

ภาคผนวก จ

ใบรับรองการสอบเทียบเครื่องมือ



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	NKH_FS0052	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	NKH_FS0049	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	NKH_FS0050	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	NKH_FS0051	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKK_EN0004	8-Feb-23	8-Feb-24	12
Ambient	Particulate Matter (PM-10)	High Volume	NKH_FS0045	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	NKH_FS0046	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	NKH_FS0047	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	NKH_FS0048	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKK_EN0004	8-Feb-23	8-Feb-24	12
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	NKH_FS0084	5-Jan-23	5-Jul-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	NKH_FS0078	5-Jan-23	5-Jul-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	NKH_FS0080	5-Jan-23	5-Jul-23	6
Ambient	Nitrogen Dioxide	NO ₂ Analyzer	NKH_FS0082	5-Jan-23	5-Jul-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	NKH_FS0085	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	NKH_FS0079	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	NKH_FS0081	4-Jan-23	4-Jul-23	6
Ambient	Sulfur Dioxide	SO ₂ Analyzer	NKH_FS0083	4-Jan-23	4-Jul-23	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NKH_FS0056	3-Oct-22	2-Apr-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NKH_FS0055	20-Dec-22	19-Jun-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NKH_FS0054	11-Jan-23	11-Jul-24	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	NKH_FS0053	11-Jan-23	11-Jul-24	18
Noise	Leq 24 hrs	Sound Calibrator	NKH_FS0019	31-Aug-22	31-Aug-23	12
Noise	Leq 24 hrs	Sound Level Meter	NKH_FS0072	20-Jun-22	20-Jun-23	12
Noise	Leq 24 hrs	Sound Level Meter	NKH_FS0071	20-Jun-22	20-Jun-23	12
Noise	Leq 24 hrs	Sound Level Meter	NKH_FS0073	20-Jun-22	20-Jun-23	12
Noise	Leq 5 min	Sound Calibrator	NKH_FS0019	31-Aug-22	31-Aug-23	12
Noise	Leq 5 min	Sound Level Meter	NKH_FS0072	20-Jun-22	20-Jun-23	12
Noise	Leq 5 min	Sound Level Meter	NKH_FS0071	20-Jun-22	20-Jun-23	12
Noise	Leq 5 min	Sound Level Meter	NKH_FS0073	20-Jun-22	20-Jun-23	12
Stack	Oxides of Nitrogen	Console Control Unit	BKK_FS0547	3-Jan-23	3-Jul-23	6
Stack	Oxides of Nitrogen	Flue gas Analyzer	BKK_FS1095	25-Nov-22	25-Nov-23	12
Stack	Oxides of Nitrogen	Vacuum Gauge	BKK_FS0437	21-Sep-21	22-Mar-23	18
Stack	Oxides of Nitrogen	Spectrophotometer	BKK_EN0018	16-Sep-22	16-Sep-23	12
Stack	Sulfur Dioxide	Console Control Unit	BKK_FS0547	3-Jan-23	3-Jul-23	6
Stack	Sulfur Dioxide	Flue gas Analyzer	BKK_FS1095	25-Nov-22	25-Nov-23	12
Stack	Sulfur Dioxide	Dry Gas	BKK_FS0505	3-Jan-23	3-Jul-23	6
Stack	Total Suspended Particulate	Console Control Unit	BKK_FS0547	3-Jan-23	3-Jul-23	6
Stack	Total Suspended Particulate	Flue gas Analyzer	BKK_FS1095	25-Nov-22	25-Nov-23	12
Stack	Total Suspended Particulate	Digital Balance	BKK_EN0002	25-Feb-22	25-Feb-23	12
Stack	Oxygen	Console Control Unit	BKK_FS0547	3-Jan-23	3-Jul-23	6
Stack	Oxygen	Flue gas Analyzer	BKK_FS1095	25-Nov-22	25-Nov-23	12
Stack	Flow Rate	Console Control Unit	BKK_FS0547	3-Jan-23	3-Jul-23	6
Stack	Flow Rate	Flue gas Analyzer	BKK_FS1095	25-Nov-22	25-Nov-23	12
Noise	Leq 8 hrs	Sound Calibrator	NKH_FS0019	31-Aug-22	31-Aug-23	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0122	8-Nov-22	8-Nov-23	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0123	4-Nov-22	4-Nov-23	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0121	8-Nov-22	8-Nov-23	12
Noise	Leq 8 hrs	Sound Calibrator	NKH_FS0019	31-Aug-22	31-Aug-23	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0118	8-Nov-22	8-Nov-23	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0116	4-Nov-22	4-Nov-23	12
Noise	Leq 8 hrs	Sound Level Meter	NKH_FS0117	8-Nov-22	8-Nov-23	12
Noise	Noise Dose, TWA	Dose Badge Reader	NNG_FS0007	3-Nov-22	3-Nov-23	12
Noise	Noise Dose, TWA	Dose Badge Reader	NKH_FS0029	2-Nov-22	2-Nov-23	12



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รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Heat	Heat Stress	Heat Stress Monitor	NKH_FS0108	14-Jun-22	14-Jun-23	12
Heat	Heat Stress	Heat Stress Monitor	NKH_FS0109	14-Jun-22	14-Jun-23	12
Heat	Heat Stress	Heat Stress Monitor	NKH_FS0025	25-Aug-22	25-Aug-23	12
Heat	Heat Stress	Heat Stress Monitor	NKH_FS0024	26-Aug-22	26-Aug-23	12
Illuminance	Illuminance	Lux Meter	NKH_FS0020	17-Nov-22	17-Nov-23	12
Illuminance	Illuminance	Lux Meter	NKH_FS0020	17-Nov-22	17-Nov-23	12
Water Lab	Calcium	ICP-OES	BKK_EL0037	2-Mar-23	1-Mar-24	12
Water Lab	Calcium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Calcium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Magnesium	ICP-OES	BKK_EL0037	2-Mar-23	1-Mar-24	12
Water Lab	Magnesium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Magnesium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Sodium	ICP-OES	BKK_EL0037	2-Mar-23	1-Mar-24	12
Water Lab	Sodium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Sodium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Lead	ICP-MS	BKK_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Lead	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Lead	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Arsenic	ICP-MS	BKK_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Arsenic	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Arsenic	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Cadmium	ICP-MS	BKK_EL0026	14-Jun-22	14-Dec-23	18
Water Lab	Cadmium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Cadmium	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	SAR	ICP-OES	BKK_EL0037	2-Mar-23	1-Mar-24	12
Water Lab	SAR	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	SAR	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Mercury	Mercury Analyzer	BKK_EL0128	30-Nov-22	30-Nov-23	12
Water Lab	Total Coliform	Autoclave	BKK_ML0041	20-May-22	20-Nov-23	18
Water Lab	Total Coliform	Incubator	BKK_ML0010	21-Jan-22	22-Jul-23	18
Water Lab	Total Coliform	Hot Air Oven	BKK_ML0013	21-Nov-22	21-May-24	18
Water Lab	Fecal Coliform	Autoclave	BKK_ML0041	20-May-22	20-Nov-23	18
Water Lab	Fecal Coliform	Incubator	BKK_ML0010	21-Jan-22	22-Jul-23	18
Water Lab	Fecal Coliform	Hot Air Oven	BKK_ML0013	21-Nov-22	21-May-24	18
Water Lab	Fecal Coliform	Water Bath	BKK_ML0056	20-May-22	20-May-23	12
Water Lab	pH at 25 °C	pH meter	BKK_EN0072	12-Sep-22	12-Mar-24	18
Water Lab	BOD	DO Meter	BKK_EN0017	24-May-22	24-Nov-23	18
Water Lab	BOD	Incubator	BKK_EN0304	5-Apr-23	5-Apr-24	12
Water Lab	Dissolved Oxygen	Burette	BKK_EN0171	30-Aug-22	1-Mar-24	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Temperature	pH meter	NKH_FS0112	31-Oct-22	31-Oct-23	12
Water Lab	Temperature	pH meter	NKH_FS0028	26-Oct-22	26-Oct-23	12
Water Lab	Temperature	pH meter	NKH_FS0075	18-Aug-22	18-Aug-23	12
Water Lab	Temperature	pH meter	NKH_FS0113	31-Oct-22	31-Oct-23	12
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0273	29-Nov-22	29-May-24	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0273	29-Nov-22	29-May-24	18
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKK_EN0002	8-Feb-23	8-Feb-24	12
Water Lab	Oil & Grease	Water Bath	BKK_EN0148	31-Jan-22	1-Aug-23	18
Water Lab	Turbidity	Chamber (Cold Room)	BKK_EN0167	30-Jun-22	30-Dec-23	18
Water Lab	Chloride	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12
Water Lab	Conductivity	Conductivity meter	BKK_EN0065	19-Nov-21	20-May-23	18
Water Lab	Nitrate	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12
Water Lab	Sulfate	Ion Chromatography	BKK_EN0069	12-Jan-23	12-Jan-24	12




Certificate Number
CL 020-65

Page 2 of 2 Pages



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

End of Calibration
 HIRANATE ASSOCIATES CO., LTD.


