

ภาคผนวก จ

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	RYG_FS0173	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	RYG_FS0179	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	RYG_EN0001	23-Mar-22	23-Mar-23	12
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0397	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	RYG_FS0188	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	RYG_EN0001	23-Mar-22	23-Mar-23	12
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0412	29-Jul-21	27-Jan-23	18
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	RYG_FS0411	29-Jul-21	27-Jan-23	18
Noise	Leq 24 hrs	Sound Calibrator	RYG_FS0215	9-Aug-21	9-Aug-22	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0434	21-Jan-22	21-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0431	21-Jan-22	21-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	RYG_FS0492	10-Jan-22	10-Jan-23	12
Noise	Noise Annoyance	Sound Calibrator	RYG_FS0215	9-Aug-21	9-Aug-22	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0434	21-Jan-22	21-Jan-23	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0431	21-Jan-22	21-Jan-23	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0492	10-Jan-22	10-Jan-23	12
Noise	Noise Annoyance	Sound Calibrator	RYG_FS0215	9-Aug-21	9-Aug-22	12
Noise	Noise Annoyance	Sound Level Meter	RYG_FS0493	10-Jan-22	10-Jan-23	12
Water Lab	Cyanide	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Water Lab	Cyanide	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Phenol	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Water Lab	Phenol	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	pH at 25 °C	pH meter	BKK_EN0072	26-Mar-21	24-Sep-22	18
Water Lab	Ammonia Nitrogen	Discrete analyzer	BKK_EN0037	28-Jun-21	28-Jun-22	12
Water Lab	Dissolved Oxygen	Burette	BKK_EN0171	30-Mar-21	28-Sep-22	18
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Nitrate	Ion Chromatography	BKK_EN0069	12-Jan-22	12-Jan-23	12
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Suspended Solids	Oven	BKK_EN0007	1-Dec-21	1-Jun-23	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKK_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKK_EN0007	1-Dec-21	1-Jun-23	18
Water Lab	BOD (5 days at 20°C)	DO Meter	BKK_EN0205	19-Jan-21	20-Jul-22	18
Water Lab	BOD (5 days at 20°C)	Incubator	BKK_EN0005	4-Oct-21	4-Apr-23	18
Water Lab	Temperature	pH Meter	BKK_LG0011	29-Nov-21	29-Nov-22	12
Water Lab	Organochlorine Pesticide	GC MSMS	BKK_EN0284	23-Nov-21	22-May-23	18
Water Lab	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Water Lab	Lead	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	Lead	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Lead	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Manganese	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	Manganese	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Manganese	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Copper	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	Copper	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	Copper	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Arsenic	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	Arsenic	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Arsenic	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Cadmium	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	Cadmium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Cadmium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Nickel	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	Nickel	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Nickel	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Zinc	ICP-MS	BKK_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	Zinc	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Zinc	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Water Lab	Mercury	CVAFS	BKK_EL0011	7-Jun-21	7-Jun-22	12
Water Lab	Total Coliform	Autoclave	BKK_ML0043	1-Dec-21	1-Jun-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	7-Jun-21	6-Dec-22	18
Water Lab	Fecal Coliform	Autoclave	BKK_ML0043	1-Dec-21	1-Jun-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	7-Jun-21	6-Dec-22	18
Water Lab	Fecal Coliform	Water Bath	BKK_ML0052	21-Feb-22	21-Feb-23	12



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Sludge	Silver	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Sludge	Silver	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Sludge	Silver	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Sludge	Lead	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Sludge	Lead	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Sludge	Lead	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Sludge	Mercury	CVAFS	BKK_EL0011	7-Jun-21	7-Jun-22	12
Sludge	Iron	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Sludge	Iron	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Sludge	Iron	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Sludge	Manganese	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Sludge	Manganese	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Sludge	Manganese	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Sludge	Nickel	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Sludge	Nickel	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Sludge	Nickel	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Sludge	Arsenic	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Sludge	Arsenic	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Sludge	Arsenic	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Sludge	Selenium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Sludge	Selenium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Sludge	Selenium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Sludge	Cadmium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Sludge	Cadmium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Sludge	Cadmium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Sludge	pH aqueous phase 50% (w/v)	pH meter	BKK_EN0072	26-Mar-21	24-Sep-22	18
Sludge	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12
Soil	Mercury	CVAFS	BKK_EL0011	7-Jun-21	7-Jun-22	12
Soil	Arsenic	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Soil	Arsenic	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Soil	Arsenic	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Soil	Cadmium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Soil	Cadmium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Soil	Cadmium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Soil	Lead	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Soil	Lead	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Soil	Lead	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Soil	Manganese	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Soil	Manganese	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Soil	Manganese	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Soil	Nickel	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Soil	Nickel	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Soil	Nickel	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18



รายการเครื่องมือที่ใช้ในการวิเคราะห์ / ทดสอบ

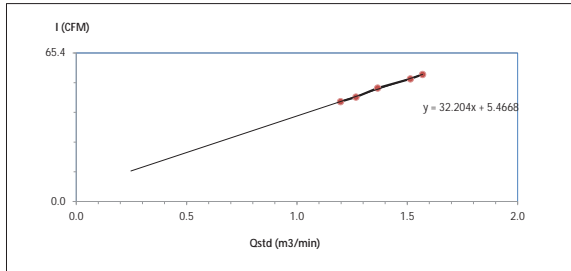
Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Soil	Selenium	ICP-OES	BKK_EL0037	13-Sep-21	12-Mar-23	18
Soil	Selenium	Hot Block	BKK_EL0054	7-Apr-22	7-Oct-23	18
Soil	Selenium	Chamber (Cold Room)	BKK_EN0167	18-May-21	16-Nov-22	18
Soil	pH aqueous phase 50% (w/v)	pH meter	BKK_EN0072	26-Mar-21	24-Sep-22	18
Soil	Hexavalent Chromium	Spectrophotometer	BKK_EN0018	15-Oct-21	15-Oct-22	12



High Volume Air Sampler Calibration Worksheet

Project Site :	Rojana Industrial Park (Chonburi) KhaoKhansong	Barometric Pressure (mm Hg) :	754
Calibrate Location :	พื้นที่ภายในสวนของโครงการ (A1)	Temperature (°C) :	32
Calibrate Date :	9-Jun-22	High Volume ID :	RYG-FS0173
CalibrationSheet No.:	C-090622-RYG-FS0173	High Volume Model :	TE-5170D
Calibrator ID:	RYG-FS0205	High Volume S/N :	4799
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.2	1.1978	44	Slope : 32.2038 Intercept : 5.4668 Correlation Coefficient : 0.9978
2	3.6	1.2676	46	
3	4.2	1.3654	50	
4	5.2	1.5140	54	
5	5.6	1.5694	56	



Calibrated by Jittakorn
(Mr.Jittakorn Sriwasa)
Field Scientist(2)

Approved by : Noppong Juntarupan
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

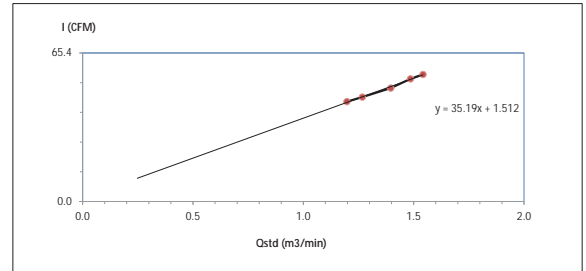
FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site :	Rojana Industrial Park (Chonburi) KhaoKhansong	Barometric Pressure (mm Hg) :	754
Calibrate Location :	สถานีสูบน้ำดิบของ EAST WATER (A2)	Temperature (°C) :	32
Calibrate Date :	9-Jun-22	High Volume ID :	RYG-FS0179
CalibrationSheet No.:	C-090622-RYG-FS0179	High Volume Model :	TE-5170D
Calibrator ID:	RYG-FS0205	High Volume S/N :	4805
Calibrator Model :	TE-5028A	Calibrator Slope :	1.53016
Calibrator S/N :	1166	Calibrator Intercept :	-0.0468

Test No.	Delta H ₂ O (inch)	Q _{std} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.2	1.1978	44	Slope : 35.1904 Intercept : 1.5120 Correlation Coefficient : 0.9969
2	3.6	1.2676	46	
3	4.4	1.3965	50	
4	5.0	1.4855	54	
5	5.4	1.5420	56	



Calibrated by Jittakorn
(Mr.Jittakorn Sriwasa)
Field Scientist(2)

Approved by : Noppong Juntarupan
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

FORM NO.: F 06-073 REVISION NO.: - ISSUE DATE: 14/03/16



PENTA CALIBRATION CO., LTD.
66/124 The Connect 33 Village Kanchanaphisek Road
Dokmai Praset Bangkok 10250
Tel : +66 (0) 2089-9773
www.pentacal.com

Certificate of Calibration

Represent to Certificate of Calibration JTC07022102

Certificate No.: PTC07022102 Page: 1 of 2
Equipment: Digital Balance Condition: Normal
Manufacturer: Sartorius Serial No: 25409004
Model: LA1305-F ID No: RYG_EN0001
Type of Balance: Single Interval

Customer: ALS Laboratory Group (Thailand) Co., Ltd.
616/10 Moo 5 T.Maejarjokoo, A.Pluakdaeng,
Rayong 21140, Thailand

Environment Condition: Temperature 23.9 °C ± 0.3 °C
Humidity 58.1 %RH ± 4.4 %RH
Air density 1.17 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.
616/10 Moo 5 T.Maejarjokoo, A.Pluakdaeng,
Rayong 21140, Thailand

The Method used: In house method, PTC-W-07, base on EN10357:18
Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co., Ltd.
NIST-ONSI Accreditation No.: Calibration 0198

Date Received: March 23, 2022
Calibration Date: March 23, 2022
Issued Date: March 25, 2022
Calibration By: Mr. Rungroek Metakul

Reviewed by Mr. Rungroek Metakul
(Mr. Rungroek Metakul)
Reviewed by

Approved By : Mr. Keattikorn Kerdso
(Mr. Keattikorn Kerdso)
Laboratory Manager

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). The effect that the results relate only to the items calibrated.

This calibration certificate shall not be reproduced except in full only, without written approval from Penta Calibration Co., Ltd.

FORM-01-07-216-000



PENTA CALIBRATION CO., LTD.
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Dokmai Praset Bangkok 10250
Tel : +66 (0) 2089-9773
www.pentacal.com

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Certificate No.: PTC07022102

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Measurement Results:

Without Adjustment :

Function Calibration: Non Adjustment

Eccentric Error: Weight to be 1/3, 1/2 or of Maximum capacity



Eccentricity test 50 (g)				
Position (g)				
1	2	3	4	5
0.0000	0.0000	-0.0001	0.0000	0.0001
Maximum deviation: 0.0001				

Repeatability Test : Weight to be 1/2 ≤ L ≤ Maximum capacity

Determination of the standard deviation of weighing balances. Repeatability 0.0001 (g)

Nominal test value (g)	Standard Deviation
100	0.00009

Error of indication : from nominal value, Repeatability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.00000	0.0000	0.0000	0.00026	2.61
0.01	0.01000	0.0100	0.0000	0.00026	2.65
0.05	0.05000	0.0500	0.0000	0.00026	2.65
0.1	0.10000	0.1000	0.0000	0.00026	2.65
0.5	0.00000	0.4999	0.0001	0.00026	2.65
1	1.00000	0.9999	0.0001	0.00026	2.65
2	2.00000	1.9999	0.0001	0.00026	2.65
5	5.00001	5.0000	0.0000	0.00026	2.65
10	10.00000	10.0001	-0.0001	0.00026	2.65
20	20.00003	20.0001	-0.0001	0.00026	2.52
100	100.00004	100.0001	-0.0001	0.00027	2.18

Note: Weight of adjust = 1g

The End of Certificate

PTC-FRM-01-07-216-000



High Volume Air Sampler Calibration Worksheet

Project Site: Rojana Industrial Park (Chonburi) KhaoKhansong Barometric Pressure (mm Hg): 754

Calibrate Location: สำนักงานสิ่งแวดล้อมภาคที่ 11 (A1) Temperature (°C): 32

Calibrate Date: 9-Jun-22 High Volume ID: RYG-FS0397

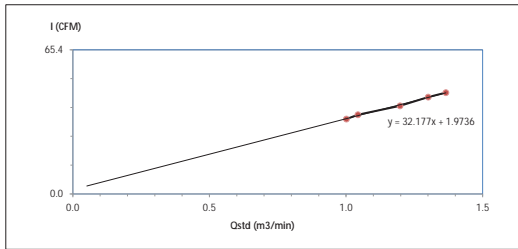
Calibration Sheet No.: C-090622-RYG-FS0397 High Volume Model: TE-5009X

