jengpuddeesat

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.

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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-347

Request No : Req-2024-1620

Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TEX040013
Resolution : 0.1 °C
ID Number : UAE.EFM.117/2566
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 : 19 July 2024
Calibrated Date : 6 August 2024
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermocouples.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO GINGO, Model: GT11 RTD100, SN: 08000027, 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 Luangtan
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 Innovative Instrument Co., Ltd.

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Certificate of Calibration

Calibration Note

UUC Adjustment : Not Adjust

Certificate No : 24-IFM-347

Request No : Req-2024-1952

Page : 2/2

Result of Calibration :

| UUC Sensor | Standard Temperature (°C) | UUC Reading (°C) | Correction (°C) | Uncertainty (°C) |
|------------|---------------------------|------------------|-----------------|------------------|
| WET | 20.010 | 20.1 | -0.1 | 0.13 |
| | 22.013 | 22.1 | -0.1 | 0.13 |
| | 30.014 | 30.1 | -0.1 | 0.13 |
| | 35.017 | 35.1 | -0.1 | 0.13 |
| | 40.019 | 40.9 | -0.1 | 0.13 |
| | 45.018 | 44.9 | -0.1 | 0.13 |
| | 50.042 | 49.9 | -0.1 | 0.13 |
| | 60.047 | 59.9 | -0.1 | 0.13 |
| DRY | 20.012 | 20.0 | 0.0 | 0.13 |
| | 25.014 | 25.0 | 0.0 | 0.13 |
| | 30.015 | 30.0 | 0.0 | 0.13 |
| | 35.014 | 35.0 | 0.0 | 0.13 |
| | 40.017 | 39.9 | -0.02 | 0.13 |
| | 45.041 | 44.8 | -0.02 | 0.13 |
| | 50.043 | 49.9 | -0.1 | 0.13 |
| | 60.046 | 59.9 | -0.1 | 0.13 |
| GLOBE | 20.011 | 20.1 | -0.1 | 0.13 |
| | 25.013 | 25.1 | -0.1 | 0.13 |
| | 30.014 | 30.1 | -0.1 | 0.13 |
| | 35.017 | 35.1 | -0.1 | 0.13 |
| | 40.016 | 39.9 | -0.1 | 0.13 |
| | 45.041 | 44.9 | -0.1 | 0.13 |
| | 50.047 | 49.9 | -0.1 | 0.13 |
| | 60.045 | 59.9 | -0.1 | 0.13 |

End of Certificate

Calibrated By :

Mr. Sirichok Jongsakulchawal

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

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Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Address : 81 Soi Ekkamuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok

10260

Certificate No : 24-AFM-223

Request No : Req-2024-1952

Unit Under Calibration Details

Measurement Item : Air Flow Meter

Manufacturer : TSI

Accuracy : 2% or 0.005 lpm, whichever is greater

Model : 4146

Sensor Model : -

Serial Number : 41461813000

Sensor Serial Number : -

ID : UAE-EFM-102-2561

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 : 28 August 2024

Calibration Date : 8 November 2024

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

| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------|----------------------------|----------------|-----------|-----------------|
| Air Flow Meter | Gilibrator 3 Low flow | 1850101006 | Seastdyne | 8 August 2025 |
| Air Flow Meter | Gilibrator 3 Standard flow | 19031011003 | Seastdyne | 2 August 2025 |
| Temperature meter | GT 11 | 08000057 | Qeson | 1 March 2025 |
| Pressure meter | CPG2400 | 41000KDU651882 | TPA | 21 October 2025 |

Traceability :

This Certificate is traceable to SI Unit through Seastdyne 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. Noppadol Luangrat

Service Calibration Engineer

Approved By :

Mr. Pait Muthavorn

Calibration Engineer Supervisor

Issue Date :