 63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd,
 Wattana, Bangkokyini, Bangkok 10500 Thailand.
 Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jnanee.com



CERTIFICATE OF CALIBRATION

OBTAINED IN WRITING FROM THE LABORATORY.

CERTIFICATE OF CALIBRATION
Page 1 of 2 Pages
MEASUREMENT ITEM: Cup anemometer
MANUFACTURER: Novatime
MODEL/TYPE: Data logger: 110 WS-250L-N
SERIAL NUMBER: Data logger: A5486
ID NUMBER: NMI F00053
CONDITION AS RECEIVED: N/A
CUSTOMER: ALS laboratory group (Thailand) co., Ltd.
104 Phuthanasan Rd., Phuthanasan Rd., Khwaeng Sun Luang, Khet Sun Luang, Bangkok 10250 Thailand.
RECEIVED DATE: 09 Jan 2023
MEASUREMENT DATE: 11 Jan 2023
ISSUE DATE: 13 Jan 2023
ENVIRONMENTAL CONDITIONS: Ambient condition in the laboratory are as follow:
Temperature: 23.0 ± 3.0 °C
Relative Humidity: 55.0 ± 15.0 %RH
Atmospheric Pressure: 1020.10 hPa
PLACE OF CALIBRATION: Effort type wind tunnel of Jiranatee Associates Co., Ltd.
CALIBRATION CONDITIONS: Wind tunnel cross section area: 900 cm²
Wind direction: Effort type
Diameter of measuring pipe: 100 mm
Blockage area of test object: 0.111 [-]
Preconditioning: 24 hours at ambient conditions.
Measurement Condition: The average values during measurement are (23.0) °C, (48.0) %RH and (1012.5) hPa.
TABULATION OF RESULTS: The table on next page give the measurement results.
Calibrated by: 23 Mr. Sorawat Thachadit
13 Miss Jitragorn Lertsomphol
Approved signature: Mr. Parinya Booncharoen
Calibration Department Manager

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CERTIFICATE OF CALIBRATION
Calibration No.: RH 03012023
Page 1 of 2 Pages
Measurement Item: Relative humidity with data logger
Manufacturer: Novatime
Model/Type: 110 WS-250L-N
Serial Number: A5486
ID No.: NMI F00053
Customer: ALS laboratory group (Thailand) co., Ltd.
104 Phuthanasan Rd., Phuthanasan Rd., Khwaeng Sun Luang, Khet Sun Luang, Bangkok 10250 Thailand.
Environmental Condition: The measurement was carried out in an ambient temperature of (25.3) °C, and relative humidity of (55.1) %RH.
Measurement Method: Unit Under Calibration (UUC) was calibrated by comparison method with standard digital temperature indicator in the humidity generator chamber to determine the errors.
Traceability: This instrument was calibrated using standard equipment whose accuracy is traceability through National Institute of Standards and Technology to the international system of units (SI) by MCS Calibration, Inc. Certificate number: 20314-101. Due date Mar 14, 2023.
Measured Date: Jan 13, 2023
Issued Date: Jan 13, 2023
Measurement Result: The equipment was connected with indoor air quality probe and Displayed (LPI) on display. Model: HMP60 S/N: R3140438. Calibration was performed to the range of 20%RH to 80%RH. The results of calibration are reported in table below.
Calibrated by: 23 Mr. Sorawat Thachadit
13 Miss Jitragorn Lertsomphol
Approved signature: Mr. Parinya Booncharoen
Calibration Department Manager

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The cup anemometer, Unit Under Calibration (UUC) was exercised at 10 m/s for 5 minutes prior to calibration being performed. The standard air velocity 0.5 m/s to 15 m/s was calculated by a standard air velocity transducer and above 15 m/s to 30 m/s was calculated by a pitot tube with precision differential pressure meter which was installed 40 mm and 300 mm respectively away from wind tunnel nozzle. UUC was installed at center of the test section. The calibration was carried out under both rising and falling air velocity in the range of 1 m/s to 15 m/s at calibration interval of 1 m/s. The results of calibration and associated measurement uncertainties are reported in the table below.
Table with 7 columns: u (m/s), Temp. wind tunnel (°C), Temp. room (°C), Error (m/s), Error (%) and U (m/s), U (%)
Remarks: Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place.
* Uncertainty of standard
* Uncertainty of Unit Under Calibration
PHOTO OF CALIBRATION SET UP: Image showing the calibration setup of the cup anemometer in the wind tunnel.

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CERTIFICATE OF CALIBRATION
Calibration No.: CL 002-66
Page 1 of 2
Equipment Name: Data Logger with Temperature Sensor
Manufacturer: Novatime
Model: 110 WS-250L-N
Serial No.: A5486
ID No.: NMI F00053
Customer: ALS laboratory group (Thailand) co., Ltd.
Address: 104 Phuthanasan Rd., Phuthanasan Rd., Khwaeng Sun Luang, Khet Sun Luang, Bangkok 10250 Thailand.
Received date: 09 Jan 2023
Calibration date: 13 Jan 2023
Issue date: 13 Jan 2023
Reference Used During Calibration: 1. Standard Temperature Probe Model: STS-100 A500. Serial No.: 661692-09. Due date: 23 Mar 2023. 2. Digital Temperature Indicator Model: DTI-1000-A MK II. Serial No.: 671407-05991. Due date: 22 July 2023.
Calibration Condition: Temperature: (23.3) °C Relative Humidity: (55.1) %RH
Calibration Procedure: The temperature calibration was done by In-house calibration method as WI-CI-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale was based on ITS-90.
Traceability: The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT). Certificate number: IT-0034-22. Certificate number: ER 0092-22.
Calibrated by: 23 Mr. Sorawat Thachadit
13 Miss Jitragorn Lertsomphol
Approved signature: Mr. Parinya Booncharoen
Calibration Department Manager

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The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around to vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.
Table with 5 columns: Air speed (m/s), D (°), D (°), Error (Degrees (°)), Error (%)
Remarks: Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place.
* Uncertainty of standard
* Uncertainty of Unit Under Calibration
PHOTO OF CALIBRATION SET UP: Image showing the calibration setup of the wind direction sensor.

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CERTIFICATE OF CALIBRATION
Calibration No.: CL 002-66
Page 2 of 2
Result of Calibration: Without Adjustment
Calibration Range: 20 - 40 °C
Function: This equipment was connected with temperature sensor Model: HMP60 S/N: R3140438. Dimension: Diameter 12 mm, Length 80 mm.
Table with 5 columns: Immersion Depth (mm), Standard Reading (°C), UUC Reading (°C), Error (°C), Uncertainty (°C)
UUC: Unit Under Calibration
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.
Calibrated by: 23 Mr. Sorawat Thachadit
13 Miss Jitragorn Lertsomphol
Approved signature: Mr. Parinya Booncharoen
Calibration Department Manager

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The wind direction sensor was calibrated against standard rotary encoder by comparison method. During calibration, the measurement was carried out at 45° intervals in clockwise and counter-clockwise directions after adjustment has been made. The flow speed of wind tunnel (usually 5 m/s) is kept constant while the sensor is rotated around to vertical axis. The results of calibration and associated measurement uncertainties are reported in the table below.
Table with 5 columns: Air speed (m/s), D (°), D (°), Error (Degrees (°)), Error (%)
Remarks: Calibration results only valid for the tested circumstances and environmental conditions during which calibration took place.
* Uncertainty of standard
* Uncertainty of Unit Under Calibration
PHOTO OF CALIBRATION SET UP: Image showing the calibration setup of the wind direction sensor.