Calibrator ID: RYG-FS0205 High Volume S/N: 5687

Calibrator Model: TE-5028A Calibrator Slope: 1.53016

Calibrator S/N: 1166 Calibrator Intercept: -0.0468

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	1.0012	34	Slope: 32.1765 Intercept: 1.9736 Correlation Coefficient: 0.9974
2	2.4	1.0436	36	
3	3.2	1.1978	40	
4	3.8	1.3011	44	
5	4.2	1.3654	46	



Calibrated by: Jittakorn
(Mr. Jittakorn Sriwasa)
Field Scientist (2)

Approved by: [Signature]
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

FORM NO.: F-06-074 REVISION NO.: - ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Rojana Industrial Park (Chonburi) KhaoKhansong Barometric Pressure (mm Hg): 754

Calibrate Location: สถานีควบคุมมลพิษ EAST WATER (A2) Temperature (°C): 32

Calibrate Date: 9-Jun-22 High Volume ID: RYG-FS0188

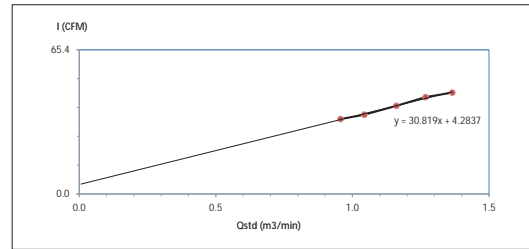
Calibration Sheet No.: C-090622-RYG-FS0188 High Volume Model: TE-5009X

Calibrator ID: RYG-FS0205 High Volume S/N: 4796

Calibrator Model: TE-5028A Calibrator Slope: 1.53016

Calibrator S/N: 1166 Calibrator Intercept: -0.0468

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.9567	34	Slope: 30.8186 Intercept: 4.2837 Correlation Coefficient: 0.9961
2	2.4	1.0436	36	
3	3.0	1.1612	40	
4	3.6	1.2676	44	
5	4.2	1.3654	46	



Calibrated by: Jittakorn
(Mr. Jittakorn Sriwasa)
Field Scientist (2)

Approved by: [Signature]
(Mr. Noppong Juntarupan)
Enviro Field Coordinator Scientist (3)

FORM NO.: F-06-074 REVISION NO.: - ISSUE DATE: 14/03/16



63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd.
Watthapra, Bangkhuyai, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

CERTIFICATE OF CALIBRATION

Certificate No: 99-10270001
Page 1 of 3 pages

Measurement Item: Gas analyser with data logger

Manufacturer: Data logger: Honeywell
Gas analyser: Honeywell

Model/Type: Data logger: ZDO WS 8018
Gas analyser: 85-00F

Serial Number: Data logger: A8234
Gas analyser: -

ID No.: Data logger: P90-P84102
Gas analyser: -

Customer: ALB Laboratory group (Thailand) Co., Ltd.
104 Petchkasem Rd. Petchkasem Rd. Klong Luang, Ang Thum Luang, Bangkok 10200 Thailand

Test Conditions: 900 cm³ flow rate test section area 900 cm³
Analytical section area 100 cm³
Dispenser of mounting plate cm³
Recharge rate of test object 0.111 s

Test Conditions: At temperature 25.5 ±0.5 °C
At pressure 1013.7 ±0.4 kPa
Relative air humidity 57.7 ±0.2 %RH

Calibration Procedure: Calibration was carried out using an
GC-81400 (3F) GC-11000 Flow Performance Measurement of Ecology Physics and
Microbiology Analytical Calibration Procedure - Version 2.0000.

Traceability: The calibration documents the procedure to national standard, which include the use of
measurements according to the international system of units (SI) through National Institute of
Measurement Thailand (NIMT).

Measurement Date: At 25.0001
Revised Date: At 25.0001

Calibrated by: [Signature]
☒ Mr. Jittakorn Sriwasa
☐ Mr. Jittakorn Sriwasa



Approved Signature: [Signature]
Mr. Noppong Juntarupan
Technical Support
and Calibration Manager



63/14-15,67/35-36, Soi Petchkasem 7,7/1, Petchkasem Rd.
Watthapra, Bangkhuyai, Bangkok 10600 Thailand.
Tel: (66) 02-8680812#13 Fax: (66) 02-8680860 www.jiranatee.com

Continuation of Certificate of Calibration Number

Certificate No: 99-10270001
Page 2 of 3 Pages

Result of calibration: ☒ without adjustment ☐ with adjustment
Calibration in the range of 1 - 16 dm³ at a calibration interval of 1 m³.
The results of calibration and associated measurement uncertainties are reported in the table below:

Flow Reading (m ³)	Flow Reading (dm ³)	Error (m ³)	Uncertainty (m ³)
0.000	0.0	-0.1	0.5
0.100	0.1	-0.1	1.0
0.200	0.2	-0.2	0.08
0.300	0.3	-0.1	0.08
0.400	0.4	-0.1	0.17
0.500	0.5	-0.2	0.09
0.600	0.6	-0.2	0.41
0.700	0.7	-0.4	0.29
0.800	0.8	-0.5	0.49
0.900	0.9	-0.6	0.61
1.000	1.0	-0.1	0.69
1.100	1.1	-0.1	0.77
1.200	1.2	-0.2	0.85
1.300	1.3	-0.3	0.93
1.400	1.4	-0.4	1.01
1.500	1.5	-0.5	1.09
1.600	1.6	-0.6	1.17
1.700	1.7	-0.7	1.25

NOTE: This is a Calibration Certificate.
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.

Appendix 1: Measurement Data

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Flow meter	ROTEC INC.	88889140	July 14, 2020	MP-05101-02	0 - 30 m ³ /h
2	Pressure Differential Pressure Meter	Sioux	DP4000/20	July 14, 2020	MP-05101-02	0 - 30 kPa
3	Gas analyser (Oxygen, CO, NOx)	Sioux	8400-12	July 14, 2020	MP-05101-02	0 - 10 ppm
4	Temperature	Sioux	DS-100	Nov 10, 2019	GL-027-04	-50 - 100 °C
5	Relative humidity	Sioux	DS-100	Nov 10, 2019	GL-027-04	0 - 100 %RH
6	Atmospheric pressure	Sioux	DS-100	Nov 10, 2019	MP-05101-02	980 - 1050 mbar
7	Flow meter	ROTEC INC.	88889140	-	-	0 - 30 m ³ /h

End of certificate of calibration



CERTIFICATE OF CALIBRATION

Certificate No: WD-11072021
Page 1 of 2 pages

Measurement Item: Wind direction sensor with data logger.
Manufacturer: Data logger: Norelco;
Wind direction sensor: Norelco.
Model/Type: Data logger: 200-WD-001R;
Wind direction sensor: WD-007.
Serial Number: Data logger: A5545;
Wind direction sensor: .
ID No.: Data logger: WFD_730411;
Wind direction sensor: .
Customer: ALN Laboratory group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd, Khwaeng Kuan Luang, Khet Suan Luang, Bangkok 10250 Thailand.
Environmental Condition:
The measurement was carried out at an ambient temperature of $23 \pm 0.5^\circ\text{C}$ and relative humidity of $46 \pm 10\%$.
Measurement Method:
The wind direction sensor calibration according to comparison method with reference signal measurement electronic facilities and the laser is used for wind control. The measurement was taken at 45° intervals in clockwise and counterclockwise directions.
Note: The UDO was vented up for 1 hour prior to the calibration being performed.
Traceability:
The measurement results are traceable to the international system of units (SI) through Certificate No: 02021-07-0245.
Certificate No: W05550044.
Measurement Date: 24.08.2021.
Issue Date: 24.08.2021.

Performed by:
☒ Mr. Somwit Theekha
☐ Miss. Onchai Wilaewitayee



Approved Signature:

[Signature]

Mr. Panyas Booncharoen
Technical Support
and Calibration Manager

THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED BY WRITING FROM THE LABORATORY.

Continuation of Certificate of Calibration Number

Certificate No: WD-11072021
Page 2 of 2 pages

Result of calibration: ☐ without adjustment ☒ with adjustment.
Calibration is in the range of $0 - 360^\circ$ at a calibration interval of 45°.

The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Measured Angle °	Standard Reading °	UUT* Reading °	Error °	Uncertainty ±°
1	Clockwise	0/360	360	358	-1	0.5
2		45	45	42	-3	0.5
3		90	90	87	-3	0.5
4		135	135	130	-5	0.5
5		180	180	180	0	0.5
6		225	225	225	0	0.5
7		270	270	273	3	0.5
8		315	315	318	3	0.5
9		0/360	360	358	-1	0.5
10	Counter Clockwise	45	45	42	-3	0.5
11		90	90	87	-3	0.5
12		135	135	132	-3	0.5
13		180	180	180	0	0.5
14		225	225	228	3	0.5
15		270	270	273	3	0.5
16		315	315	318	3	0.5

UUT*: 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%.

End of Certificate of Calibration



SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

451-451/1 Sirirachon Rd, Bangbunru, Bangkok 10700 THAILAND.
Tel: 0-2433-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC21009
Pages : 1 of 3

Calibration Certificate

Equipment: SOUND CALIBRATOR
Manufacturer: RION
Model: NC-74
Serial No.: 34178123
ID No.: RYG_F50213

Condition As Found: GOOD

Customer: ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

Location:
Ambient Temperature: $(23.0 \pm 3)^\circ\text{C}$
Pressure: $(101.3 \pm 3) \text{ kPa}$
Relative Humidity: $(50.0 \pm 20) \%$

Received Date: 05 AUGUST 2021
Calibration Date: 09 AUGUST 2021
Date of Issue: 11 AUGUST 2021

Calibrated by:

Nathakorn Pinitpraisan

Approved by:

[Signature]
(Thanakul Petchurui)

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SITHIPORN ASSOCIATES CO.,LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No. : ACC21009
Job No. : VC64AC0058
Pages : 2 of 3

Calibration Procedure: CP-AC-03

Calibration Method:

This equipment was calibrated by based on IEC-60942-2003 Standard.
The sound pressure level, frequency and total distortion of the sound calibrator was measured using the reference microphone.

Condition of this result of calibration:

1. Reference Standard Instruments:

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Digital Multimeter	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V744B6069	EF-0010-21	10-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

Continuation of Calibration Certificate

Cert. No. : ACC21009
Job No. : VC64AC0058
Pages : 3 of 3

Result of calibration :

1. Sound pressure level

Specified sound pressure level (dB)	Measured value (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit (dB)
94	94.06	0.06	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.5	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.67	0.10	3.0

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

End of Calibration Certificate

QF-TS12-04-04-020664



451-451/1 Siemthorn Rd., Banghumsu, Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2431-1679 e-mail: cal-cent@sihiporn.com http://www.sithiporn.com

Cert. No. : ACL22057
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier N11-24
Serial No. : 00296517 / 179120 / 87527
ID No. : RYG_PS0434

Condition As Found : GOOD

Customer : A.I.S. LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTANAKAN 40, PHATTANAKAN ROAD,
KHWAENG PHATTANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 14 JANUARY 2022
Calibration Date : 21-24 JANUARY 2022
Date of Issue : 25 JANUARY 2022

Calibrated by : Nathakorn Petchumai

Approved by :

T. Petchumai
(Thanakul Petchumai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22057
Job No. : VC65AC0043
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY32302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY33220104	EEL-RP_05-0264	10-Feb-22
Digital Multimeter	33461A	MY33220076	EEL-RP_03-0264	08-Feb-22
Digital Multimeter	34461A	MY60054273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MA7-1070	62100114	1500-Q7734E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-2003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22057
Job No. : VC65AC0043
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22057
Job No. : VC65AC0043
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.7
Flat	23.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.7	0.7	±5.0

QP-TS12-04-04-020664

T. Petch...

Continuation of Calibration Certificate

Cert. No. : ACL22057
Job No. : VC65AC0043
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QP-TS12-04-04-020664

T. Petch...

Continuation of Calibration Certificate

Cert. No. : ACL22057
Job No. : VC65AC0043
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
127.0	127.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QP-TS12-04-04-020664