8 November 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.

เอกสารไม่ควบคุม

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



Certificate No : 24-AFM-223

Request No : Req-2024-1952

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 |
|------------------|----------------|-------------|-------------|---------------|---------------------|-------------|--------|
| 23.30 | 101.30 | 0.022 | 0.020 | -0.002 | 0.0013 | 0.005 | N/A |
| 23.50 | 101.30 | 0.051 | 0.050 | -0.001 | 0.0033 | 0.005 | N/A |
| 23.53 | 101.30 | 0.102 | 0.100 | -0.002 | 0.0028 | 0.005 | N/A |
| 23.30 | 100.68 | 0.202 | 0.200 | -0.002 | 0.0056 | 0.005 | N/A |
| 23.50 | 101.30 | 0.508 | 0.500 | -0.008 | 0.0073 | 0.010 | N/A |
| 23.60 | 101.30 | 1.010 | 1.000 | -0.010 | 0.014 | 0.020 | N/A |
| 23.30 | 101.40 | 1.717 | 1.702 | -0.015 | 0.025 | 0.034 | N/A |
| 23.10 | 101.40 | 2.026 | 2.000 | -0.026 | 0.029 | 0.040 | N/A |
| 23.60 | 101.61 | 3.014 | 3.000 | -0.014 | 0.043 | 0.060 | N/A |
| 23.70 | 101.72 | 4.023 | 4.000 | -0.023 | 0.056 | 0.080 | N/A |
| 23.90 | 101.95 | 5.025 | 5.001 | -0.024 | 0.072 | 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.

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.

เอกสารไม่ควบคุม

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



Certificate No : 24-AFM-223

Request No : Req-2024-1952

Decision Rule for Statements of Conformity

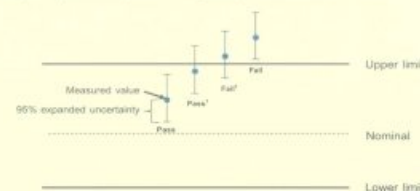
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09 2009, Guidelines on the Reporting of Compliance with Specification in following Fig and statements

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 Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

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

Certificate of Calibration

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

Certificate No : 24-ASP-126
Request No : Req-2024-1797

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GRAA Plus
Serial Number : 20250610200
ID : UAE.EFM.1302566
Location of Calibration : LAB 4 AIR VELOCITY METER

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 15 August 2024
Calibration Date : 27 August 2024

Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter

| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------------------|---------------------------|---------------|-----------|-----------------|
| Air Flow Meter | Gilbreath 3 Standard Flow | 19031011003 | Sensidyne | 2 August 2025 |
| Digital Thermometer with Probe | GT11 | 08000057 | Q.Reborn | 1 March 2025 |
| Barometer | CPG2400 | 4100KDU851882 | TPA | 9 November 2024 |

Traceability :

This Certificate is traceable to SI Unit through Sensidyne AZLA Accreditation No. 2943.01

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. Noppadol Luangpan
Service Calibration Engineer

Approved By :
Mr. Paet Matharom
Calibration Engineer Supervisor
Issue Date : 27 August 2024

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.03 Issue date 16/8/24

Certificate No : 24-ASP-126

Request No : Req-2024-1797

Result of Calibration : High(Without Adjustment)

| Temperature (°C) | Pressure (kPa) | STD (l/min) | UUC (l/min) | Error (l/min) | Error (l/min, %) | MPE (l/min, %) | **Back Pressure (inH ₂ O) | Uncertainty (l/min) | Result |
|---------------------|-------------------|----------------|----------------|------------------|---------------------|-------------------|--|------------------------|--------|
| 23.90 | 99.19 | 0.503 | 0.590 | -0.003 | -0.4 % | 5 % | 5 | 0.0080 | Pass |
| 23.90 | 95.57 | 0.506 | 0.590 | -0.006 | -1.2 % | 5 % | 20 | 0.0081 | Pass |
| 23.90 | 91.75 | 0.505 | 0.590 | -0.005 | -1 % | 5 % | 40 | 0.0081 | Pass |
| 24.10 | 99.25 | 1.005 | 1.000 | -0.005 | -0.5 % | 5 % | 5 | 0.0116 | Pass |
| 24.10 | 95.26 | 0.996 | 1.000 | 0.004 | 0.4 % | 5 % | 20 | 0.0116 | Pass |
| 24.10 | 91.95 | 0.982 | 1.000 | 0.018 | 1.8 % | 5 % | 35 | 0.0116 | Pass |
| 24.00 | 99.17 | 1.706 | 1.700 | -0.006 | -0.4 % | 5 % | 5 | 0.027 | Pass |
| 24.00 | 95.45 | 1.665 | 1.700 | 0.035 | 2.1 % | 5 % | 20 | 0.027 | Pass |
| 24.00 | 92.77 | 1.639 | 1.700 | 0.061 | 3.7 % | 5 % | 30 | 0.027 | Pass |
| 23.90 | 99.13 | 2.005 | 2.000 | -0.005 | -0.2 % | 5 % | 5 | 0.032 | Pass |
| 23.90 | 95.21 | 1.971 | 2.000 | 0.029 | 1.5 % | 5 % | 20 | 0.032 | Pass |
| 23.90 | 92.72 | 1.953 | 2.000 | 0.047 | 2.4 % | 5 % | 30 | 0.032 | Pass |
| 23.90 | 99.13 | 3.006 | 3.000 | -0.006 | -0.2 % | 5 % | 5 | 0.048 | Pass |
| 23.90 | 95.24 | 2.978 | 3.000 | 0.022 | 0.7 % | 5 % | 20 | 0.048 | Pass |
| 23.90 | 92.80 | 2.975 | 3.000 | 0.025 | 0.8 % | 5 % | 30 | 0.048 | Pass |
| 24.00 | 99.14 | 4.005 | 4.000 | -0.005 | -0.1 % | 5 % | 5 | 0.064 | Pass |
| 24.00 | 97.84 | 4.010 | 4.000 | -0.010 | -0.2 % | 5 % | 10 | 0.064 | Pass |
| 24.00 | 95.24 | 4.007 | 4.000 | -0.007 | -0.2 % | 5 % | 20 | 0.064 | Pass |
| 24.00 | 99.10 | 5.004 | 5.000 | -0.004 | -0.1 % | 5 % | 5 | 0.080 | Pass |
| 24.00 | 97.28 | 5.011 | 5.000 | -0.011 | -0.2 % | 5 % | 12 | 0.080 | Pass |