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CERTIFICATION REPORT
Calibration Number: RH-01012023
Page 1 of 2 Pages
Measurement Item: Rain gauge with data logger
Manufacturer: Data logger: Novatime
Model/Type: Data logger: 110 WS-250L-N
Serial Number: Data logger: A5486
ID No.: NMI F00053
Customer: ALS laboratory group (Thailand) co., Ltd.
104 Phuthanasan Rd., Phuthanasan Rd., Khwaeng Sun Luang, Khet Sun Luang, Bangkok 10250 Thailand.
Environmental Condition: The measurement was carried out in an ambient temperature of (26.3) °C, and relative humidity of (55.1) %RH.
Measurement Method: The Rain gauge, Unit Under Calibration (UUC) was calibrated by Precision reference bottle with flow collector at low rate 0.6 mm per minute or 1 tipping every 20 seconds. The tipping number was determined by procedures below.
1. Obtain rain gauge inlet area: Rain gauge precise diameter in cm = Diameter/2 = R (radius) Rain gauge area = (PI)R²/4 (UUC diameter=26.3 cm, UUC radius=10.18 cm) Rain gauge area = 323.6 cm².
2. Obtain theoretical correct rain gauge answer (number of tipping) using 323.6 cm² inlet area and 0.6 L of rain. a) 10,000 mm / 323.6 cm² inlet area = 30.90 (rain gauge area = 1/2500 of square meter) b) 30.90 * 0.6 L volume = 18.54 mm (mm of rain over 1 m² surface 600 ml of rain volume on the rain gauge area = 18.54 mm of rain. c) Number of tipping = 18.54 / 0.25 mm = 72.16 tipping.
Note: Rain gauge is fully cleaned and leveling prior the calibration performed.
Measured Date: Jan 13, 2023
Issued Date: Jan 13, 2023
Performed by: 23 Mr. Sorawat Thachadit
13 Miss Jitragorn Lertsomphol
Approved signature: Mr. Parinya Booncharoen
Calibration Department Manager

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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 filled 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	G8000A ; MY48010005
Instrument System Site and Location	ALS C (UK)

List System Component Product Numbers	List the Serial Numbers of each Component
1. 05010A	MY16010005
2. 05440A	AU15440944
3. 05111	0005 - 00159
4. 05455	AU16040115
5.	
6.	
7.	
8.	
9.	

ICP-OES Configuration Table	Circle the type or write in the type if other
Nebulizer Type:	Sax/Spray / DriedHeb / Conical / Other
Spray Chamber:	Cyclonic: Single Pass / Cyclonic: Double Pass / Other
Torch:	Radial / Dual View / Other
Torch Type:	One Piece / Semi-Dismountable / Fully Dismountable / Other
Injector Diameter:	2.4mm / 1.8mm / 1.6mm / 0.8mm / Other
Injector Material:	Quartz / Ceramic / Other

Preparation

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

Preventive Maintenance Procedures

Record Pre-PM instrument performance

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

Clean and inspect ICP-OES system

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

Agilent Water Recirculator

- ☐ Service not applicable
- ✓ Drain cooling fluid and remove any particles from the chiller reservoir.
- ✓ Remove, clean and reinstall water inlet 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 FFC cables for cracks, incorrect positioning, damaged edges or damaged connectors.
- ✓ Pump Tubing Replacement: Replace peristaltic pump tubing. Replace all tubing that goes from the rinse station to the pump and from the pump to the waste/rinse bottles.
- ✓ Test using customer's tray and move the sample probe to the sample vial 1, wash vial and rinse port and ensure that the probe is centered in the vial. If not use calibration wizard and calibrate the position.

AVS 4, 6, 7 Advanced Valve System

- ☐ Service not applicable
- ✓ Replace valve rotor seal – *See page 4*
- ✓ 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.
- ✓ Leave system in an idle state on 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 SRBB	93603.9	146365.1	77346.7	164269.5
Mn 257.610 nm SRBB	153838.7	205860.3	159260.0	217406.1
Al 396.152 nm SRB	29893.5	209141.7	29895.9	196802.0
V 356.891 nm SRB	99416.7	315121.8	99399.4	296316.9

* 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

Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution		
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)	
	Min.	Max.			
100.0	100.0	100.4	0.29	0.53	
105.0	105.0	105.4	0.29	0.79	



* The quoted uncertainty exclude "uniformity"
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 


FM-L13 108-30-05-57

Certificate of Calibration

Equipment : Chamber (Cold Room)
Manufacturer : KOLDTECH
Model : KM 320
Serial No. : TBN-1012061/05
Customer Code : BKK_EN0167
ID No. : T2463A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.

REVIEW BY 
APPROVED BY 
NEXT CAL DATE 30/12/23

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10259

Customer Location : Environmental Laboratory
Date of Receipt : 27 June 2022
Calibrated By : Sujjar Nakhakred (Site Calibration Manager)
Approved By :  / Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 04 JUL 2022

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

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

FM-L14 11701-02-64

Calibration Report

Equipment : Chamber (Cold Room)
Date of Calibration : 30 June - 1 July 2022
Environment : Temperature : 18.9-23.7 °C
Line Voltage : 222.9-226.5 V
Relative Humidity : 55 - 65 %RH

- Condition of this results of calibration :
- This equipment was calibrated by insert nine standard thermocouples type T into its chamber , the other one standard thermocouples type T use for ambient temperature measurement . The calibration was done in according to WI-T20 (based on ASTM E145-94 (Reapproved 2001) and AS2853-1986) . All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90
 - Reference Standard Instrument :

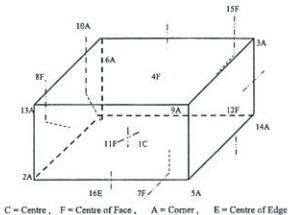
Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T210009	30 July 2022
TC	TYPE T	TN171-TN180	T210009	30 July 2022
DATA LOGGER	34970A	T149	T210009	30 July 2022
 - This certificate is traceable to : National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 9244)
 - Condition of calibrated item : good
Equipment Description :

Time Constant	3	Hour	Minute	At	3	°C
Fresh Air Damper	<input type="checkbox"/> Open	<input type="checkbox"/> Min	<input type="checkbox"/> Medium	<input type="checkbox"/> Max		
	<input type="checkbox"/> Close					
	<input checked="" type="checkbox"/> Not Available					
 - Adjustment : () without adjustment (X) after adjustment

Approved By: 

FM-L15 11715-05-63

Calibration Report



1C = TN161	11F = TN171
2A = TN162	12F = TN172
3A = TN163	13A = TN173
4F = TN164	14A = TN174
5A = TN165	15F = TN175
6A = TN166	16E = TN176
7F = TN167	
8F = TN168	
9A = TN169	
10A = TN170	

Approved By: 

FM-L15 11715-05-63

Calibration Report

Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)					
	TN161	TN162	TN163	TN164	TN165	TN166
3	2.71	2.82	2.75	2.89	2.95	3.68
	3.02	2.96	3.03	2.85		
	TN171	TN172	TN173	TN174	TN175	TN176
	2.97	3.02	2.89	3.04	2.97	3.33

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor λ
	Min , Max	Average					
3.0	2.9, 4.0	3.2	2.99	1.05	1.30	1.66	2.00

* The quoted uncertainty exclude "uniformity"
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 

FM-L15 11715-05-63



Agilent CrossLab Compliance
Qualification Type : ICPMS-OQ
System ID : JP12091612
EQR Name : AgilentRecommended
EQR Revision : ICPMS 02-50
EQR Publish Date : March 2020
Date : June 14, 2022 10:32:16 AM
Report Type : Report
Org. Name : ALS Laboratory Group (Thailand) Co.,Ltd.
Org. Location : 104 Phatthanakan 40, Suan Luang, Bangkok 10250 Thailand.



REVIEW BY 
APPROVED BY 
NEXT CAL DATE 31/12/23

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Test Summary

Purpose
This section includes a status for each scheduled test and the overall qualification. For each test that is run, (1) the status is automatically determined based on pre-defined limits, and (2) the total number of times the test was run is displayed. For detailed results and specifications for a test, refer to the test results in this EQR.

Details	Status	Runs
Autosampler Check : ASX-620	Pass	1
Integrated Sample Introduction System (ISIS) Check : ISIS2	Pass	1
Autotune : G3281A	Pass	1
Background (No Gas Mode) : G3281A	Pass	1
Background (Gas Modes) : G3281A	Pass	1
20-Minute Stability (No Gas Mode) : G3281A	Pass	1
Overall Qualification Status	Pass	

Service Details

Purpose

This section includes local contact and delivery details for this service.

General Details

Service Order No./Request:	6005218484
EQP Name:	AgilentRecommended
EQP Revision:	ICPMS.02.50
Report Type:	Report
Organization Details	
Name:	ALS Laboratory Group (Thailand) Co.,Ltd.
Location:	104 Phatthanakarn 40, Suan Luang, Bangkok 10250 Thailand.
Local Contact Details	
Name:	Khan Chatchanal
Job Title:	Lab Manager
Qualification Location:	Spectro Room
Operator Details	
Name:	Pantheep Kurasathain
Job Title:	Field Service Engineer
Data Acquisition Details	
Acquisition Software Name:	Masshunter
Acquisition Software Revision:	D.01.01
Customer Data System (CDS):	icplife, Masshunter

Date: June 14, 2022 10:32:18 AM
System ID: JP12091612

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1	
Manufacturer	Agilent Technologies
Name	7700x
Model Number	G3291A
Detector Type	SQ
Nebulizer	Mira Mist (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	Ni
Skimmer Cone	Ni
Serial Number	JP12091612
Firmware Revision	D.01.01
ISIS 1	
Manufacturer	Agilent Technologies
Name	ISIS2
Model Number	G4911A
Installed Options	#003: 2 pumps, 1 valve, auto dilution and discrete sampling
Type	Peristaltic pump system
Autosampler 1	
Manufacturer	Agilent Technologies
Name	ASX-520
Model Number	G3296A
Serial Number	G31403A20
Chiller 1	
Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3290A
Serial Number	4N1220700

Date: June 14, 2022 10:32:18 AM
System ID: JP12091612

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Calculation Formulas

Purpose

This section includes calculation formulas for all available tests. Depending upon which tests are scheduled, all or some apply to your qualification.