T. Petch...

Continuation of Calibration Certificate

Cert. No. : ACL22057
Job No. : VC65AC0043
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	133.4	135.1	+0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QP-TS12-04-04-020664

T. Petch...

Continuation of Calibration Certificate

Cert. No. : ACL22057
Job No. : VC65AC0043
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-020664

T. Petchu

451-451/1 Sitrachon Rd., Bangumru, Bangplad Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2435-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22058
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No.: 00296518 / 179118 / 87525
ID No.: RVG F50431

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %Received Date : 14 JANUARY 2022
Calibration Date : 21-24 JANUARY 2022
Date of Issue : 25 JANUARY 2022

REVIEW BY :	<i>Manon P.</i>
APPROVED BY :	<i>T. Petchu</i>
NEXT CAL. DATE :	21/1/25

Calibrated by : Natakorn Pootpisuan

Approved by :

T. Petchu
(Thanakul Petchu)

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Continuation of Calibration Certificate

Cert. No. : ACL22058
Job No. : VC65AC0043
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference
Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY32302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY33220104	EEL-IP, 03/02/24	10-Feb-22
Digital Multimeter	33461A	MY33220076	EEL-IP, 03/02/24	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	ISO-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QP-TS12-04-04-020664

T. Petchu

Continuation of Calibration Certificate

Cert. No. : ACL22058
Job No. : VC65AC0043
Pages : 3 of 8

Summary of Measurement Result :

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

QP-TS12-04-04-020664

T. Petchu

Continuation of Calibration Certificate

Cert. No. : ACL22058
Job No. : VC65AC0043
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.6

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

Frequency Weighting	Measured value (dB)
A-weight	11.6
C-weight	17.6
Flat	23.2

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.1	0.1	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.8	0.9	0.9	±3.0

QF-TS12-04-04-020664

✓ P.T.A

Continuation of Calibration Certificate

Cert. No. : ACL22058
Job No. : VC65AC0043
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

✓ P.T.A

Continuation of Calibration Certificate

Cert. No. : ACL22058
Job No. : VC65AC0043
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

QF-TS12-04-04-020664

✓ P.T.A

Continuation of Calibration Certificate

Cert. No. : ACL22058
Job No. : VC65AC0043
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Th (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 (-5.0)
	2	8	117.0	116.9	-0.1	1.0 (-2.5)
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 (-5.0)
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 (-5.0)
SEL	2	8	108.0	108.0	0.0	1.0 (-2.5)
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.8	-0.6	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.3	-0.3	±2.0

QF-TS12-04-04-020664

✓ P.T.A

Continuation of Calibration Certificate

Cert. No. : ACL22058
Job No. : VC65AC0043
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.7	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

QE-TS12-04-04-020664

T. Petchum



451-451/1 Sithiporn Rd., Banghumsri, Bangkok 10700 THAILAND
Tel: 0-2435-8800 Fax: 0-2433-1629 e-mail: cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL22026
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00900071 / 188464 / 01733
ID No. : RYG_F50492

Condition As Found : GOOD

Customer : A.S. LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUANG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 05 JANUARY 2022
Calibration Date : 10-12 JANUARY 2022
Date of Issue : 13 JANUARY 2022

REVIEW BY : *Manhem P.*
APPROVED BY : *T. Petchum*
NEXT CAL DATE : 10/1/23

Calibrated by : Natthakorn Pinitpaum

Approved by : *T. Petchum*
(Thanakul Petchum)

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QE-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22026
Job No. : VC65AC0040
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.

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

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Exp. Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP, 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP, 03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180725251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QE-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22026
Job No. : VC65AC0040
Pages : 3 of 8

Summary of Measurement Result :

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

QE-TS12-04-04-020664

T. Petchum

Continuation of Calibration Certificate

Cert. No. : ACL22026
Job No. : VC65AC0040
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.8
Flat	23.6

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.2	0.3	0.3	±5.0

QF-TS12-04-04-020664

T. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22026
Job No. : VC65AC0040
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

T. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22026
Job No. : VC65AC0040
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	33.9	-0.1	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.8	-0.2	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22026
Job No. : VC65AC0040
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

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

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.2	-0.2	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Rth

Continuation of Calibration Certificate

Cert. No. : ACL22026
Job No. : VC65AC0040
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.5	-0.1	±1.5

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

T. Petchu

451-451/1 Srinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND
Tel:0-2435-8800 Fax:0-2431-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22027
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00900072 / 188465 / 01734
ID No. : RYG-F50493

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHWAENG PHATTHANAKAN, KHET SUAN LUANG,
BANGKOK, 10250 THAILAND.

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

Received Date : 05 JANUARY 2022
Calibration Date : 10-12 JANUARY 2022
Date of Issue : 13 JANUARY 2022



Calibrated by : Nathakorn Pitsatpisan

Approved by :

T. Petchu
(Thanakul Petchural)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22027
Job No. : VC65AC0040
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Certs. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP_03/0264	08-Feb-22
Digital Multimeter	34461A	MY60024273	1-15180723251-1	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	05-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-3003-21	16-Feb-22

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

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

3.1 National Institute of Metrology (Thailand).

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

QF-TS12-04-04-020664

T. Petchu

Continuation of Calibration Certificate

Cert. No. : ACL22027
Job No. : VC65AC0040
Pages : 3 of 8

Summary of Measurement Result :

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

QF-TS12-04-04-020664

T. Petchu

Continuation of Calibration Certificate

Cert. No. : ACL22027
Job No. : VC65AC0040
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.96)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

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

Frequency Weighting	Measured value (dB)
A-weight	9.9
C-weight	16.9
Flat	22.6

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 94 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.4	0.4	0.4	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.2	-1.1	-1.1	±5.0

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22027
Job No. : VC65AC0040
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

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

5.2 Time weighting at 1 kHz

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

6. Long-term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A-weight	94.0	94.0	0.0	±0.3

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22027
Job No. : VC65AC0040
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.1	0.1	± 1.1
23.0	23.1	0.1	± 1.1

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22027
Job No. : VC65AC0040
Pages : 7 of 8

8. Level linearity including the level range control

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

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
SEL	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.0	-0.4	±3.0

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

QF-TS12-04-04-020664

T. Petch

Continuation of Calibration Certificate

Cert. No. : ACL22027
Job No. : VC65AC0048
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability

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

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

End of Calibration Certificate

QP-TS12-04-04-029664

T. Pich



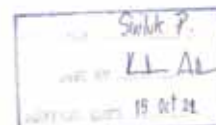
Bara Scientific Co., Ltd.
888 U Chu Liang Building Floor 7 Ramak Road
Siam Bangkok Bangkok Thailand 10250
Tel : 02-6324300 Fax : 02-6375486-7
www.barscientific.com



Certificate of Calibration

Number of Page(s) 1 of 2

Certificate No. BSCC-UV-29021
Equipment UV/Vis Spectrophotometer
Model UV-1800
Manufacturer Shimadzu
Serial No. A1145490833CD
ID No. BKK_E00018
Date of receipt 15 October 2021
Date of calibration 15 October 2021
Date of issue 25 October 2021



Customer name ALB Laboratory Group (Thailand) Co., Ltd.
Address 104 Soi Phatthanakan 40, Phatthanakan Road, Phatthanakan, Suan Luang, Bangkok 10250

Temperature (25.0 - 26.4) °C (On site)
Humidity (48.5 - 53.4) %RH (On site)

Equipment condition Good Operation

Calibration Location Organic Prep

Calibration Procedure In-house method W-UV-702-01 based on ASTM E275-01

Traceability Wavelength Accuracy is traceable to certificate No. 87830 and 87044
Photometric Accuracy is traceable to certificate No. 87845 and 87877
Stray Light is traceable to certificate No. 87825
The above certificate are traceable to SI unit through Bara Scientific Ltd.
(UKAS-accredited calibration laboratory NO. 0659)

Calibrated by Mr Wanchana Jaritoy

Approved by

[Signature]

Mr Kanth Chootep
Technician Manager

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
except in full, without written approval of the Bara Scientific Co., Ltd.

FM-UV-708-02 Rev.01 (2021/03)



Bara Scientific Co., Ltd.
888 U Chu Liang Building Floor 7 Ramak Road
Siam Bangkok Bangkok Thailand 10250
Tel : 02-6324300 Fax : 02-6375486-7
www.barscientific.com



Certificate of Calibration

Certificate No. BSCC-UV-29021 Number of Page(s) 2 of 2

Calibration Results:

1. Wavelength Accuracy

Certified Wavelength (nm)	UUC (nm)	Error (nm)	Uncertainty (nm)
241.70	241.55	-0.15	0.15
334.02	333.80	-0.22	0.18
418.53	418.40	-0.13	0.15
572.99	572.85	-0.14	0.15
878.41	878.15	-0.26	0.15

2. Photometric Accuracy (UV)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
235	0.0000	0.0000	0.0000	0.0079
	0.7174	0.7198	0.0024	0.0075
257	0.0000	-0.0001	-0.0001	0.0075
	0.8362	0.8377	0.0015	0.0073
313	0.0000	0.0000	0.0000	0.0078
	0.2778	0.2803	0.0025	0.0075
350	0.0000	-0.0001	-0.0001	0.0075
	0.6202	0.6221	0.0019	0.0075

*CNR = Customer not request

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FM-UV-708-02 Rev.01 (2021/03)



Bara Scientific Co., Ltd.
888 U Chu Liang Building Floor 7 Ramak Road
Siam Bangkok Bangkok Thailand 10250
Tel : 02-6324300 Fax : 02-6375486-7
www.barscientific.com



Certificate of Calibration

Certificate No. BSCC-UV-29021 Number of Page(s) 3 of 3

Calibration Results:

3. Photometric Accuracy (Visible)

Wavelength (nm)	Certified Absorbance (A)	UUC (A)	Error (A)	Uncertainty (±A)
420.0	0.0000	0.0000	0.0000	0.0040
	0.5631	0.5670	0.0041	0.0042
	0.7390	0.7334	-0.0056	0.0043
	1.0863	1.0816	-0.0047	0.0043
440.0	0.0000	0.0000	0.0000	0.0040
	0.5534	0.5469	-0.0065	0.0040
	0.7217	0.7186	-0.0031	0.0040
	1.0606	1.0572	-0.0034	0.0040
465.0	0.0000	0.0000	0.0000	0.0040
	0.5018	0.4986	-0.0032	0.0040
	0.6687	0.6610	-0.0077	0.0040
	0.8775	0.8740	-0.0035	0.0040
546.1	0.0000	0.0000	0.0000	0.0040
	0.5147	0.5113	-0.0034	0.0040
	0.6743	0.6709	-0.0034	0.0040
	0.9609	0.9600	-0.0009	0.0040
560.0	0.0000	0.0000	0.0000	0.0040
	0.5427	0.5394	-0.0033	0.0040
	0.7027	0.7001	-0.0026	0.0040
	1.0338	1.0323	-0.0015	0.0040
633.0	0.0000	0.0000	0.0000	0.0040
	0.5268	0.5233	-0.0035	0.0040
	0.6720	0.6685	-0.0035	0.0040
	0.9864	0.9847	-0.0017	0.0040

*CNR = Customer not request

4. Stray Light*

Standard cut-off wavelength (nm)	Unit Under Calibration(UUC) Wavelength (nm)	Transmission (%T)	Absorbance (A)
200.91±0.11nm	200.31	0.0395	2.0274

The Stray light transmission reference is less than 1 %T and Stray light absorbance reference is greater than 2.00A.
*Stray Light not NSC-ONSAC Accredited.

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

End of Certificate

The above results are valid exclusively for the calibrated item(s) as mention in this report / certificate.
Advertising the report / Certificate and publicity of the results are prohibited and also shall not be reproduced
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FM-UV-708-02 Rev.01 (2021/03)



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

Saraburi Tel : +66 3627 3096 Fax : +66 3627 3100

Bangkok Tel : +668 9205 6851 , +669 8247 2360

Website : www.scieco.co.th E-Mail : calibrate@scg.co.th



NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. T211009

Page 1 of 4

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.