Note : STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 23 °C, 101.3 kPa, Air

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

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

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

meas = Measurement Condition ref = Standard Condition

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.03 Issue date 16/8/24

Certificate No : 24-ASP-126

Request No : Req-2024-1797

Result of Calibration : Low (Without Adjustment)

| Temperature (°C) | Pressure (kPa) | STD (l/min) | UUC (l/min) | Error (l/min) | Error (l/min, %) | MPE (l/min, %) | **Back Pressure (inH ₂ O) | Uncertainty (l/min) | Result |
|---------------------|-------------------|----------------|----------------|------------------|---------------------|-------------------|--|------------------------|--------|
| 23.80 | 99.36 | 0.019 | 0.020 | 0.001 | 0.001 % | 0.003 % | 5 | 0.0010 | Pass |
| 23.80 | 95.73 | 0.018 | 0.020 | 0.002 | 0.002 % | 0.003 % | 20 | 0.0010 | Pass |
| 23.80 | 90.31 | 0.017 | 0.020 | 0.003 | 0.003 % | 0.003 % | 40 | 0.0009 | Pass |
| 23.80 | 99.24 | 0.050 | 0.050 | 0.000 | 0 % | 0.003 % | 5 | 0.0028 | Pass |
| 23.80 | 95.86 | 0.052 | 0.050 | -0.002 | -0.002 % | 0.003 % | 20 | 0.0029 | Pass |
| 23.80 | 90.81 | 0.051 | 0.050 | -0.001 | -0.001 % | 0.003 % | 40 | 0.0028 | Pass |
| 23.70 | 99.36 | 0.100 | 0.100 | 0.000 | 0 % | 5 % | 5 | 0.0026 | Pass |
| 23.70 | 95.68 | 0.097 | 0.100 | 0.003 | 3.1 % | 5 % | 20 | 0.0025 | Pass |
| 23.70 | 90.65 | 0.097 | 0.100 | 0.003 | 3.1 % | 5 % | 40 | 0.0025 | Pass |
| 23.70 | 99.13 | 0.201 | 0.200 | -0.001 | -0.5 % | 5 % | 5 | 0.0036 | Pass |
| 23.70 | 95.01 | 0.198 | 0.200 | 0.002 | 1 % | 5 % | 20 | 0.0036 | Pass |
| 23.70 | 90.13 | 0.197 | 0.200 | 0.003 | 1.5 % | 5 % | 40 | 0.0035 | Pass |

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FM-708-AFM-01 Rev.03 Issue date 16/8/24

Certificate No : 24-ASP-126

Request No : Req-2024-1797

Note

* Indicates non accredited

** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

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

Decision Rule for Statements of Conformity

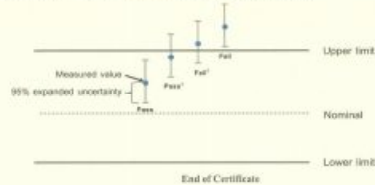
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G89:2019, Guidelines on the Reporting of Compliance with Specification as following Fig. and statements.