For a description of calculations for ICP-MS tests performed by the MassHunter software, refer to the MassHunter application and documentation.

Date: June 14, 2022 10:32:18 AM
System ID: JP12091612

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Protocol Details

Purpose

This section lists the revisions for all test units used in this report. For complete test-specific and high-level change details, refer to the Revision History document.

Test Revision	Test
ICPMS.02.50	20-Minute Stability (No Gas Mode)
ICPMS.02.50	Autosampler Check
ICPMS.02.50	Autotune
ICPMS.02.50	Background (Gas Modes)
ICPMS.02.50	Background (No Gas Mode)
ICPMS.02.50	Integrated Sample Introduction System (ISIS) Check

Date: June 14, 2022 10:32:18 AM
System ID: JP12091612

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Autosampler Check

Purpose

This test demonstrates that the autosampler module is correctly installed and connected. It does not test module performance.

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
After the self test, is probe in the home position?		Yes	Yes	Pass
As commanded, is the probe positioned at vial 2?		Yes	Yes	Pass

Setpoint Status: Pass Run: 1

Overall Autosampler Check Test Status

Pass

Date: June 14, 2022 10:32:18 AM
System ID: JP12091612

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Integrated Sample Introduction System (ISIS) Check

Purpose

This test demonstrates that the ISIS module is correctly installed and connected. It does not test module performance.

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
As commanded, does the pump rotate?		Yes	Yes	Pass
As commanded, do the valves load and inject?		Yes	Yes	Pass

Setpoint Status: Pass Run: 1

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Date: June 14, 2022 10:32:18 AM
System ID: JP12091612

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Autotune

Purpose

This test uses traceable checkout standards to run a software-executed autotune in all modes. The tune report provides values for peak width, mass axis, sensitivity, oxide species, and doubly-charged species tests.

Setpoint

Results	
Peakwidth Mass 7	0.735 AMU
Agilent Recommended:	>= 0.65
Status:	<= 0.80 Pass
Peakwidth Mass 89	0.732 AMU
Agilent Recommended:	>= 0.65
Status:	<= 0.80 Pass
Peakwidth Mass 205	0.745 AMU
Agilent Recommended:	>= 0.65
Status:	<= 0.80 Pass
Mass Axis 7	7.00 AMU
Agilent Recommended:	>= 6.9
Status:	<= 7.1 Pass
Mass Axis 89	89.00 AMU
Agilent Recommended:	>= 88.9
Status:	<= 89.1 Pass
Mass Axis 205	205.00 AMU
Agilent Recommended:	>= 204.9
Status:	<= 205.1 Pass

Date: June 14, 2022 10:32:18 AM
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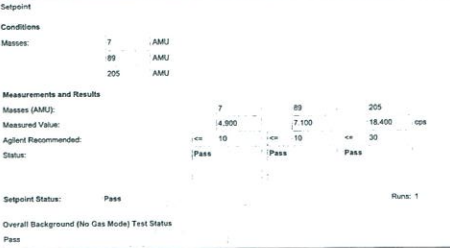
Mass 7 Sensitivity No Gas	81.18 Mpsu/gpm
Agilent Recommended:	>= 25.5
Status:	<= 85 Pass
Mass 89 Sensitivity No Gas	247.81 Mpsu/gpm
Agilent Recommended:	>= 85
Status:	<= 184.87 Pass
Mass 205 Sensitivity No Gas	184.87 Mpsu/gpm
Agilent Recommended:	>= 51
Status:	<= 84.86 Pass
Mass 59 Sensitivity He	84.86 Mpsu/gpm
Agilent Recommended:	>= 29.4
Status:	<= 1.30 Pass
Oxide Ratio 155/140	1.119 %
Agilent Recommended:	<= 1.30
Status:	<= 1.140 Pass
Doubly Charged Species Ratio 70/140	1.140 %
Agilent Recommended:	<= 2.3
Status:	<= 2.3 Pass
Setpoint Status:	Pass Run: 1
Overall Autotune Test Status	
Pass	

Date: June 14, 2022 10:32:18 AM
System ID: JP12091612

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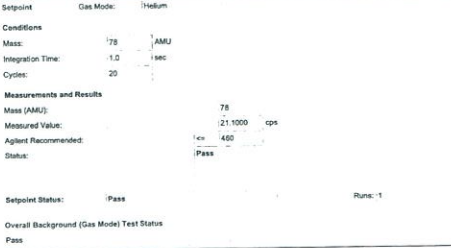
Background (No Gas Mode)

Purpose
This test examines the background of the ICP-MS in no gas mode by monitoring ions during a blank run.



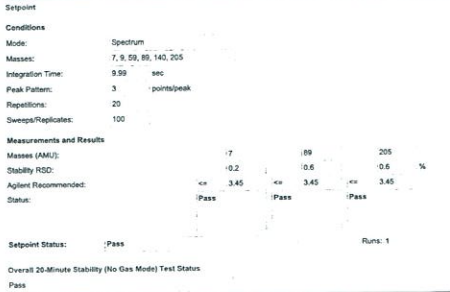
Background (Gas Mode)

Purpose
This test examines the background of the ICP-MS in the various gas modes by monitoring ions during a blank run.



20-Minute Stability (No Gas Mode)

Purpose
This test monitors the abundance of ions present in the check-out standard over a 20-minute period to verify that the signal is stable. The %RSD of the abundance of given ions is calculated internally by the software and compared to the limit.



Declaration of Change Control

This document is under change control. Revision history is maintained and printed on each document. Access to the master documents is limited to process owners. Documents receive periodic review and cannot be assigned an evergreen status. The qualification performed according to this document refers only to the hardware/software configuration in place at the time of the qualification. Agilent Technologies recommends that instrument configuration change management procedures be in place in order to maintain the validation process. Any changes to the analytical or computer hardware or software must be clearly specified. A change management system provides a means for determining the degree of requalification required according to the extent of the changes made. All details of the changes must be thoroughly recorded and documented, together with details of completed tests and their results. Note: Hardware/software configuration management is the customer's responsibility.

Attachments

Training requirements note: The delivery engineer attaches an ACE technique-specific training certificate to the Equipment Qualification Report (EQR). Obtaining ACE technique-specific certification includes pre-qualify trainings for Data Integrity, General Compliance topics (GMP, QLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. The one certificate encompasses all pre-qualify trainings as documented in the Agilent Learning Management System called Success Factors.

Location	Category	Document Name	Page
EQR	General	Certificate of System Qualification	17
EQR	General	Operator's training certificate and qualifications	18
EQR	General	Certificate of Qualification for ACE	19
EQR	General	Certificate of Qualification for ACE	20
EQR	General	Tune reports	21
EQR	General	Test Report	24
EQR	General	Test Report	26

General

Document Name: Certificate of System Qualification

Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: September 14, 2021 4:59:15 PM

Driver Serial #: ACADSDCA Platform Revision: ACE 3.11

Individual self-qualification reports for each specific technique included one site available upon request. They provide additional details on the general report from the trouble summary and are structured by the actual algorithm challenged during the process. There is not a one-to-one relationship between algorithm and OS program tests because some algorithms are used by several tests and some modules utilize hardware components of the qualified system.

Technique Type	Tests Completed	Result
Atomic Absorption	7	Confirms
Capillary Electrophoresis	10	Confirms
Chromatography	6	Confirms
Emission Spectroscopy	3	Confirms
Gas Chromatography - GCMS	17	Confirms
Gas Chromatography	26	Confirms
Gas Permeable Chromatography	9	Confirms
ICP-MS	6	Confirms
Infrared Spectroscopy	7	Confirms
Liquid Chromatography	17	Confirms
Liquid Chromatography - LCMS	8	Confirms
Mass Filter	16	Confirms
Sample Preparation - Gas Chromatography	9	Confirms
Sample Preparation - Liquid Chromatography	8	Confirms
Supercritical Fluid Chromatography	15	Confirms
Software	8	Confirms
UV-Vis Spectrophotometer	13	Confirms

Overall Qualification Status

Confirms

General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name: Poojey Karsanishin

Title Of Course: AN-CE-ICPMS-2-011-BL7766u/7766u ICP-MS base, <Open> JSM-S/NF & OQ/TV

Completion Date: November 21, 2012

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific text:

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent authorized service provider, through which the service engineer has ongoing access to Agilent's Safety Alerts, Service Notes, General Technical Updates, system training, support documentation, technical support, customer care, and parts system. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

General

Document Name: Certificate of Qualification for ACE

Agilent Technologies

Certificate of Completion

Learner Name: Poojey Karsanishin

Title Of Course: AN-CE-SI-B-030-A: ACE 3.X User Update Training

Completion Date: July 7, 2009

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific text:

A certificate for Service and Support training is only valid while employed by Agilent Technologies or while working as an Agilent authorized service provider, through which the service engineer has ongoing access to Agilent's Safety Alerts, Service Notes, General Technical Updates, system training, support documentation, technical support, customer care, and parts system. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

Electronic Signature

Purpose
This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details
Full Name of Signer: Panthep Kurassathin
Logged On User Name: panthep_kurassathin@agilent.com
Signature Creation Date: June 14, 2022
Reason for Signature: Executed protocol and published this original version of document

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

Warranty
Agilent Technologies makes no warranty of any kind to this material, including but not limited to, the implied warranties or merchantability and fitness for a particular purpose. Agilent Technologies shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

User Name: panthep_kurassathin Username: ASDKRW0313 System ID: JP12091612 Print Date: June 14, 2022 10:32:38 AM				
ALS OQHW 7700 14Jun2022 Transaction log				
Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:14:43 AM	Auto1	Swapped/Overlaid	Session	None
June 14, 2022 10:14:43 AM	Start	Configuration	Session	None
June 14, 2022 10:14:43 AM	Auto1	End/Leave	Learning	User is Field Engineer and does not require an unlock code
June 14, 2022 10:19:18 AM	Auto1	Exp/Loaded	Session	EOP details for primary technique (pass): File path: Photo\Photo\SampleMxConf\instrum02 5019x14x 83 50.e op; EOP File Name: [path\02 50 14x 83 50.e op; EOP Name: [AgilentRecommended]
June 14, 2022 10:19:20 AM	End	Configuration	Session	None
June 14, 2022 10:19:24 AM	Start	Qualification	Session	OQ
June 14, 2022 10:19:24 AM	Start	Execution	Autosampler Check: ASX-620	None
June 14, 2022 10:19:42 AM	End	Autosampler Check: ASX-620	Run Count: 1	Autosampler Check
June 14, 2022 10:19:43 AM	Start	Execution	Integrated Sample Introduction System (ISIS) Check: (ISIS) Integrated Sample Introduction System (ISIS) Check	None
June 14, 2022 10:19:47 AM	End	Execution	Integrated Sample Introduction System (ISIS) Check: (ISIS) Integrated Sample Introduction System (ISIS) Check	Run Count: 1
June 14, 2022 10:19:58 AM	Start	Execution	Autosampler: (G3291A, Autosampler 1	None
June 14, 2022 10:32:38 AM	End	Execution	Autosampler: (G3291A, Autosampler 1	Run Count: 1

User Name: panthep_kurassathin Username: ASDKRW0313 System ID: JP12091612 Print Date: June 14, 2022 10:32:38 AM				
ALS OQHW 7700 14Jun2022 Transaction log				
Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:32:34 AM	Start	Execution	Background (No Gas Mode): (G3291A, No Gas Mode Background 1	None
June 14, 2022 10:32:44 AM	End	Execution	Background (No Gas Mode): (G3291A, No Gas Mode Background 1	Run Count: 1
June 14, 2022 10:32:44 AM	Start	Execution	Background (Gas Mode): (G3291A, Gas Mode Background: Medium	None
June 14, 2022 10:33:38 AM	End	Execution	Background (Gas Mode): (G3291A, Gas Mode Background: Medium	Run Count: 1
June 14, 2022 10:33:37 AM	Start	Execution	20-Minute Stability (No Gas Mode): (G3291A, 20-Minute Stability (No Gas Mode) 1	None
June 14, 2022 10:34:08 AM	End	Execution	20-Minute Stability (No Gas Mode): (G3291A, 20-Minute Stability (No Gas Mode) 1	Run Count: 1
June 14, 2022 10:34:08 AM	End	Qualification	Session	OQ
June 14, 2022 10:34:08 AM	Start	Reporting	Session	None
June 14, 2022 10:36:38 AM	Auto1	Reporting	Session	Report Generated: Certificate
June 14, 2022 10:36:38 AM	Auto1	Reporting	Session	Report Generated: Report

Certificate of System Qualification
ICPMS-OQ

System ID: JP12091612
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Phatthanasarn 40, Suan Luang, Bangkok 10250 Thailand.

Date: June 14, 2022 10:32:51 AM
EOP Name: AgilentRecommended
EOP Revision: ICPMS-02.50
Overall Qualification Status: Pass

Autosampler Check

Overall Autosampler Check Test Status
Pass

Integrated Sample Introduction System (ISIS) Check

Overall Integrated Sample Introduction System (ISIS) Check Test Status
Pass

Autosampler	
Position: Mass 7	Pass
Position: Mass 89	Pass
Position: Mass 205	Pass
Mass Axis 7	Pass
Mass Axis 89	Pass
Mass Axis 205	Pass
Mass 7 Sensitivity No Gas	Pass
Mass 89 Sensitivity No Gas	Pass
Mass 205 Sensitivity No Gas	Pass
Mass 59 Sensitivity He	Pass
Oxide Ratio 156/140	Pass
Doubly Charged Species Ratio 70/140	Pass

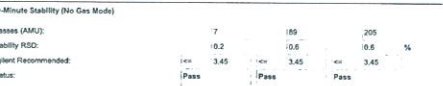
Overall Autosampler Test Status
Pass



Overall Background (No Gas Mode) Test Status
Pass



Overall Background (Gas Mode) Test Status
Pass



Overall 20-Minute Stability (No Gas Mode) Test Status
Pass

Instrument Details

Purpose
This section describes the as found system configuration.

Details	
ICP-MS 1	
Manufacturer	Agilent Technologies
Name	7700x
Model Number	G3291A
Detector Type	SiC
Nebulizer	Mist Mix (G3161)
Spray Chamber	Quartz
Torch	Quartz
Sampling Cone	NI
Skimmer Cone	NI
Serial Number	JP12091612
Firmware Revision	D.01.01
ISIS 1	
Manufacturer	Agilent Technologies
Name	ISIS2
Model Number	G4311A
Installed Options	#003: 2 pumps, 1 valve, auto dilution and discrete sampling
Type	Peristaltic pump system
Autosampler 1	
Manufacturer	Agilent Technologies
Name	ASX-620
Model Number	G3296A
Serial Number	031403A020
Chiller 1	
Manufacturer	Agilent Technologies
Name	Chiller
Model Number	G3292A
Serial Number	4N1220700

Electronic Signature

Purpose
This signature page was created and published because the ACE sign-off action was executed, which is valid for the entire document, including attachments. The ACE sign-off is an electronic signature that requires two distinct identification components: unique username and personal password. The Agilent representative who has delivered this service understands the meaning and legal status of an electronic signature. As a trained official operator, the Agilent representative has a unique password and login to access ACE and electronically sign this document. (Other e-signatures can be applied to this document using a Document Content Management or other suitable method defined in your data access and control procedures.)

Details
Full Name of Signer: Panthep Kurassathin
Logged On User Name: panthep_kurassathin@agilent.com
Signature Creation Date: June 14, 2022
Reason for Signature: Executed protocol and published this original version of document

Regulatory Disclaimer

This document provides a protocol to verify and record instrument configuration and evidence of proper operation. It has been prepared from our interpretation of applicable regulations as well as industry best practices. The document is designed to provide an important component of a complete compliance package. Validation depends upon many factors and use of this protocol alone does not assure compliance. Agilent Technologies makes no promises or representations as to its sufficiency for any specific regulatory program.

Warranty
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User Name: panthep_kurassathin Username: ASDKRW0313 System ID: JP12091612 Print Date: June 14, 2022 10:32:51 AM				
ALS OQHW 7700 14Jun2022 Transaction log				
Time	Transaction Date	Activity Performed	Type of Transaction	Optional Information
June 14, 2022 10:14:43 AM	Auto1	Swapped/Overlaid	Session	None
June 14, 2022 10:14:43 AM	Start	Configuration	Session	None
June 14, 2022 10:14:43 AM	Auto1	End/Leave	Learning	User is Field Engineer and does not require an unlock code
June 14, 2022 10:19:18 AM	Auto1	Exp/Loaded	Session	EOP details for primary technique (pass): File path: Photo\Photo\SampleMxConf\instrum02 5019x14x 83 50.e op; EOP File Name: [path\02 50 14x 83 50.e op; EOP Name: [AgilentRecommended]
June 14, 2022 10:19:20 AM	End	Configuration	Session	None
June 14, 2022 10:19:24 AM	Start	Qualification	Session	OQ
June 14, 2022 10:19:24 AM	Start	Execution	Autosampler Check: ASX-620	None
June 14, 2022 10:19:42 AM	End	Autosampler Check: ASX-620	Run Count: 1	Autosampler Check
June 14, 2022 10:19:43 AM	Start	Execution	Integrated Sample Introduction System (ISIS) Check: (ISIS) Integrated Sample Introduction System (ISIS) Check	None
June 14, 2022 10:19:47 AM	End	Execution	Integrated Sample Introduction System (ISIS) Check: (ISIS) Integrated Sample Introduction System (ISIS) Check	Run Count: 1
June 14, 2022 10:19:58 AM	Start	Execution	Autosampler: (G3291A, Autosampler 1	None
June 14, 2022 10:32:51 AM	End	Execution	Autosampler: (G3291A, Autosampler 1	Run Count: 1