104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,

Khet Suan Luang, Bangkok 10250

Customer Location : Laboratory

Date of Receipt : 6 May 2021

Calibrated By : Watcharapon Songthong (Technician)

Approved By : Sam Loo / Boonchai Suriyawong (Site Calibration Manager)

Date of Issue : 20 MAY 2021

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 117/01-02-64



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. T211009

Page 2 of 4

Calibration Report

Equipment : Chamber (Cold Room)

Date of Calibration : 18 May 2021

Environment : Temperature : 23.4-24.9 °C

Line Voltage : 221.4-230.2 V

Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

1. This equipment was calibrated by insert 16 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.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN161-TN170	T210009	8 January 2022
TC	TYPE T	TN171-TN180	T210009	8 January 2022
DATA LOGGER	34970A	T149	T210009	8 January 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244).

4. Condition of calibrated item : good

Equipment Description :

Time Constant 1 Hour 3 Minute At 3 °C
 Fresh Air Damper ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By: Sam Loo

FM-L15 117/15-05-63



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.

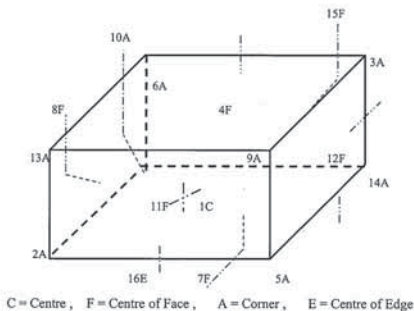


NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. T211009

Page 3 of 4

Calibration Report



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

Approved By: Sam Loo

FM-L15 117/15-05-63



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



NSC-TISI-TIS 17025
CALIBRATION 0244

Certificate No. T211009

Page 4 of 4

Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)									
	TN161	TN162	TN163	TN164	TN165	TN166	TN167	TN168	TN169	TN170
3	3.23	3.38	3.23	3.41	3.36	3.52	3.51	3.11	3.29	3.50
	TN171	TN172	TN173	TN174	TN175	TN176				
	3.36	3.18	3.52	3.22	3.28	3.31				

Chamber (Cold Room)			Temperature Distribution				
Setting (°C)	Reading (°C)		Average (°C)	Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min	Max					
3.0	2.7	3.4	3.0	3.34	1.00	1.10	1.46

* The Acquired 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: Sam Loo

FM-L15 117/15-05-63



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
114/1 PATTANAKARN ROAD BOX 18, SUANLUANG, WANGMAUNG BANGKOK 10330
TEL. 0-2711-8888-27 FAX. 0-2711-8888



Cert.No.: 21CH452
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S220
Serial No. : B520948426
ID No. : BKK_EN0072
Condition As-Received : Used Item
Received Date : 24 March 2021
Calibration Date : 28 March 2021
Reference : 2103-1008DSC-1
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanasak 40, Phatthanasak Rd.,
Khwaeng Phatthanasak, Khet Suan Luang,
Bangkok 10250 Thailand

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

Calibrated by : Warakorn Lemagatrakul

Approved by :
Approved Signatory

() Malee Butkrusa
() Sathip Meangmai
() Warakorn Lemagatrakul

Issue Date : 31 March 2021

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

This certificate may not be reproduced without the prior written
approval of the Head of Corporate Services & Equipment Calibration and Testing Services.

A 0026590



Cert.No.: 21CH452
Page: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument : -

Instrument	Serial No.	ID No.	Cert. No.	Exp. Date
1) Document Process Calibrator	1385032	130RC022	20E4213	24 Nov 2021
2) Ref. Standard Thermometer	4982054	110RC044	20H2233	15 Oct 2021

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

2. Certified Reference Materials : The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AB-1635

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	706694	06 Sep 2022
pH 6.985	CPA chem	722285	19 Dec 2021
pH 10.012	CPA chem	722287	19 Dec 2021

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 (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement (mV)	Coverage factor k
		pH	mV	mV	pH		
pH Meter S/N: B520948426	4.000		177.48	177.4	4.000	0.058	2.00
	7.000		0.00	-0.1	7.000	0.058	2.00
	10.000		-177.48	-177.5	10.000	0.058	2.00

a 1048959



Cert.No.: 21CH452
Page: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (±)	Coverage factor k
pH Electrode S/N: 0265091	4.008	4.010	150.3	0.0048	2.05
	6.985	6.989	-22.5	0.0077	2.00
	10.012	10.011	-193.7	0.013	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : InLab Expert Pro-ISM
- Serial No. : 9265091
Dimension of probe:
- Length : 120 mm.
- Diameter : 12 mm.
- Immersion Depth : 100 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement (± °C)	Coverage factor k
25.0	25.003	25.2	0.197	0.20	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 %.

-080-

a 1048958



บริษัท ดับเบิล เอส ไดแอกโนสติกส์ จำกัด
DOUBLE S DIAGNOSTICS CO., LTD.

* อยากรู้เรื่องใด กรุณาโทรสอบถามรายละเอียด โทร (02) 747-7008 โทรสาร (02) 747-7009
3, rue 11th March 15, Bangkok, Bangkok 10260 Tel. (02) 747-7008 Fax: (02) 747-7009

Maintenance Plan YEAR : 2021

เดือน	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
เสร็จ												

Periodical maintenance check list for Konelab

	6M	12M	Note
1.Diluent-wash tubing change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2.ISE tubing change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
3.Syringe check/change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
4.Dispensing check/ change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
5.Waste tubing change when necessary	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
6.Lamp check/change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
7.Mixer paddle/paddle change(not Konelab20)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
8.ISE needles check/change	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
9.Pump tubing check/ change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
10.Broken/worn out part check /change	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
11.Peristaltic pump check /cleaning/ lubrication	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
12.Heating check	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
13.Cooling check	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
14.Dispenser mechanic check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
15.Cuvette transfer mechanic check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
16.Dispenser movement check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
17.Sample/reagent register check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
18.Dispensing tubing tightness check	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
19.Photometer and optics cleaning/check/adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
20.Workstation PC cleaning if necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
21.Mechanic cleaning/lubrication	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
22.Instrument cleaning if necessary	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
23.Complete analyzer testing with waterblank/QC or sample	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
24.Test parameters/Adjustment/config. Save to USB key	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
25.UPS Test	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Place : BS Lab Instrument : Agarose 350
Date/Time : 28-06-21 Serial no : 22981
Service done by : Dr. P. Install date : 28/6/21
Signature of customer : Dr. P. Date/Time : 28/6/21



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
2541 PATTANAKARN ROAD W/14, BANGKANG, BANGKANG BANGKOK 10150
TEL. 0-2717-888-27 FAX. 0-2719-8884



Cert.No.: 21CG1446
Page.: 1 of 2

Certificate of Calibration

Equipment : Burette
Capacity : 50 mL
Serial No. : -
ID. No. : BKK_EN0171

Manufacturer : Witeg
Made in : Germany
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.
Khwang Phatthanakan, Khet Suan Luang
Bangkok 10250 Thailand

Ambient Temperature : 20 ± 2.5 °C
Relative Humidity : (50 ± 10) %
Barometric Pressure : 755 mmHg
Calibration Procedure : ASTM E 542 - 01

Calibrated by : Sa-nguankam Wongsa

Approved by :
Approved Signatory

- () Porntippa Tameyakul
(x) Mailee Sukkusa
() Porpan Papien
() Sriuda Khamtha

Issue Date : 31 March 2021

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

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A 0025589



Equipment : Burette
Received Date : 24 March 2021
Condition As-Received : Used Item
Calibration Date : 30 March 2021
Reference : 2103-1008QSC-5

Cert.No.: 21CG1446
Page.: 2 of 2

Condition of this result of calibration

1. Reference Standard Instruments :
- | Instruments | Model | Serial No. | ID. No. | Certificate No. | Traceability | Due date |
|----------------------|--------|------------|----------|-----------------|--------------|--------------|
| 1) Balance | XP205 | B134206712 | 140RC007 | 21MM181 | NIMT | 02 Mar 2022 |
| 2) Thermo-Hygrograph | TH 803 | 09153022 | 140EC004 | 20H1434 | NIST/NIMT | 19 June 2021 |
| 3) Thermometer | | 1594592 | 140EC010 | 2011191 | NIMT | 08 Oct 2021 |
- This certification 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	50.0041	0.011	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 %.

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a 1048960



REVIEW BY :
APPROVED BY :
NEXT CAL DATE : 12/2021/22

Certificate of Calibration

ICS-2100: Anion (ID#659)

This certificate is to verify that instrument below are calibrated
by Archemica 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, 2022

(Mr.Thitpong Piromkriput)
Applications Chemist

Sartorius (Thailand) Co., Ltd.
128 Rama 9 Road, Huaykong, Huaykong, Bangkok 10110
Tel: +66 (0)2 6201-6, e-mail: sarthai@thailand.sartorius.com



SARTORIUS

Certificate of Calibration

Model Number : MSU2245-000-DA
Description : Analytical Balance
Serial Number : 27405555 # BKK_EN0003
Manufacturer : Sartorius

Certificate No. : 21BC0263
Issued Date : Monday, September 06, 2021
Reference No. : 502052
Page No. : 1 OF 2

Customer Name : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan, Khet Suan Luang, Bangkok 10250

Calibrated Place : Lab Room

Calibrated By : Mr.Chonchai Inthana
Calibration Date : Friday, September 03, 2021

Calibration Procedure No. : This calibration was conducted by using in-house calibration procedure number (WI-001) Based on UKAS LAB 14

Metrological data :

Capacity : 220 g Readability : 0.0001 g

Ambients Conditions :

Temperature : 23.5 °C \pm 5.0 °C
Humidity : 59.1 % RH \pm 10.0 % RH
Pressure : \pm

Reasons for calibration

☐ New Installation ☐ Service / Required ☒ Re-calibration / Maintenance

Equipment Condition : ☒ Good Operator : ☐ Full

Measurement Method : UKAS Publication Ref :Lab 14

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). The calibration certificate documents the traceability to National Standards, which realize the unit of measurement according to the International Standard System of Units (SI). Report of Traceability came from list of Sartorius Metrological Specifications.

Traceability:

Model Number	Description	Traceability	Certificate No.	Due Date
YC011-522-00	Sartorius weight set, 1mg - 200g E2/YS011-522-00	Sartorius	118834 D-A-10388-01-00	10-Sep-2021
MHB-38250	Humidity/Balometer/Temp. Logon MHB-38250	SPCC	KSPR2111868	31-Aug-2022

This certificate relate and apply this equipment only.

This certificate may not be reproduced other than in full except with the prior written approval of the Verification Operation Division Sartorius (Thailand) Co., Ltd.

ISO 9001:2015-40-22 30/03/2020 R2

Mr.Chonchai Inthana(Technical Manager)

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Certificate of Calibration

Model Number: **MSU224S-000-DA**
Description: **Analytical Balance**
Serial Number: **27405555 # BKK EN0003**
Manufacturer: **Sartorius**

Certificate No.: **21BIC0263**
Issued Date: **Monday, September 06, 2021**
Reference No.: **502052**
Page No.: **2 of 2**

Calibration Results: Without Adjustment

Repeatability

The repeatability is the ability of a weighing instrument to display nearly identical readouts under constant test conditions when the same load within a measurement series is placed repeatedly on the weighing pan in the same manner. The standard deviation is used to express repeatability quantitatively.

Nominal Value: (Low Load)	20.0000	200.0001
20 g	20.0001	200.0000
Tolerance	20.0000	200.0001
0.0001 g	20.0000	200.0001
	20.0001	200.0001
Nominal Value: (High Load)	20.0000	200.0001
200 g	20.0001	200.0000
Tolerance	20.0000	200.0001
0.0001 g	20.0000	200.0000
	20.0000	200.0001
Standard Deviation	0.00005	0.00005

Eccentricity (Off-center loading error)

The off-center loading error is yielded by the difference between the readout of the load, i.e. 1/3 or 1/4 of maximum capacity, placed in the middle of the weighing pan and between each of four additional measurement points (positions defined according to OIML R110).

Nominal value: **50 g**
Tolerance: **0.0004 g**



Difference	
1	0.0000
2	0.0000
3	0.0000
4	0.0000
5	0.0001
6	0.0000

Linearity

The linearity, also called linearity error, describes the deviation of the characteristic curve of a weighing instrument from the linear slope.