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

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

Fail² = 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.



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.03 Issue date 16/8/24

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-AFM-157
Request No : Req-2024-1561

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI
Model : 4146
Serial Number : 41462327004
ID : UAE.EFM.124/2566
Location of Calibration : LAB 4 AIR VELOCITY METER
Accuracy : 2% of Reading
Sensor Model : -
Sensor Serial Number : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 10 July 2024
Calibration Date : 19 August 2024

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

| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------|----------------------------|-----------------|-----------|-----------------|
| Air Flow Meter | Gilibrator 3 Low flow | 1850101006 | Sensidyne | 6 August 2025 |
| Air Flow Meter | Gilibrator 3 Standard flow | 19031011003 | Sensidyne | 2 August 2025 |
| Temperature meter | GT 11 | 08000037 | Qnborn | 1 March 2025 |
| Pressure meter | CPG2400 | 41000KDU/651882 | TPA | 9 November 2024 |

Traceability :

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

Note :

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

Calibration By : Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By : Mr. Pachi Mathavorn
Calibration Engineer Supervisor

Issue Date : 27 August 2024

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 : 24-AFM-157
Request No : Req-2024-1561

Decision Rule for Statements of Conformity

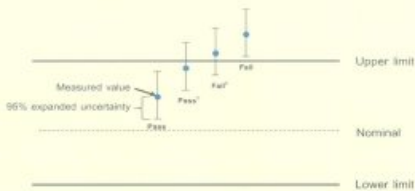
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019; Guidelines on the Reporting of Compliance with Specification at following Fig. and statement.

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

Pass¹ - The measurement result was within the limits. 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 was 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 : 24-AFM-157
Request No : Req-2024-1561

Result of Calibration : Without Adjustment

| Temperature | Pressure | STD | UUC | Error | Uncertainty | MPE | Result |
|-------------|----------|---------|---------|---------|-------------|---------|--------|
| °C | (kPa) | (l/min) | (l/min) | (l/min) | (l/min) | (l/min) | |
| 22.70 | 100.45 | 0.020 | 0.020 | 0.000 | 0.0013 | 0.005 | N/A |
| 22.60 | 100.51 | 0.050 | 0.051 | 0.001 | 0.0033 | 0.005 | N/A |
| 22.50 | 100.46 | 0.099 | 0.102 | 0.003 | 0.0028 | 0.005 | N/A |
| 22.90 | 100.49 | 0.200 | 0.203 | 0.003 | 0.0056 | 0.005 | N/A |
| 23.00 | 100.52 | 0.500 | 0.509 | 0.009 | 0.007 | 0.010 | N/A |
| 23.00 | 100.49 | 1.000 | 1.013 | 0.013 | 0.014 | 0.020 | N/A |
| 22.80 | 100.57 | 1.698 | 1.726 | 0.028 | 0.024 | 0.034 | N/A |
| 22.80 | 100.60 | 1.999 | 2.022 | 0.023 | 0.029 | 0.040 | N/A |
| 23.00 | 100.67 | 2.998 | 3.052 | 0.054 | 0.043 | 0.060 | N/A |
| 23.10 | 100.80 | 4.002 | 4.058 | 0.056 | 0.056 | 0.080 | N/A |
| 23.00 | 100.96 | 5.001 | 5.067 | 0.066 | 0.072 | 0.100 | N/A |

Note : STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : 21.3 °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 not 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

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-ASP-121
Request No : Req-2024-1796

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : G4Air Plus
Serial Number : 20230810201
ID : UAE.EFM.131/2566
Location of Calibration : LAB 4 AIR VELOCITY METER

Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 15 August 2024
Calibration Date : 26 August 2024

Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter

| Reference Standard | Model | Serial Number | Traceable | Due Calibration |
|--------------------------------|----------------------------|-----------------|-----------|-----------------|
| Air Flow Meter | Gilibrator 3 Standard flow | 19031011003 | Sensidyne | 2 August 2025 |
| Digital Thermometer with Probe | GT11 | 08000037 | Q.Reborn | 1 March 2025 |
| Barometer | CPG2400 | 41000KDU/651882 | TPA | 9 November 2024 |

Traceability :

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

Note :