Certificate No. T230682 Calibration Report Page 4 of 4

Measurement Results										
Calibration Point	Average Standard Reading at each position (°C)									
	37CH1	37CH2	37CH3	37CH4	37CH5	37CH6	37CH7	37CH8	37CH9	37CH10
20.0	20.26	20.17	20.10	20.13	19.96	20.14	19.69	20.20	19.82	
	38CH1	38CH2								
	20.03	20.04								

* The quoted uncertainty exclude "uniformity"
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: *[Signature]*

FM4.1311715-05-03

Certificate of Calibration

Equipment: Burette
Capacity: 50 mL
Serial No.: -
ID No.: BKK_EN0171
Manufacturer: Witag
Made in: Germany
Submitted by: ALS Laboratory Group (Thailand) Co.Ltd.
104 Phatthanakan 40, Phatthanakan Rd.
Khwaeng Phatthanakan, Khet Suan Luang
Bangkok 10250 Thailand
Ambient Temperature: (20 ± 2.5) °C
Relative Humidity: (50 ± 10) %
Barometric Pressure: 759 mmHg
Calibration Procedure: ASTM E 542 - 01
Calibrated by: Panwar Pramkiam
Approved by: *[Signature]*
() Ponthippa Tameyakul
() Malee Butkrua
(x) Pongpan Papiem
() Sineida Khumtha
Issue Date: 31 August 2022

The Uncertainties are for a confidence probability of approximately 95 %
This certificate may be reproduced after this as full, except with the prior written
Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0044607

Equipment: Burette
Received Date: 26 August 2022
Condition As-Received: Used Item
Calibration Date: 30 August 2022
Reference: 2208-0918DC-2
Cert.No.: 22CG3154
Page: 2 of 2

Condition of this result of calibration

- Reference Standard Instruments:
Instruments Model Serial No. ID No. Certificate No. Traceability Due date
1) Balance AB205 N30679 140RC001 21MA429 NIMT 22 Sep 2022
2) Thermo-hygrometer THOX-GE 00016540 140EC001 22H1243 NIST/NIMT 09 June 2023
3) Thermometer - 1594592 140EC010 22181 NIMT 10 Feb 2023
This certificate is traceable to SI Unit
2. The certificate is valid only to the item calibrated on date and place of calibration.
3. True value is converted to true volume at the standard temperature of 20 °C

Calibration result:

Nominal capacity (mL)	Reading (mL)	Uncertainty (± mL)	k Factor
50	49.9959	0.010	2.00

Remark: mL = cm³

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

a 1123908

METTLER TOLEDO

Certificate Number CPH-0220-22

Calibration Certificate Seven2Go™ pH/mV meter S2

Customer: ALS LABORATORY GROUP (THAILAND) CO., LTD.
Address: 33209 C.P. Tower Floor 13rd Floor, Mueang
Mueang Ratchadama 3000
Customer ID number: 30304168
Customer representative:
Instrument: Type: Seven2Go™ pH/mV S2 Instrument Serial number: C22012008
Internal identification: Firmware version: 1.01
Technical specifications:
Measuring Range: -1999.9 to 1999.9 mV -2 to 20 pH
Resolution: 1 mV 0.01 pH
Limit of Error: ±1 mV ±0.01 pH
Temperature range ATC: ±100 °C
Temperature range ATC: ±100 °C
Resolution: 0.1 °C
Limit of Error: ±0.5 °C
Procedure Statement:
METTLER TOLEDO Seven2Go Service Manual Section B (Doc. No. 3032219) will be used as referring documentation to adjust and verify the instrument subjected to the "Type" and "Serial number" section. The measurement results of this certification were obtained in ambient conditions.

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Page 1 of 2

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METTLER TOLEDO

METTLER TOLEDO

Certificate Number CPH-0220-22

Certification Tools

Certified digital voltmeter Manufacturer: HEWLETT PACKARD / 24041A Serial number: US3803181
Type: 24041A Certificate number: 010222051
Date of Certification: September 2, 2022
Certified Temperature Resistor Manufacturer: METTLER TOLEDO Serial number: A227
Type: 51302410 Certificate number: 03811
Date of Certification: April 27, 2022

Designation	Nominal value	Certified value
NTC 30 x 3, 5 °C	34.900 kΩ	34.901 ± 0.02
NTC 30 x 3, 15 °C	30.900 kΩ	30.902 ± 0.02
NTC 30 x 3, 55 °C	10.900 kΩ	10.903 ± 0.02
NTC 30 x 3, 75 °C	4.900 kΩ	4.904 ± 0.02
NTC 30 x 3, 100 °C	2.000 kΩ	2.008 ± 0.02

Certificate Number CPH-0220-22

Certification Measurements

Designation	Certified value	Measured value	Max. Tolerance	Passed / Failed
1900 mV	1900.0 mV	1900 mV	1 mV	Passed
1000 mV	1000.0 mV	1000 mV	1 mV	Passed
500 mV	500.0 mV	500 mV	1 mV	Passed
100 mV	100.0 mV	100 mV	1 mV	Passed
0 mV	0.0 mV	0 mV	1 mV	Passed
100 mV	100.0 mV	100 mV	1 mV	Passed
500 mV	500.0 mV	500 mV	1 mV	Passed
1000 mV	1000.0 mV	1000 mV	1 mV	Passed
1900 mV	1900.0 mV	1900 mV	1 mV	Passed

Designation	Nominal value	Measured value	Max. Tolerance	Passed / Failed
PTC 30 x 3, 0 °C	84.1 °C	84.1 °C	0.5 °C	Passed
PTC 30 x 3, 25 °C	25.3 °C	25.3 °C	0.5 °C	Passed
PTC 30 x 3, 55 °C	5.3 °C	5.3 °C	0.5 °C	Passed
PTC 30 x 3, 75 °C	1.3 °C	1.3 °C	0.5 °C	Passed
PTC 30 x 3, 100 °C	0.3 °C	0.3 °C	0.5 °C	Passed

Summary of Certification

Certification of instrument: Passed

The instrument referred to in this certificate has fulfilled the criteria of the certification. This is indicated by the notation Passed in the columns above.

Remarks: Service Assignment ID: 0270213711
Test high impedance at 1000.99 mV, Result: 1900 mV
Difference = 0.0% within MPE (0.1%)

Certification of the instrument was performed by:
Name: Soukai Sathakul Function: Service Technician
Company: METTLER TOLEDO
Date: October 31, 2022 Signature: *[Signature]*

Performance Test

Attachment to Certificate No. CPH-0220-22
pH Electrode
Type: InLab Expert Go-ISM SN: Z300571
Certified standards used:
Standard 1: Type: pH Buffer Manufacturer: METTLER TOLEDO Exp. date: Jun-24
Nominal value: pH (25.00 °C): 4.01 Lot No.: 1113502
Standard 2: Type: pH Buffer Manufacturer: METTLER TOLEDO Exp. date: Jan-24
Nominal value: pH (25.00 °C): 7.00 Lot No.: 1110130
Standard 3: Type: pH Buffer Manufacturer: METTLER TOLEDO Exp. date: May-24
Nominal value: pH (25.00 °C): 10.00 Lot No.: 101444A
Standard 4: Type: Buffer Solution Manufacturer: METTLER TOLEDO Exp. date: -
Nominal value: pH (25.00 °C): - Lot No.: -
Adjustment:
Set Calibration Buffer: 07 (25 °C) 2.00, 4.01, 7.00, 10.00
Select Calibration Mode: 3-Point calibration 2-Point calibration 2-Point calibration
3-Point Calibration: °C pH °C pH °C pH °C pH
Cal 1 ATC 24.9 4.01 ATC 25.6 - ATC 25.0 -
Cal 2 ATC 24.9 7.00 ATC 25.6 - ATC 25.6 -
Cal 3 - - - - -
Offset (mV): 98.4 - -
Slope % (or mV/pH): 98.4 - -
Cal 3 ATC 24.9 10.00 - -
Slope % (or mV/pH): 98.4 - -

Before adjustment		After adjustment	
Buffer Values	Measured	Buffer Values	Measured
pH °C	pH	pH °C	pH
4.01 24.9 ATC	3.96	4.01 24.9 ATC	4.00
7.00 24.9 ATC	6.99	7.00 24.9 ATC	7.01
10.00 24.9 ATC	9.95	10.00 24.9 ATC	10.02