Tolerance: **0.0002 g**

Nominal Value (g)	Conventional Mass Value (g)	Displayed Value (g)	Deviation (g)	Uncertainty (g)
0.01	0.0100	0.0100	0.0000	0.00013
0.1	0.1000	0.1000	0.0000	0.00013
1	1.0000	1.0000	0.0000	0.00013
2	2.0000	2.0000	0.0000	0.00013
5	5.0000	5.0000	0.0000	0.00013
10	10.0000	10.0000	0.0000	0.00013
20	20.0000	20.0000	0.0000	0.00013
50	50.0001	50.0002	0.0001	0.00014
100	100.0001	100.0002	0.0001	0.00018
200	200.0001	200.0001	0.0000	0.00029

End of Report

ISO17025-REF-22 26/03/2020 R2



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
8184 PHITTHANAKAN ROAD 101 10, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2111-8880-27 FAX 0-2709-9484



Cert. No.: **21TM2189**
Page: **1 of 3**

Certificate of Calibration

Equipment: **Hot Air Oven**

Manufacturer: **Mettler**

Model: **UFE 500**

Serial No.: **Q511.1574**

ID No.: **BKK_EN0007**

Submitted by: **ALS Laboratory Group (Thailand) Co., Ltd.**
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand

Location: **Oven Room**

Received Order: **1 December 2021**

Calibration Date: **1 December 2021**

Ambient Temperature: **(26 ± 10) °C**

Relative Humidity: **(50 ± 30) %**

Calibrated by: **Khel Rutanaprapachai**

Approved by:

Approved Signatory

() Pornthipa Tarayakul
() Malee Buhrusa
() Sawit Imjai

Issue Date: **7 December 2021**

The Uncertainties are for a confidence probability of approximately 95 %

This certificate may not be reproduced without the prior written approval of the head of Corporate Services & Equipment Calibration and Testing Services

A 0032815



Equipment: **Hot Air Oven**
Condition As-Received: **Used Item**
Reference: **2112-0002OC-1**

Cert. No.: **21TM2189**
Page: **2 of 3**

Procedure Used

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

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44060450	21LM4/T	06 Mar 2022

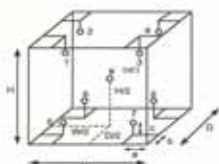
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration: () Without Adjustment

Function of UUC: Temperature Source

Fresh air setting: **Close**



Probe Installation Details: Dimension of Chamber:
a = 5.0 cm D = 0.40 m
b = 5.0 cm W = 0.56 m
c = 5.0 cm H = 0.48 m
Capacity = 0.11 m³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	25	25
REL. Humid. (%)	51	53
AC Supply (Volt)	221	222

Ref. Std. ID No.: @ Calibration Point		
Position:	(104) °C	(121,175,180) °C
1	19-14RTD-01	19-14TC-01
2	19-14RTD-02	19-14TC-02
3	19-14RTD-03	19-14TC-03
4	19-14RTD-04	19-14TC-04
5	19-14RTD-05	19-14TC-05
6	19-14RTD-06	19-14TC-06
7	21-14RTD-07	19-14TC-07
8	19-14RTD-08	19-14TC-08
9 (ref.)	19-14RTD-09	19-14TC-09



Equipment: **Hot Air Oven**
Condition As-Received: **Used Item**
Reference: **2112-0002OC-1**

Cert. No.: **21TM2189**
Page: **3 of 3**

Result of Calibration

Function of UUC: Temperature Source

Fresh air setting: **Close**

Calibration Point (°C)	UUC Setting (°C)	UUC Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor
104.0	104.0	104.0	0.059	0.52	0.59	0.45	2
121.0	121.0	121.0	0.11	0.75	1.2	1.1	2
175.0	175.0	175.0	0.13	0.90	1.6	1.1	2
180.0	180.0	180.0	0.13	0.93	1.6	1.1	2

Calibration Point (°C)	Measured Temperature (°C)								
	1	2	3	4	5	6	7	8	9 (ref.)
104.0	104.265	104.229	104.080	103.922	104.390	104.304	104.284	103.994	103.909
121.0	120.838	120.519	120.661	120.524	121.162	120.655	120.703	120.126	120.726
175.0	175.021	174.603	174.848	174.652	175.830	175.321	175.411	174.440	175.222
180.0	179.792	179.374	179.575	179.376	180.643	180.081	180.174	179.217	180.014

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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Cert.No.: 21TW6
Page: 1 of 2

Certificate of Testing

Equipment : DO Meter
Manufacturer : YSI
Model : 5100
Serial No. : 15L103204
ID No. : BKK_EN0205
Received Date : 15 January 2021
Test Date : 19 January 2021
Reference : 2101-0428WSC-6
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khuang Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Laboratory Condition : Temperature (25 ± 5) °C
Humidity (50 ± 20) %
Test Procedure : In - house method : CP-CH9
by Comparison Technique with Azide Modification Method
Calibrated by : Walalak Sirthean
Approved by :
Approved Signatory
(/) Matee Bulkruea
() Sathip Meangmai
() Wansorn Lemgagrakul
Issue Date : 25 January 2021



0251901



Cert.No.: 21TW6
Page: 2 of 2

Result : Dissolved Oxygen Meter Adjustment With Air 100 %
Dissolved Oxygen Probe No.: 18C100772

Titration Method (Azide Modification Method) (mg/L)	DO Meter Reading (mg/L)	Standard Deviation (mg/L)
8.10	8.10	0.0055

This report was certified only for the instrument we tested. It is allowable to use for study the system efficiency. The environmental impact control and present to organization it may concerned intend to use for advertising and referral purpose is prohibited. This report may not be reproduced other in full without written approval of the laboratory

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Cert. No.: 21TM166
Page: 1 of 2

Certificate of Calibration

Equipment : DO Meter with Sensor
Manufacturer : YSI
Model : 5100
Serial No. : 15L103204
ID No. : BKK_EN0205
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khuang Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 15 January 2021
Calibrated Date : 21 January 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Kritsada Chaitrong
Approved by :
Approved Signatory
() Porritippa Taneyakul
(/) Matee Bulkruea
() Suwit Imjai
Issue Date : 28 January 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 Corporate Services 3 : Equipment Calibration and Testing Services.

0023875



Cert. No.: 21TM166
Page: 2 of 2

Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2101-0428WSC-6
Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	2188080	2011389	20 Nov 2021

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 maintained at:-
- National Institute of Metrology Thailand (NIMT)

Result of Calibration :- (*) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 18C100772

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.00	80	20.002	19.94	-0.062	0.15	2.00

UUC* : Unit Under Calibration

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

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Certificate No. T212123

Page 1 of 3

Certificate of Calibration

Equipment : Chamber (Incubator)
Manufacturer : SHEL LAB
Model : 2020-2E
Serial No. : 802899
Customer Code : BKK_EN0005
ID No. : T7499A0
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Wet Chemistry Lab2
Date of Receipt : 1 October 2021
Calibrated By : Sujjar Naknakred (Site Calibration Manager)
Approved By : [Signature] /Boonchai Suriyawong (Site Calibration Manager)
Date of Issue : 07 OCT 2021



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.

PM 6.13 17/15-05-63

Certificate No. T212123

Page 2 of 3

Calibration Report

Equipment : Chamber (Incubator)
Date of Calibration : 4-5 October 2021
Environment : Temperature : 23.8-24.9 °C
Line Voltage : 227.5-231.1 V
Relative Humidity : 55 - 65 %RH

Condition of this results of calibration :

- This equipment was calibrated by insert nine resistance thermometer detectors into its chamber , the other one resistance thermometer detector 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
RTD	100 ohm	29-(CHI)-10	T210118	2 February 2022
DATA LOGGER	34970A	T47	T210118	2 February 2022
- This certificate is traceable to :
National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION 0244)
- Condition of calibrated item : good
 Equipment Description :
 Time Constant : 2 Hour 20 Minute At 20 °C
 Fresh Air Dumper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available
- Adjustment :
 () without adjustment (X) after adjustment

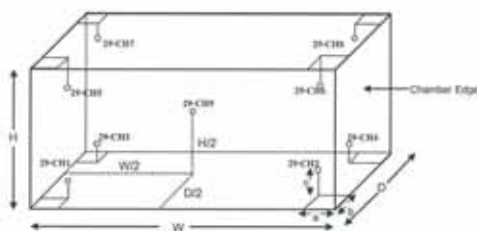
Approved By : [Signature]

PM 6.13 17/15-05-63

Certificate No. T212123

Page 3 of 3

Calibration Report



Remark :
Internal Dimensions of Chamber : W (Width) = 70 cm., H (Height) = 130 cm. and D (Depth) = 55 cm.
Size of Installed standard sensor number 29-CH1 to number 29-CH9 : a = 5 cm., b = 7 cm. and c = 5 cm.
Size of Installed standard sensor number 29-CH9 : W/2 = 35 cm./2 , H/2 = 130 cm./2 and D/2 = 55cm./2

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)								
	29-CH1	29-CH2	29-CH3	29-CH4	29-CH5	29-CH6	29-CH7	29-CH8	29-CH9
20	20.04	20.06	20.19	19.86	19.68	20.08	20.12	19.80	20.07
25	24.99	25.06	25.18	24.89	24.74	25.12	25.16	24.80	25.10

Chamber (Incubator)			Temperature Distribution			
Setting (°C)	Reading (°C)		Stability (± °C)	Uniformity (°C)	Uncertainty (± °C)	Coverage Factor k
	Min, Max	Average				
20.0	-	20.0	0.05	1.81	0.38	2.00
25.0	-	25.0	0.07	0.96	0.38	2.00

* The quoted uncertainty excludes "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]

PM 6.13 17/15-05-63

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
2144 PATTANAKARN ROAD 9th FL. BANGKOK, THAILAND 10260
TEL. 0-2717-888-01 FAX. 0-2719-6884

MAC
NSC-TIS-1702
CALIBRATION 2020

MAC-JSIA

Cert.No.: 21CH1650
Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : S2-Field Kit
Serial No. : B729410583
ID No. : BKK_LG0011
Condition As-Received : Used Item
Received Date : 25 November 2021
Calibration Date : 29 November 2021
Reference : 2111-0911DSC-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 standard voltage calibrator and direct measurement with certified reference material (CRM)
Calibrated by : Warakorn Lemgagrakul
Approved by : [Signature]
Approved Signatory
(/) Malee Buhruss
(/) Sathip Meangmal
(/) Warakorn Lemgagrakul
Issue Date : 2 December 2021

REVIEW BY : [Signature]
APPROVED BY : [Signature]
NEXT CAL. DATE : 29/11/23

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 Technology Promotion & Support, Calibration and Testing Services.

A 0035374



Cert. No.: 21CH1650
Page: 2 of 2

Condition of this calibration result

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030048	130RC116	21E2682	25 Aug 2022

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

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	761016	02 Aug 2023
pH 6.962	CPA chem	761017	02 Aug 2022
pH 10.015	CPA chem	761018	02 Aug 2022

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 (4.7,10)

Unit Under Calibration	Nominal Value	Standard Voltage Input		Actual Reading		Uncertainty of Measurement (mV)	Coverage factor k
	pH	mV	mV	mV	pH		
pH Meter S/N: 8729410583	4.00	177.48	177	4.00	0.58	2.00	
	7.00	0.00	0	7.00	0.58	2.00	
	10.00	-177.48	-178	10.00	0.58	2.00	

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4.7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH measurement (t)	Coverage factor k
pH Electrode S/N: 9291914	4.008	4.01	179	0.0085	2.05
	6.962	6.98	5	0.0099	2.00
	10.015	10.02	-171	0.0095	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 %.

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
2564 PATTANAKARN ROAD NR. 15, NONGKHAO, BANGKOK 10250 THAILAND
TEL: 0-2715 9886-71 FAX: 0-2719-9886



Cert. No.: 21LM22
Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor
Manufacturer : Mettler Toledo
Model : S2-Field Kit
Serial No. : 8729410583
ID No. : BKK_LG0011
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khuang Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : TPA On Site Calibration Laboratory
Received Order : 25 November 2021
Calibrated Date : 29 November 2021
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V
Calibrated by : Watsorn Lemgagrakul
Approved by :
() Pornthippa Taneyakul
() Malee Bulkruea
() Suwit Injai
Issue Date : 1 December 2021

The Uncertainties are for a confidence probability of approximately 95%

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A 0035352



Cert. No.: 21LM22
Page: 2 of 2

Equipment : pH Meter with Sensor
Condition As-Received : Used Item
Reference : 2111-09110SC-2

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT01 according to comparison with Industrial Platinum Resistance Thermometer (IPRT) into Temperature Bath.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Digital Thermometer	1523	3240076	211193	15 Feb 2022

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.

Result of Calibration :- (°) Without Adjustment

Function : Temperature measurement.