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

Calibration By : Mr. Noppadol Luangrat
Service Calibration Engineer

Approved By : Mr. Pachi Mathavorn
Calibration Engineer Supervisor

Issue Date : 26 August 2024

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.03 Issue date 16/8/24

Certificate No : 24-ASP-121
Request No : Req-2024-1796

Result of Calibration : Low (Without Adjustment)

| Temperature (°C) | Pressure (kPa) | STD (l/min) | UUC (l/min) | Error (l/min) | Error (l/min, %) | MPE (l/min, %) | **Back Pressure (inH ₂ O) | Uncertainty (l/min) | Result |
|---------------------|-------------------|----------------|----------------|------------------|---------------------|-------------------|--|------------------------|--------|
| 23.80 | 99.06 | 0.019 | 0.020 | 0.001 | 0.001 l/min | 0.003 l/min | 5 | 0.0010 | Pass |
| 23.80 | 95.96 | 0.021 | 0.020 | -0.001 | -0.001 l/min | 0.003 l/min | 20 | 0.0012 | Pass |
| 23.80 | 90.16 | 0.018 | 0.020 | 0.002 | 0.002 l/min | 0.003 l/min | 40 | 0.0010 | Pass |
| 23.80 | 99.25 | 0.049 | 0.050 | 0.001 | 0.001 l/min | 0.003 l/min | 5 | 0.0027 | Pass |
| 23.80 | 95.58 | 0.051 | 0.050 | -0.001 | -0.001 l/min | 0.003 l/min | 20 | 0.0028 | Pass |
| 23.80 | 90.65 | 0.050 | 0.050 | 0.000 | 0 l/min | 0.003 l/min | 40 | 0.0028 | Pass |
| 23.50 | 99.24 | 0.099 | 0.100 | 0.001 | 1 l/min | 5 l/min | 5 | 0.0026 | Pass |
| 23.50 | 95.50 | 0.097 | 0.100 | 0.003 | 3.1 l/min | 5 l/min | 20 | 0.0025 | Pass |
| 23.50 | 90.79 | 0.096 | 0.100 | 0.004 | 4.2 l/min | 5 l/min | 40 | 0.0025 | Pass |
| 23.50 | 99.34 | 0.200 | 0.200 | 0.000 | 0 l/min | 5 l/min | 5 | 0.0026 | Pass |
| 23.50 | 95.33 | 0.198 | 0.200 | 0.002 | 1 l/min | 5 l/min | 20 | 0.0026 | Pass |
| 23.50 | 90.47 | 0.197 | 0.200 | 0.003 | 1.5 l/min | 5 l/min | 40 | 0.0025 | Pass |

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.03 Issue date 16/8/24

เอกสารไม่ควบคุม

Certificate No : 24-ASP-121
Request No : Req-2024-1796

Result of Calibration : High (Without Adjustment)