Measurements:
Note: The difference result of calibrated electrode should be within ±1.00 pH
Remarks:
Place: Chemical Laboratory Calibration Date: October 31, 2022
Service Specialist: Soukai Sathakul Signature: *[Signature]*

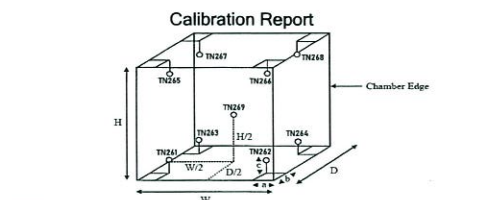


Certificate of Calibration

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: Seven2Go S2
Serial No.: B647350528
ID No.: N01 FS0028
Condition As-Received: Used Item
Received Date: 25 October 2022
Reference Date: 26 October 2022
Reference: 2210-0768DC-1
Submitted by: ALS Laboratory Group (Thailand) Co.Ltd.
104 Phatthanakan 40, Phatthanakan Rd.
Khwaeng Phatthanakan, Khet Suan Luang
Bangkok 10250 Thailand
Ambient Temperature: (25 ± 2.5) °C
Relative Humidity: (50 ± 15) %
Calibration Procedure: In-house method
- CP-CH5 by direct measurement with relative voltage calibrator and direct measurement with certified reference material (CRM)
Calibrated by: Warakorn Leringrakul
Approved by: *[Signature]*
() Malee Butkrua
(x) Warakorn Leringrakul
() Warakorn Leringrakul
Issue Date: 27 October 2022

The Uncertainties are for a confidence probability of approximately 95 %
This certificate may be reproduced after this as full, except with the prior written
Approval of the head of Corporate Services & Equipment Calibration and Testing Services.

A 0046551




Remark :
Internal Dimensions of Chamber : W (Width) = 104 cm, H (Height) = 72 cm, and D (Depth) = 60 cm.
Size of installed Standard sensor number T2251 to number T2258 : a = 5 cm, b = 5 cm, and c = 5 cm.
Size of installed Standard sensor number T2259 : W/2 = 104 cm/2, H/2 = 72 cm/2, and D/2 = 60 cm/2.

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)							
	T2261	T2262	T2263	T2264	T2265	T2266	T2267	T2268
180	179.14	179.17	179.65	179.26	180.41	179.64	181.18	180.99


Chamber (Oven)			Temperature Distribution				Coverage Factor k
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (±°C)	
	Min. Max	Average					
180.0	-	180.0	179.98	0.38	1.78	1.10	2.00

* The quoted uncertainty exclude "uniformity".
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 

FM-L15 11715-05-63

Certificate of Calibration

Equipment : Liquid Bath (Water)
Manufacturer : MEMMERT
Model : WNB29
Serial No. : L611.0135
Customer Code : BKK_EN0148
ID No. : T6455A4
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250
Customer Location : ORGANIC PREPARATION LAB
Date of Receipt : 26 January 2022
Calibrated By : Watcharapon Sangtong (Technician)
Approved By :  / Sujjar Nakanakred (Site Calibration Manager)
Date of Issue : 08 FEB 2022


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

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

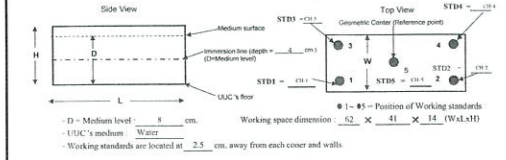
FM-L1417501-02-64

Calibration Report
Equipment : Liquid Bath (Water)
Date of Calibration : 31 January 2022
Environment : Temperature : 22.4-23.9 °C
Line Voltage : 221.4-235.4 V
Relative Humidity : 55 - 65 %RH

- Condition of this results of calibration :
- This equipment was calibrated by insert five resistance thermometer detectors into its water bath , the other one thermocouple type T use for ambient temperature measurement . The calibration was done in according to 98-736 (based on ASTM E715-93 / Reapproved 2001)
All data show below were final values and the initial data from customer request . The temperature scale used was based on ITS - 90
 - Reference Standard Instrument :
Instrument Model Instrument No. Certificate No. Due Date
RTD 100 CRM M34 (111-C115) T210115 2 February 2022
DATA LOGGER 3470A 147 T210115 2 February 2022
 - This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC TES-TIS T7025 CALIBRATION 0244)
 - Condition of calibrated item : good
Equipment Description :
Time Constant 1 Hour Minute At 60 °C
 - Adjustment :
(X) without adjustment () after adjustment

Approved By: 

FM-L1511715-05-63



Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CH-1	CH-2	CH-3	CH-4	CH-5
60	59.95	60.04	60.12	60.01	59.99
85	85.17	84.89	85.34	84.78	84.93
95	93.46	93.14	93.81	93.63	93.26

Setting (°C)	Liquid Bath (Water)			Temperature Distribution		
	Reading (°C)			Stability (±°C)	Uniformity (±°C)	Uncertainty (±°C)
	Min.	Max.	Average			
61.0	60.9	61.0	60.95	0.10	0.19	0.25
86.0	85.9	86.1	86.0	0.12	0.39	0.32
95.0	94.8	95.1	94.9	0.14	0.51	0.38

* The quoted uncertainty exclude "uniformity".
The calibration result apply only the above calibrated item.
The result of test was found accurate as shown on date and place of test only.
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t-distribution, providing a level of confidence of approximately 95 %.

Approved By: 

FM-L1511715-05-63


ARCHIMICA

Certificate of Calibration
ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated
by Archimica Lab Co., Ltd.

ICS-2100 S/N: 15010977
AS-HV S/N: 5450A36659

For
ALS Laboratory Group (Thailand) Co., Ltd.

Operator Signature:  Date: Jan 12, 2023
(Mr. Nutdanai Laekhwan)
Application Chemist


TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CALIBRATION AND TESTING EQUIPMENT SERVICES
534/4 PATTANAKAN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2171 3001-24 FAX 0-21705 9483

Cert.No.: 21CH1589
Page: 1 of 2

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : SevenCompact
Serial No. : B429832167
ID No. : BKK_EN0065
Condition As-Received : Used Item
Received Date : 17 November 2021
Calibration Date : 19 November 2021
Reference : 2111-0586DSC-6
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand

Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In-house method :
- CP-CH5 : based on direct measurement by using reference material (RM)

Calibrated by : Walalak Sirithean
Approved by : 
Approved Signatory

Issue Date : 23 November 2021
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 Laboratory and Testing Equipment Services.

A 0007977

Cert.No.: 21CH1589
Page: 2 of 2

Condition of this result of calibration

- Reference Standard Instrument :
Instrument Serial No. ID No. Certificate No. Due date
1) Thermometer 9540224 130RC003 21H451 15 Apr 2022

This certification is traceable to the International System of Unit maintained at -
Traceable to National Institute of Metrology (Thailand), NIMT

- Certified Reference Materials :
- Conductivity calibration solution, Thermo Scientific (traceable to NIST)

Conductivity Solution	Manufacturer	Lot No.	Exp. date
84 µS/cm	Thermo Scientific	08102	23 Feb 2024
1413.0 µS/cm	Thermo Scientific	17102	30 Apr 2024
12.860 mS/cm	Thermo Scientific	23001	07 June 2023

- Control Conductivity calibration solution temperature by Water bath (25±0.1) °C
3. This certificate is valid only to the item calibrated on date and place of calibration.

Calibration results
Function : Conductivity Measurement
(*) After Adjustment at 1413 µS/cm
Conductivity Electrode Serial No.: 5821270404

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (±)	Coverage factor k
84 µS/cm	85.92 µS/cm	85.52 µS/cm	4.3 µS/cm	2.00
1413 µS/cm	1419 µS/cm	1413 µS/cm	15 µS/cm	2.00
12.88 mS/cm	12.92 mS/cm	12.79 mS/cm	0.14 mS/cm	2.00

Remark :
- UUC* = Unit Under Calibration
- Adjustment Cell constant = 0.559929 cm⁻¹

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 %.

FM-L1511715-05-63

ภาคผนวก ฉ

สำเนาหนังสือใบอนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
กับกรมโรงงานอุตสาหกรรม



ลำดับที่	สารเคมี	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[6]
98	pH	Electrometric Method ^[6]
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[6]
100	Phenol	1) Distillation, Direct Photometric Method ^[6] 2) Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[6]
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[6]
102	Selenium	1) Digestion, Inductively Coupled Plasma Method ^[4] 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[6]
103	Silver	1) Digestion, Inductively Coupled Plasma Method ^[4] 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[6]
104	Styrene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
107	Toluene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[6]
109	TPH (C ₇ -C ₉)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
110	TPH (C ₁₀ -C ₁₆)	Solvent Extraction, Gas Chromatographic Method ^[9,21]
111	TPH (C ₁₇ -C ₂₅)	Solvent Extraction, Gas Chromatographic Method ^[9,21]
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]

รูปถ่าย

114 1,1,2-Trichloroethane...