This instrument was connected with temperature sensor, S/N: 9291914

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	120	20.002	20.0	-0.002	0.16	2.00
25.0	120	25.005	25.1	0.095	0.16	2.00
30.0	120	30.006	30.1	0.094	0.16	2.00
35.0	120	35.002	35.1	0.098	0.16	2.00
40.0	120	40.005	40.1	0.095	0.16	2.00
45.0	120	45.002	45.1	0.098	0.16	2.00
50.0	120	50.004	50.1	0.096	0.16	2.00

UUC* : Unit Under Calibration

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

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Certificate of System Qualification

GC-00 + GCMS-00

System ID: GM-10
Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Phatthanakan 40, Phatthanakan Rd., Khuang Phatthanakan, Khet Suan Luang, Bangkok 10250

Date: November 23, 2021 11:23:38 PM
EQP Name: Agilent/Recommended, Agilent/Recommended
EQP Revision: GC-02-52, GCMS-02-51
Overall Qualification Status: Pass

CDS Logon Verification - GC

Logon: Nanthawadee Somboon

Overall CDS Logon Verification - GC Test Status

Pass

System Inspection and Basic Safety and Operation

Name: T890

Setpoint Status: Pass

Overall System Inspection and Basic Safety and Operation Test Status

Pass

Inlet Pressure Accuracy

Name: T890

Front MM

Setpoint Status: Pass

Setpoint Actual

Inlet Pressure: 25.0 psi 24.9 psi

Accuracy: 0.1 psi

Agilent Recommended: ± 1.2

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System ID: GM-10

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Overall Inlet Pressure Accuracy Test Status

Pass

GC Oven Temperature Accuracy

Name:

7890

Setpoint Status:

Pass

Zone:

Oven

Temperature:

230.0 229.8 °C

Accuracy:

-0.2 °C

Agilent Recommended:

≤ -1.0 % setpoint in K (-5.0 °C)

≤ 1.0 % setpoint in K (5.0 °C)

Setpoint Status:

Pass

Zone:

Oven

Temperature:

100.0 99.8 °C

Accuracy:

-0.2 °C

Agilent Recommended:

≤ -1.0 % setpoint in K (-3.7 °C)

≤ 1.0 % setpoint in K (3.7 °C)

Overall GC Oven Temperature Accuracy Test Status

Pass

GC Oven Temperature Stability

Name:

7890

Setpoint Status:

Pass

Temperature:

100.0 99.78333 °C

Stability:

0.1 °C

Agilent Recommended:

≤ 0.5

Overall GC Oven Temperature Stability Test Status

Pass

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Tune EI

Tested Combination1

Front MMI / External TQ

Name:

7000D

Setpoint Status:

Pass

Filament:

1

Setpoint Status:

Pass

Filament:

2

Overall Tune EI Test Status

Pass

Scouting Run

Tested Combination1

Front MMI / External TQ

Name:

Injection Tower

Source:

EI - Extractor

Setpoint Status:

Completed

Injection Volume on Column:

1.0 µL

Overall Scouting Run Status

Completed

Instrument Detection Limit

Tested Combination1

Front MMI / External TQ

Name:

Injection Tower

Source:

EI - Extractor

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Setpoint Status:

Pass

Injection Volume on Column:

1.0 µL

Minimum RSD:

5.79 %

Agilent Recommended:

≤ 12.00

Status:

Pass

Instrument Detection Limit:

1.94800 fg

Agilent Recommended:

≤ 4.03800

Status:

Pass

Overall Instrument Detection Limit Test Status

Pass

Mass Ratio Precision

Tested Combination1

Front MMI / External TQ

Name:

Injection Tower

Source:

7693A

Setpoint Status:

EI - Extractor

Injection Volume on Column:

Pass

Area Mass 1

Mass Ratio

Abundance's

RSD:

4.07 %

Agilent Recommended:

≤ 5.00

Status:

Pass

Overall Mass Ratio Precision Test Status

Pass

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

System

System ID	GM-10
Manufacturer	Agilent Technologies
Name	7890
Flow Data Input	Manual Data
Temperature Data Input	Manual Data or Other Data Logging

Tested Combination1

Injection Technique	Injection Tower
Inlet	Front
Detector	External
LTM Included?	No

Sampler 1

Manufacturer	Agilent Technologies
Type	Injection Tower
Name	7693A
Model Number	G4513A
Serial Number	CN18180003
Firmware Revision	A.11.03
Usage	Sample Injection
Location	Front
Syringe Volume (µL)	10

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Sampler 2	
Manufacturer	Agilent Technologies
Type	Tray
Name	7693A
Model Number	G4514A
Serial Number	CN18170137
Firmware Revision	A.11.03
Vial Heater	Not installed
Mainframe 1	
Manufacturer	Agilent Technologies
Name	7890
Model Number	G3442B
Serial Number	CN18153080
Firmware Revision	B.02.05
Oven Type	Standard
Inlet 1	
Manufacturer	Agilent Technologies
Name	7890
Type	MMI
Location	Front
Carrier Gas	Helium
Control Type	Electronic Pressure Control (EPC)
Purged Inlet	Yes
Detector 1	
Manufacturer	Agilent Technologies
Name	Mass Spectrometer
Type	Mass Spectrometer
Location	External

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Mass Spectrometer 1	
Manufacturer	Agilent Technologies
Type	TQ
Name	7000D
Serial Number	US1826U108
Firmware Revision	G.7000.085A
High Vacuum System	Turbo Pump
Scouting Run Standard	OFN Std
MS EI Source 1	
Manufacturer	Agilent Technologies
Source Type	EI - Extractor
Number of filaments	2

Date: November 23, 2021 1:12:35 PM
System ID: GM-10

Electronic Signature

Purpose
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Details
Full Name of Signer: Jaruwat Channarong
Logged On User Name: jaruwat.channarong@agilent.com
Signature Creation Date: November 23, 2021
Reason for Signature: Executed protocol and published this original version of document

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Date: November 23, 2021 1:12:35 PM
System ID: GM-10

User Name: jaruwat.channarong

Hostname: ASBKKWX265

System Id: GM-10

Print Date: November 23, 2021 1:12:38 PM

ALS_GM10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:13:35 AM	Audit	SessionCreated	Session	None
November 23, 2021 10:13:35 AM	Start	Configuration	Session	None
November 23, 2021 10:13:35 AM	Audit	Entitlement	Licensing	User is Field Engineer and does not require an unlock code
November 23, 2021 10:20:27 AM	Audit	EqpLoaded	Session	EQP details for primary technique [GC] - File path: [ProtocolPacks/Go/Configurations/02.52/Go.02.52.eqp], EQP File Name: [Go.02.52.eqp], EQP Name: [AgilentRecommended] EQP details for hyphenated technique [GcMs] - File path: [ProtocolPacks/GoMs/Configurations/02.51/GcMs.02.51.eqp], EQP File Name: [GcMs.02.51.eqp], EQP Name: [AgilentRecommended]
November 23, 2021 10:20:37 AM	End	Configuration	Session	None
November 23, 2021 10:21:34 AM	End	Configuration	Session	None
November 23, 2021 10:21:52 AM	Start	Qualification	Session	OQ
November 23, 2021 10:21:54 AM	Start	Execution	CDS Logon Verification - GC -	None - Qualitative test
November 23, 2021 10:26:40 AM	End	Execution	CDS Logon Verification - GC -	Run Count : 1 - Qualitative test

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System ID: GM-10

User Name: jaruwat.channarong
Hostname: ASBKKWX265

System Id: GM-10
Print Date: November 23, 2021 1:12:38 PM

ALS_GM10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:26:42 AM	Start	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	None
November 23, 2021 10:26:54 AM	End	Execution	System Inspection and Basic Safety and Operation - 7890: - Qualitative Test - No setpoints associated	Run Count : 1
November 23, 2021 10:26:56 AM	Start	Execution	Inlet Pressure Accuracy - Front MMI - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	None
November 23, 2021 10:27:01 AM	End	Execution	Inlet Pressure Accuracy - Front MMI - Pressure Controlled Inlet - S: 25.0 psi - L: <= 1.2 psi	Run Count : 1
November 23, 2021 10:27:05 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
November 23, 2021 10:27:28 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry
November 23, 2021 10:27:31 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 230.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
November 23, 2021 10:27:33 AM	Start	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	None
November 23, 2021 10:27:44 AM	Audit	Data	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Manual Data Entry

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System ID: GM-10

User Name: jaruwat.channarong
Hostname: ASBKKWX265

System Id: GM-10
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ALS_GM10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:27:45 AM	End	Execution	GC Oven Temperature Accuracy - 7890: - Temperature : Oven - S: 100.0°C - L: >= -1.0 AND <= 1.0 % setpoint in K	Run Count : 1
November 23, 2021 10:28:26 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
November 23, 2021 10:35:24 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
November 23, 2021 10:35:29 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
November 23, 2021 10:37:44 AM	Start	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	None
November 23, 2021 10:39:20 AM	Audit	Data	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Manual Data Entry
November 23, 2021 10:39:23 AM	End	Execution	GC Oven Temperature Stability - 7890: - Temperature : Oven - S: 100.0°C - L: <= 0.5°C	Run Count : 1
November 23, 2021 10:39:26 AM	Start	Execution	Tune EI - 7000D TQ - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	None
November 23, 2021 10:41:10 AM	End	Execution	Tune EI - 7000D TQ - Source: - EI - Extractor Filament 1 (Qualitative - No setpoints associated)	Run Count : 1

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System ID: GM-10

User Name: jaruwat.channarong
Hostname: ASBKKWX265

System Id: GM-10
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ALS_GM10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:41:13 AM	Start	Execution	Tune EI - 7000D TQ - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	None
November 23, 2021 10:41:34 AM	End	Execution	Tune EI - 7000D TQ - Source: - EI - Extractor Filament 2 (Qualitative - No setpoints associated)	Run Count : 1
November 23, 2021 10:43:42 AM	Start	Execution	Scouting Run - Injection Tower, Front MMI, TQ - Source: - EI - Extractor- Part of GCMS System Preparation	None
November 23, 2021 10:44:20 AM	Audit	Data	Scouting Run - Injection Tower, Front MMI, TQ - Source: - EI - Extractor- Part of GCMS System Preparation	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\ISQ_001.D
November 23, 2021 10:45:10 AM	End	Execution	Scouting Run - Injection Tower, Front MMI, TQ - Source: - EI - Extractor- Part of GCMS System Preparation	Run Count : 1
November 23, 2021 10:45:14 AM	Start	Execution	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	None
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_003.D
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_004.D

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System ID: GM-10

User Name: jaruwat.channarong
Hostname: ASBKKWX265

System Id: GM-10
Print Date: November 23, 2021 1:12:38 PM

ALS_GM10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_005.D
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_006.D
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_007.D
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_008.D
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_009.D
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_010.D
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MMI, TQ - Source: - EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS1\data \Agilent\OQ2021\IDL_011.D

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System ID: GM-10

User Name: jaruwat.channarong
Hostname: ASBKWKX265

System ID: GM-10
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ALS_GM10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:45:39 AM	Audit	Data	Instrument Detection Limit - Injection Tower, Front MM, TQ: - Source: EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Data files Path : D:\MassHunter\GCMS\1\data V\Agilent\OQ2021\IDL_012.D
November 23, 2021 10:46:50 AM	End	Execution	Instrument Detection Limit - Injection Tower, Front MM, TQ: - Source: EI - Extractor - RSD L (Area): <= 12.00% - RSD L (Ret. Time): <= 1.00%	Run Count : 1
November 23, 2021 10:47:03 AM	Start	Execution	Mass Ratio Precision - Injection Tower, Front MM, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	None
November 23, 2021 10:47:23 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): V\Agilent\OQ2021\MRP_002.D
November 23, 2021 10:47:23 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): V\Agilent\OQ2021\MRP_002.D
November 23, 2021 10:47:23 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): V\Agilent\OQ2021\MRP_003.D
November 23, 2021 10:47:23 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): V\Agilent\OQ2021\MRP_004.D
November 23, 2021 10:47:23 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): V\Agilent\OQ2021\MRP_005.D

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System ID: GM-10

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User Name: jaruwat.channarong
Hostname: ASBKWKX265

System ID: GM-10
Print Date: November 23, 2021 1:12:38 PM

ALS_GM10 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
November 23, 2021 10:47:23 AM	Audit	Data	Mass Ratio Precision - Injection Tower, Front MM, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Data files Path : D:\MassHunter\GCMS\1\data Source: EI - Extractor - L (RSD): V\Agilent\OQ2021\MRP_006.D
November 23, 2021 10:48:02 AM	End	Execution	Mass Ratio Precision - Injection Tower, Front MM, TQ: - Source: EI - Extractor - L (RSD): <= 5.00%	Run Count : 1
November 23, 2021 10:48:07 AM	End	Qualification	Session	OQ
November 23, 2021 10:48:07 AM	Start	Reporting	Session	None
November 23, 2021 1:01:43 PM	Audit	AceClosed	Session	None
November 23, 2021 1:03:30 PM	Audit	AceRestarted	Session	None
November 23, 2021 1:03:32 PM	Audit	SessionReloaded	Session	None
November 23, 2021 1:03:37 PM	Start	Qualification	Session	OQ
November 23, 2021 1:11:56 PM	Audit	Reporting	Session	Report Generated : Certificate

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Agilent CrossLab Compliance

Qualification Type: ICPMS-OQ

System ID: JP15471169

EQR Name: AgilentRecommended

EQR Revision: ICPMS.02.50

EQR Publish Date: March 2020

Date: September 30, 2021 4:07:18 PM

Report Type: Report

Org. Name: ALS Laboratory Group (Thailand) Co.,Ltd.