| Temperature (°C) | Pressure (kPa) | STD (l/min) | UUC (l/min) | Error (l/min) | Error (l/min, %) | MPE (l/min, %) | **Back Pressure (inH ₂ O) | Uncertainty (l/min) | Result |
|---------------------|-------------------|----------------|----------------|------------------|---------------------|-------------------|--|------------------------|--------|
| 23.50 | 99.45 | 0.501 | 0.500 | -0.001 | -0.2 l/min | 5 l/min | 5 | 0.0080 | Pass |
| 23.50 | 95.72 | 0.498 | 0.500 | 0.002 | 0.4 l/min | 5 l/min | 20 | 0.0080 | Pass |
| 23.50 | 91.67 | 0.497 | 0.500 | 0.003 | 0.6 l/min | 5 l/min | 40 | 0.0080 | Pass |
| 23.40 | 99.32 | 1.005 | 1.000 | -0.005 | -0.5 l/min | 5 l/min | 5 | 0.016 | Pass |
| 23.40 | 96.61 | 1.006 | 1.000 | -0.006 | -0.6 l/min | 5 l/min | 20 | 0.016 | Pass |
| 23.40 | 92.87 | 0.993 | 1.000 | 0.007 | 0.7 l/min | 5 l/min | 35 | 0.016 | Pass |
| 23.40 | 99.26 | 1.702 | 1.700 | -0.002 | -0.1 l/min | 5 l/min | 5 | 0.027 | Pass |
| 23.40 | 96.67 | 1.696 | 1.700 | 0.004 | 0.2 l/min | 5 l/min | 20 | 0.027 | Pass |
| 23.40 | 93.00 | 1.698 | 1.700 | 0.002 | 0.1 l/min | 5 l/min | 30 | 0.027 | Pass |
| 23.40 | 99.28 | 2.003 | 2.000 | -0.003 | -0.1 l/min | 5 l/min | 5 | 0.032 | Pass |
| 23.40 | 96.67 | 1.991 | 2.000 | 0.009 | 0.5 l/min | 5 l/min | 20 | 0.032 | Pass |
| 23.40 | 92.10 | 1.978 | 2.000 | 0.022 | 1.1 l/min | 5 l/min | 30 | 0.032 | Pass |
| 24.30 | 99.40 | 3.015 | 3.000 | -0.015 | -0.5 l/min | 5 l/min | 5 | 0.048 | Pass |
| 24.30 | 95.55 | 3.007 | 3.000 | -0.007 | -0.2 l/min | 5 l/min | 20 | 0.048 | Pass |
| 24.30 | 93.05 | 2.994 | 3.000 | 0.006 | 0.2 l/min | 5 l/min | 30 | 0.048 | Pass |
| 25.00 | 99.39 | 4.008 | 4.000 | -0.008 | -0.2 l/min | 5 l/min | 5 | 0.064 | Pass |
| 25.00 | 98.13 | 4.017 | 4.000 | -0.017 | -0.4 l/min | 5 l/min | 10 | 0.064 | Pass |
| 25.00 | 95.63 | 4.008 | 4.000 | -0.008 | -0.2 l/min | 5 l/min | 20 | 0.064 | Pass |
| 24.30 | 99.39 | 5.006 | 5.000 | -0.006 | -0.1 l/min | 5 l/min | 5 | 0.080 | Pass |
| 24.30 | 97.60 | 4.994 | 5.000 | 0.006 | 0.1 l/min | 5 l/min | 12 | 0.080 | Pass |

Note STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

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

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

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

meas = Measurement Condition ref = Standard Condition

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.

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เอกสารไม่ควบคุม

Certificate No : 24-ASP-121
Request No : Req-2024-1796

Note

* Indicates non accredited

** Specified in ISO 13137, Back Pressure control = 1 inH₂O

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

Decision Rule for Statements of Conformity

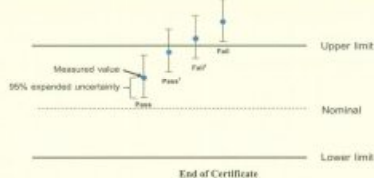
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:09/2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements:

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 Innovative Instrument Co., Ltd.













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เอกสารไม่ควบคุม



ALS Certificate

เอกสารรับรองความสามารถของ ALS Laboratory Group (Thailand) ในขอบข่ายที่ขึ้นทะเบียน สามารถสแกนผ่าน QR CODE หรือพิมพ์ Shorten link

| หน่วยงานอนุญาต | สาขาที่ขึ้นทะเบียน | ไฟล์เอกสารแนบ | รายละเอียดการขึ้นทะเบียน |
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| ผู้ควบคุมมลพิษด้านสิ่งแวดล้อมจาก กรมโรงงานอุตสาหกรรม | บ.123-48-029 |  หรือ https://bit.ly/3tD5pjU | ระบบบำบัดมลพิษน้ำ, อากาศ, กากอุตสาหกรรม |
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ติดต่อเรา

ALS Laboratory Group (Thailand) ห้องปฏิบัติการวิเคราะห์ที่ได้รับการรับรองความสามารถตามมาตรฐานสากล ISO/IEC 17025 และขึ้นทะเบียนห้องปฏิบัติการกับกรมโรงงานอุตสาหกรรม ให้บริการวิเคราะห์ทดสอบครบวงจรทั้งด้านอาหาร ยา เวชภัณฑ์ เครื่องสำอาง และสิ่งแวดล้อม ซึ่งมีความเชี่ยวชาญและประสบการณ์กว่า 38 ปี ด้วยนักวิทยาศาสตร์ที่มีความเชี่ยวชาญกว่า 400 คน พร้อมทั้งเครื่องมือและเทคโนโลยีที่ทันสมัย ปัจจุบันเรามีความพร้อมในการบริการครอบคลุมถึง 8 สาขา อันได้แก่ กรุงเทพฯ ระยอง เชียงใหม่ สงขลา สุราษฎร์ธานี นครราชสีมา หนองคาย และภูเก็ต

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