(นางสาวกัญญา ชัยสุภกิจ)

ผู้ชำนาญการเฉพาะทางปฏิบัติการทางเคมีอินทรีย์
มหาวิทยาลัยเทคโนโลยีสุรนารี

ลำดับที่	สารเคมี	วิธีวิเคราะห์
114	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
115	Trichloroethylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
116	2,4,5-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[6]
117	2,4,6-Trichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[6]
118	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
119	Vanadium	1) Digestion, Inductively Coupled Plasma Method ^[4] 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[6]
120	Vinyl Acetate	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
121	Vinyl Chloride	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
122	m-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
123	o-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
124	p-Xylene	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
125	Xylene (Total)	Purge and Trap, Gas Chromatographic/Mass Spectrometric Method ^[6]
126	Zinc	1) Digestion, Inductively Coupled Plasma Method ^[4] 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[6]

เอกสารสืบ (ปีต่อรอบ) จำนวน 16 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method ^[2]
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method ^[2]

รูปถ่าย

3 Carbon Monoxide...

(นางสาวกัญญา ชัยสุภกิจ)

ผู้ชำนาญการเฉพาะทางปฏิบัติการทางเคมีอินทรีย์
มหาวิทยาลัยเทคโนโลยีสุรนารี

ลำดับที่	สารเคมี	วิธีวิเคราะห์
3	Carbon Monoxide	1) Sampling Bag Non-Dispersive Infrared Method ^[2] 2) Non-Dispersive Infrared Method ^[2] 3) Instrumental Analyzer Method ^[2]
4	Chlorine	1) Absorption Sampling, Ion Chromatographic Method ^[2] 2) Isokinetic Sampling, Ion Chromatographic Method ^[2]
5	Copper	Isokinetic, Digestion, Inductively Coupled Plasma Method ^[2]
6	Dioxins	Isokinetic Sampling, Analysis by ISO/IEC 17025 Accredited Laboratory or Analysis by Department of Industrial Works Registered Laboratory (Dioxins/Furans Analysis Approved) ^[2]
7	Hydrogen Chloride	1) Absorption Sampling, Ion Chromatographic Method ^[2] 2) Isokinetic Sampling, Ion Chromatographic Method ^[2]
8	Hydrogen Sulfide	Absorption Sampling, Iodometric Method ^[2]
9	Lead	Isokinetic, Digestion, Inductively Coupled Plasma Method ^[2]
10	Mercury	1) Isokinetic Sampling, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[2] 2) Isokinetic, Digestion, Inductively Coupled Plasma Method ^[2]
11	Opacity	Ringelmann's Method ^[2]
12	Oxides of Nitrogen	1) Absorption Sampling, Phenoldisulfonic Acid Method ^[2] 2) Chemiluminescence Method ^[2] 3) Instrumental Analyzer Method ^[2]
13	Sulfur Dioxide	1) Absorption Sampling, Barium-Thorin Titrimetric Method ^[2] 2) UV Fluorescence Method ^[2] 3) Instrumental Analyzer Method ^[2]
14	Sulfuric Acid	Isokinetic Sampling, Barium-Thorin Titrimetric Method ^[2]
15	Total Suspended Particulate	Isokinetic Sampling, Gravimetric Method ^[2]
16	Xylene	Absorption Sampling, Gas Chromatographic Method ^[2]

รูปถ่าย

สืบข้อมูล...

(นางสาวกัญญา ชัยสุภกิจ)

ผู้ชำนาญการเฉพาะทางปฏิบัติการทางเคมีอินทรีย์
มหาวิทยาลัยเทคโนโลยีสุรนารี

สืบข้อมูลวิธีวิเคราะห์ในหัวข้อ จำนวน 35 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[3,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]

รูปถ่าย

6 Cadmium...

(นางสาวกัญญา ชัยสุภกิจ)

ผู้ชำนาญการเฉพาะทางปฏิบัติการทางเคมีอินทรีย์
มหาวิทยาลัยเทคโนโลยีสุรนารี

ลำดับที่	สารเคมี	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
9	Chromium (III)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method, Waste Extraction, Colorimetric Method, Calculation Method ^[4,15,17] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method ^[4,15,17] 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^[4,15,17] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^[4,15,17]
10	Chromium (IV)	1) Waste Extraction, Colorimetric Method ^[4,15] 2) Alkaline Digestion, Colorimetric Method ^[4,15]

รูปถ่าย

11 Cobalt...

(นางสาวกัญญา ชัยสุภกิจ)

ผู้ชำนาญการเฉพาะทางปฏิบัติการทางเคมีอินทรีย์
มหาวิทยาลัยเทคโนโลยีสุรนารี

ลำดับที่	สารเคมี	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
14	DDO	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
15	DOE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
16	DOT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23]

รูปถ่าย

2) Soxhlet...

(นางสาวกัญญา ชัยสุภกิจ)

ผู้ชำนาญการเฉพาะทางปฏิบัติการทางเคมีอินทรีย์
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ลำดับที่	สารเคมี	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[4,15]

รูปถ่าย

2) Waste Extraction...

(นางสาวกัญญา ชัยสุภกิจ)

ผู้ชำนาญการเฉพาะทางปฏิบัติการทางเคมีอินทรีย์
มหาวิทยาลัยเทคโนโลยีสุรนารี

ลำดับที่	สารเคมี	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^[4,15] 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ^[4,28] 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^[4,28]
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,23] 2) Soxhlet Extraction, Gas Chromatographic Method ^[3,23] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[3,23]
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[4,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[4,15] 3) Digestion, Inductively Coupled Plasma Method ^[7,18] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,18]

รูปถ่าย

27 Polychlorinated...

(นางสาวกัญญา ชัยสุภกิจ)

ผู้ชำนาญการเฉพาะทางปฏิบัติการทางเคมีอินทรีย์
มหาวิทยาลัยเทคโนโลยีสุรนารี

ที่ ๒๓ ๐๓๐๑๖/ ๒๑๒ ๕



กรมโรงงานอุตสาหกรรม
แบบคราะที่ ๒ แพร่พยุหยาไ
เขตราพวิ กรุณพท ๑๐๔๐๐

๒๑ มีนาคม ๒๕๖๒

เรื่อง เปลี่ยนแปลงเอกสารขอขออนุญาตปฏิบัติงานวิเคราะ

เรียน กรรมการผู้ตรวจการ บริษัท เอสแอลเอส แลบลาวทอริ กรุ๊ป (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/ต่ออายุ/เปลี่ยนแปลงเอกสาร และชนิดการขอขออนุญาตปฏิบัติงานวิเคราะ

ตามหนังสือที่อ้างถึง บริษัท เอสแอลเอส แลบลาวทอริ กรุ๊ป (ประเทศไทย) จำกัด
ขอขออนุญาตปฏิบัติงานวิเคราะที่เลขที่ ๖ ๒๐๑๔ สถานที่ตั้งเลขที่ ๑๐๑ ซอยพัฒนาการ ๔๐
ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร ขอเปลี่ยนแปลงเอกสารขอขออนุญาตปฏิบัติงาน
วิเคราะที่ ความละเอียดเดิมเป็น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ไม่เปลี่ยนแปลงข้อเท็จจริงที่ประจักษ์ต่อปฏิบัติงาน
วิเคราะที่ จากเดิม นางสาวณัฏฐิ มงคลจิรัง ๖๒๐๑๔-๑-๑๐๑๑๔ เป็น นางสาวณัฏฐิ มงคลจิรัง
๖๒๐๑๔-๑-๑๐๑๑๔

ทั้งนี้ หากท่านมีความประสงค์จะยื่นคำขอใดๆ สามารถยื่นคำขอผ่านระบบอิเล็กทรอนิกส์
ได้ทั้งนี้ผ่านเว็บไซต์กรมโรงงานอุตสาหกรรม ตาม QR Code ที่แนบมาจึงขอเป็น

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

๒๑ มีนาคม ๒๕๖๒

ในนามของ ท่านรอง
ผู้อำนวยการกองส่งเสริมโรงงาน
กรมโรงงานอุตสาหกรรม

กองวิเทศและสัมพันธ์ระหว่าง

กรมโรงงานอุตสาหกรรมวิเคราะที่ขอขออนุญาตและขอขออนุญาตปฏิบัติงาน

โทร ๐ ๒๕๓๐ ๒๓๑๒ ต่อ ๒๓๑๑-๕

โทรสาร ๐ ๒๕๓๐ ๒๓๑๒ ต่อ ๒๓๑๑

ไปรษณีย์อิเล็กทรอนิกส์ sarakangduw@mail.go.th



ยื่นคำขอผ่านระบบอิเล็กทรอนิกส์



ดูข้อมูลเพิ่มเติมได้ที่เว็บไซต์ กรมโรงงานอุตสาหกรรม กรมส่งเสริมการค้าระหว่างประเทศ กระทรวงพาณิชย์