Org. Location: 104 Phetnakarn 40, Suan Luang, Bangkok 10250

REVIEW BY *Saphan H.*

APPROVED BY *Saphan H.*

NEXT CAL. DATE 29 March 2023

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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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

Test	Status	Runs
Autosampler Check : SPS4	Pass	1
Integrated Sample Introduction System (ISIS) Check : ISIS3	Pass	1
Autotune : G8403A	Pass	1
Background (No Gas Mode) : G8403A	Pass	1
Background (Gas Modes) : G8403A	Pass	1
20-Minute Stability (No Gas Mode) : G8403A	Pass	1

Overall Qualification Status

Pass

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Service Details

Purpose

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

General Details

Service Order No./Request: 6004837154
EQP Name: Agilent/Recommended
EQP Revision: ICPMS.02.50
Report Type: Report

Organization Details

Name: ALS Laboratory Group (Thailand) Co.,Ltd.
Location: 104 Phattanakarn 40, Suan Luang, Bangkok 10250.

Local Contact Details

Name: Chatchanal Komarakul.
Job Title: Manager
Qualification Location: Laboratory

Operator Details

Name: Panthep Kurasathain
Job Title: Field Service Engineer.

Data Acquisition Details

Acquisition Software Name: MassHunter
Acquisition Software Revision: C.01.04

Customer Data System (CDS): IcpMs: MassHunter

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System ID: JP15471169

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

ICP-MS 1

Manufacturer: Agilent Technologies
Name: 7900
Model Number: G8403A
Installed Options: #100H: Standard Package with Hydrogen option
Detector Type: SQ
Nebulizer: Mira Mist (G3161)
Spray Chamber: Quartz
Torch: Quartz
Sampling Cone: Ni
Skimmer Cone: Ni
Serial Number: JP15471169
Firmware Revision: C.01.04

ISIS 1

Manufacturer: Agilent Technologies
Name: ISIS3
Model Number: G8411A
Type: Peristaltic pump system
Serial Number: JP15510227

Autosampler 1

Manufacturer: Agilent Technologies
Name: SPS4
Model Number: G8410A
Serial Number: AU15430722

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Chiller 1

Manufacturer: Agilent Technologies
Name: Chiller
Model Number: G3292A
Serial Number: 3U1610713

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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.

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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

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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			Runs: 1

Overall Autosampler Check Test Status

Pass

Date: September 30, 2021 4:07:18 PM
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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			Runs: 1

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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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

0.719 AMU
≥ 0.65
≤ 0.80
Pass

Status:

Peakwidth Mass 89

0.750 AMU
≥ 0.65
≤ 0.80
Pass

Agilent Recommended:

Status:

Peakwidth Mass 205

0.713 AMU
≥ 0.65
≤ 0.80
Pass

Agilent Recommended:

Status:

Mass Axis 7

7.05 AMU
≥ 6.9
≤ 7.1
Pass

Agilent Recommended:

Status:

Mass Axis 89

88.95 AMU
≥ 88.9
≤ 89.1
Pass

Agilent Recommended:

Mass Axis 205

205.00 AMU
≥ 204.9
≤ 205.1
Pass

Agilent Recommended:

Status:

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Mass 7 Sensitivity No Gas

94.28 Mcps/ppm
≥ 25.5
Pass

Agilent Recommended:

Status:

Mass 89 Sensitivity No Gas

307.15 Mcps/ppm
≥ 127.5
Pass

Agilent Recommended:

Status:

Mass 205 Sensitivity No Gas

203.77 Mcps/ppm
≥ 76.5
Pass

Agilent Recommended:

Status:

Mass 59 Sensitivity He

28.38 Mcps/ppm
≥ 23.8
Pass

Agilent Recommended:

Status:

Mass 89 Sensitivity H2

129.27 Mcps/ppm
≥ 68
Pass

Agilent Recommended:

Status:

Oxide Ratio 156/140

1.047 %
≤ 1.38
Pass

Agilent Recommended:

Status:

Doubly Charged Species Ratio 70/140

1.482 %
≤ 2.3
Pass

Agilent Recommended:

Status:

Setpoint Status: Pass

Runs: 1

Overall Autotune Test Status

Pass

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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.

Setpoint

Conditions

Masses:

7 AMU
89 AMU
205 AMU

Measurements and Results

Masses (AMU):

Measured Value:

Agilent Recommended:

Status:

7 89 205
3.200 3.300 9.900 cps
≤ 6.9 ≤ 4.6 ≤ 11.5
Pass Pass Pass

Setpoint Status: Pass

Runs: 1

Overall Background (No Gas Mode) Test Status

Pass

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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.

Setpoint

Gas Mode: Helium

Conditions

Mass:

78 AMU

Integration Time:

1.0 sec

Cycles:

20

Measurements and Results

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

78
42.8500 cps
≤ 115
Pass

Setpoint Status: Pass

Runs: 1

Setpoint

Gas Mode: Hydrogen

Conditions

Mass:

78 AMU

Integration Time:

1.0 sec

Cycles:

20

Measurements and Results

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

78
2.1500 cps
≤ 4.6
Pass

Setpoint Status: Pass

Runs: 1

Overall Background (Gas Mode) Test Status

Pass

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20-Minute Stability (No Gas Mode)

Purpose

This test monitors the abundance of ions present in the checkout 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.

Setpoint

Conditions

Mode: Spectrum
Masses: 7, 9, 59, 89, 140, 205
Integration Time: 9.99 sec
Peak Pattern: 3 points/peak
Repetitions: 20
Sweeps/Replicates: 100

Measurements and Results

Masses (AMU): 7, 59, 89, 140, 205
Stability RSD: 0.98400, 0.51495, 0.73011 %
Agilent Recommended: 2.3, 2.3, 2.3
Status: Pass, Pass, Pass

Setpoint Status: Pass Runs: 1

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

Pass

Date: September 30, 2021 4:07:18 PM
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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.

Date: September 30, 2021 4:07:18 PM
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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-requisite trainings for Data Integrity, General Compliance topics (GMP, GLP, ALCOA, etc.), instrument hardware and software components, and the ACE technique itself. The one certificate encompasses all pre-requisite trainings as documented in the Agilent Learning Management System called Success Factors.


Location	Category	Document Name	Page
EQR	General	Certificate of System Qualification	18
EQR	General	Operator's training certificate and qualifications	19
EQR	General	Certificate of Qualification for ACE	20
EQR	General	Certificate of Qualification for ACE	21
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General

Document Name: Certificate of System Qualification

 Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: September 14, 2021 4:59:15 PM
Drive Serial #: ACA025C9 Platform Revision: ACE 3.11

Individual self-qualification reports for each specific technique installed are also available upon request. They provide additional details on the general report from the concise summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and OQ program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified systems.

Technique Type	Tests Completed	Result
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Dissolution	6	Conforms
Emission Spectroscopy	3	Conforms
Gas Chromatography - GCMS	17	Conforms
Gas Chromatography	29	Conforms
Gas Permeation Chromatography	9	Conforms
ICP-MS	6	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LCMS	8	Conforms
Microfluidics	18	Conforms
Sample Preparation - Gas Chromatography	9	Conforms
Sample Preparation - Liquid Chromatography	8	Conforms
Supercritical Fluid Chromatography	15	Conforms
Software	6	Conforms
UV-Vis Spectrophotometer	13	Conforms

Overall Qualification Status

Conforms

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General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name: Panthep Kurusuathin

Title Of Course: AN-CE-ICPMS-2-036-A: Agilent 7900 ICPMS FSE update training

Completion Date: June 7, 2014

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

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 employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

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General

Document Name: Certificate of Qualification for ACE

Agilent Technologies

Certificate of Completion

Learner Name: Panthep Kurusuathin

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

Completion Date: July 7, 2020

Certified By Company: Learning at Agilent

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General

Document Name: Certificate of Qualification for ACE

Agilent Technologies

Certificate of Completion

Learner Name: Panthep Kurusuathin

Title Of Course: AN-CE-ICPMS-2-035-B: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-MS Systems

Completion Date: October 31, 2020

Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

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General

Document Name: Tune reports

Tune Report

Operator Name: Supakorn Mook

Acq/Data Batch: CI\Agilent\ICPMS\Tune\Tune_7900.D


Acq. Date/Time: 2021-09-30 14:44:05

Report Comment: OO 30 Sep 2021

Instrument Name: 04633A.JP15471169

[No Gas]

Sensitivity



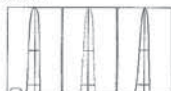
Mass	Range	Count	100%	Background
7	19000	9428	2.438	3.250
89	30000	30719	2.825	2.300
202	30000	20577	0.216	0.600

Sampling Period [sec]: 0.311
Integration Time [sec]: 0.1

Online/Ready Charged Ratio

On-line: 156 / 145 1.067 %
Ready Charged: 70 / 145 1.482 %

Flame Ionization



Mass	Peak Height	Area	100%	10-10%
7	9414.69	7.08	0.43	0.718
89	30719.43	86.85	0.59	1.290
202	20596.12	105.00	0.52	0.713

Integration Time [sec]: 0.1
Acquisition Time [sec]: 22.74
Y Axis: Linear

Tune Parameters

Plasma Parameters	Nebulizer Gas	1.00 L/min	Make-up Gas	0.10 L/min
RF Power	1500 W	Option Gas	---	Auxiliary Gas
RF Matching	1.10 V	Nebulizer Pump	6.10 ips	Plasma Gas
Sample Depth	9.0 mm	S/C Temp	2 °C	

Low Parameters	Omega Lens	6.1 V	Deflect	13.8 V
Extract 1	Cell Distance	-30 V	Plate Bias	-35 V
Extract 2	Cell Exit	-50 V		
Omega Bias				

Cell Parameters	3rd Gas Flow	---	Energy Discrimination	5.5 V
Use Gas	He Flow	0.8 mL/min	Co/F Bias	-8.0 V

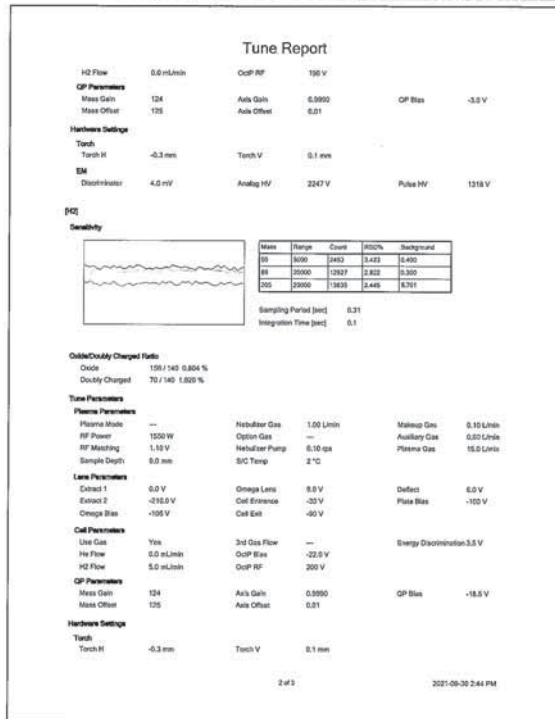
1 of 3 2021-09-30 2:44 PM

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Document Name:

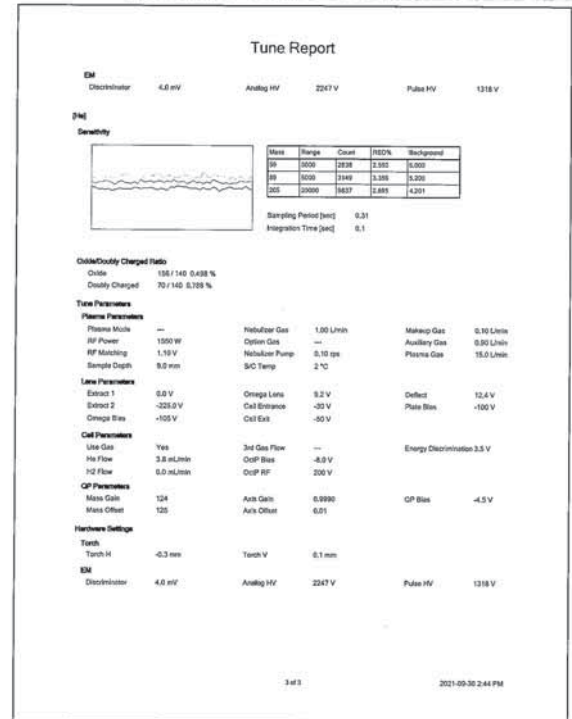
Tune reports

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Document Name:

Tune reports

Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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General

Document Name:

Test Report

Batch Summary Report

Batch Folder: C:\msdch2021\85 He 3h
Analyte File: 85 He batch 3 h
Tune Step: F1 He

Batch	Acq. Date/Time	Data File	Sample Name	Type	Level	Dilution
1	2021-09-30 14:21:47	85 He.d	85 He	Sample		1.0000

Page 1 / 2 2021-09-30 14:23:39

Date: September 30, 2021 4:07:18 PM
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Document Name:

Test Report

Batch Summary Report

Analyte Table

Sample Name	Conc
1. 85 He	0.0000

Page 2 / 2 2021-09-30 14:23:40

Date: September 30, 2021 4:07:18 PM
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General

Document Name: Test Report

Batch Summary Report

Batch Folder: D:\Agilent Services\DO 30 Sep 2021\05 H2 newish
Analyte File: 05 H2 new Batch.txt
Tune Step: 41 H2

Run	Acq. Date/Time	Data File	Sample Name	Type	Level	Dilution
1	2021-09-30 15:08:56	05102.d	05102	Sample		1.0000

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2021-09-30 15:10:31

Date: September 30, 2021 4:07:18 PM
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Document Name: Test Report

Batch Summary Report

Analyte Table	
	78 / 40.1
Sample Name	CPS
05102	2.1300

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2021-09-30 15:10:31

Date: September 30, 2021 4:07:18 PM
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General

Document Name: Test Report

Batch Summary Report

Batch Folder: D:\Agilent Services\DO 30 Sep 2021\20 Minish
Analyte File: 20 Min Batch.txt
Tune Step: 41 No Gas

Run	Acq. Date/Time	Data File	Sample Name	Type	Level	Dilution
1	2021-09-30 15:17:44	20 Minish.d	20 Min	Sample		1.0000

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2021-09-30 15:40:42

Date: September 30, 2021 4:07:18 PM
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Document Name: Test Report

Batch Summary Report

Analyte Table		7	7 No Gas 1	9	9 No Gas 1	39	39 No Gas 1	40	40 No Gas 1	205	205 No Gas 1
Sample Name	CPS 350	CPS 350	CPS 350	CPS 350	CPS 350	CPS 350	CPS 350	CPS 350	CPS 350	CPS 350	CPS 350
20 Min	0.98600	7.02801	0.40917	0.51493	0.61014	0.73011					

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2021-09-30 15:40:43

Date: September 30, 2021 4:07:18 PM
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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 Kurasathin
Logged On User Name: panthep_kurasathin@agilent.com
Signature Creation Date: September 30, 2021
Reason for Signature: Executed protocol and published this original version of document

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User Name: panthep_kurasathin
Hostname: ASBKKWC315

System ID: JP15471169
Print Date: September 30, 2021 4:07:22 PM

ALS OQHW 7900 30Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:50:07 PM	Audit	Session Created	Session	None
September 30, 2021 3:50:07 PM	Start	Configuration	Session	None
September 30, 2021 3:50:07 PM	Audit	Entitlement	Licensing	User is FieldEngineer and does not require an unlock code
September 30, 2021 3:52:52 PM	Audit	Exp. loaded	Session	EQP details for primary technique [eqpMtl] - File path: [ProtocolPacks\eqpMtl\Conf\unifera02.500eqpMtl.02.50.eqp], EQP File Name [eqpMtl.02.50.eqp], EQP Name: [AgilentRecommended]
September 30, 2021 3:52:54 PM	End	Configuration	Session	None
September 30, 2021 3:52:57 PM	Start	Qualification	Session	OQ
September 30, 2021 3:52:57 PM	Start	Execution	Autosampler Check : SP54: Autosampler Check	None
September 30, 2021 3:53:03 PM	End	Execution	Autosampler Check : SP54: Autosampler Check	Run Count : 1
September 30, 2021 3:53:04 PM	Start	Execution	Integrated Sample Introduction System (SIS) Check : ISIS3: Integrated Sample Introduction System (SIS) Check	None
September 30, 2021 3:53:06 PM	End	Execution	Integrated Sample Introduction System (SIS) Check : ISIS3: Integrated Sample Introduction System (SIS) Check	Run Count : 1

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Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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User Name: panthep_kurasathin
Hostname: ASBKKWC315

System ID: JP15471169
Print Date: September 30, 2021 4:07:22 PM

ALS OQHW 7900 30Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:53:10 PM	Start	Execution	Autotune : G8403A: Autotune 1	None
September 30, 2021 3:55:06 PM	End	Execution	Autotune : G8403A: Autotune 1	Run Count : 1
September 30, 2021 3:55:12 PM	Start	Execution	Background (No Gas Mode) : G8403A: No Gas Mode Background 1	None
September 30, 2021 3:55:40 PM	End	Execution	Background (No Gas Mode) : G8403A: No Gas Mode Background 1	Run Count : 1
September 30, 2021 3:55:43 PM	Start	Execution	Background (Gas Mode) : G8403A: Gas Mode Background : Helium	None
September 30, 2021 3:56:17 PM	End	Execution	Background (Gas Mode) : G8403A: Gas Mode Background : Helium	Run Count : 1
September 30, 2021 3:56:19 PM	Start	Execution	Background (Gas Mode) : G8403A: Gas Mode Background : Hydrogen	None
September 30, 2021 3:56:38 PM	End	Execution	Background (Gas Mode) : G8403A: Gas Mode Background : Hydrogen	Run Count : 1
September 30, 2021 3:56:41 PM	Start	Execution	20-Minute Stability (No Gas Mode) : G8403A: 20-Minute Stability (No Gas Mode) 1	None
September 30, 2021 3:57:22 PM	End	Execution	20-Minute Stability (No Gas Mode) : G8403A: 20-Minute Stability (No Gas Mode) 1	Run Count : 1
September 30, 2021 3:57:24 PM	End	Qualification	Session	OQ
September 30, 2021 3:57:24 PM	Start	Reporting	Session	None

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Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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User Name: panthep_kurasathin
Hostname: ASBKKWC315

System ID: JP15471169
Print Date: September 30, 2021 4:07:22 PM

ALS OQHW 7900 30Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 4:03:07 PM	Audit	Reporting	Session	Report Generated : Certificate
September 30, 2021 4:03:17 PM	Audit	Reporting	Session	Report Generated : Report
September 30, 2021 4:03:59 PM	Start	Qualification	Session	OQ
September 30, 2021 4:04:06 PM	End	Qualification	Session	OQ
September 30, 2021 4:04:08 PM	Start	Reporting	Session	None
September 30, 2021 4:04:26 PM	Audit	Reporting	Session	Report Generated : Certificate
September 30, 2021 4:04:36 PM	Audit	Reporting	Session	Report Generated : Report

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Date: September 30, 2021 4:07:18 PM
System ID: JP15471169

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Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T220730

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Certificate of Calibration

Equipment : HEATING BLOCK
Manufacturer : Environmental Express
Model : SC 196
Serial No. : 6974CECW3285
Customer Code : BKK_EL0054
ID No. : TS306A3
Customer : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Phatthanakan,
Khet Suan Luang, Bangkok 10250
Customer Location : Acid Digestion Lab
Date of Receipt : 30 March 2022
Calibrated By : Watcharapon Sangtong (Technician)
Approved By : [Signature] / Sujjar Nakkakred (Site Calibration Manager)
Date of Issue : 17 APR 2022

REVIEW BY Tattiporn C.
APPROVED BY [Signature]
NEXT CAL. DATE 7/10/23

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-L13 08/30-05-17



Metrological Center

SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T220730

Page 2 of 6

Calibration Report

Equipment : HEATING BLOCK
Date of Calibration : 7 April 2022
Environment : Temperature : 21.8-23.1 °C
Line Voltage : 221.6-226.3 V
Relative Humidity : 55-65 %RH

Condition of this results of calibration :

1. 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.
All data show below were final values and the initial data from customer request. The temperature scale used was based on ITS-90.

2. Reference Standard Instrument :

Instrument	Model	Instrument No.	Certificate No.	Due Date
TC	TYPE T	TN221-TN230	T210008	08 June 2022
TC	TYPE T	TN231-TN240	T210008	08 June 2022
DATA LOGGER	34970A	T140	T210008	08 June 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TIS-TIS 17025 CALIBRATION (244))

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour 25 Minute At 95 °C
Fresh Air Damp : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By: [Signature]

FM-L13 08/30-05-17



Metrological Center

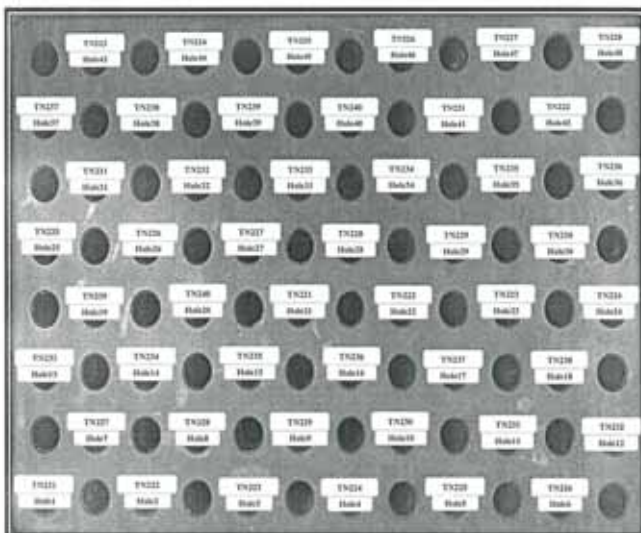
SCI ECO Services Company Limited

33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110
Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T220730

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Calibration Report



FRONT CONTROL

Approved By: [Signature]

FM-L13 08/30-05-17



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Telephone : +66 2 586 5792-4 Fax : +66 2 586 5109
Website : www.scieco.co.th E-Mail : calibrate@scg.co.th

Certificate No. T220730

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Calibration Report

Measurement Results

Calibration Point	Average Standard Reading at each position (°C)					
R1 Hole1-Hole6	TN221	TN222	TN223	TN224	TN225	TN226
CAL POINT	Max	93.60	93.82	94.05	94.20	94.36
	Min	93.07	93.24	93.51	93.66	93.82
	Average	93.33	93.54	93.78	93.93	94.09
R2 Hole7-Hole12	TN227	TN228	TN229	TN230	TN231	TN232
	Max	94.29	94.79	94.63	94.53	94.82
	Min	94.05	94.25	94.08	93.97	94.26
	Average	94.32	94.52	94.36	94.26	94.54
R3 Hole13-Hole18	TN233	TN234	TN235	TN236	TN237	TN238
	Max	95.03	94.34	94.78	94.84	95.06
	Min	94.40	93.88	94.20	94.28	94.49
	Average	94.74	94.26	94.49	94.56	94.78
R4 Hole19-Hole24	TN239	TN240	TN223	TN222	TN223	TN224
	Max	94.89	94.82	95.73	95.83	95.73
	Min	94.33	94.26	95.51	95.62	95.51
	Average	94.61	94.54	95.62	95.73	95.62
R5 Hole25-Hole30	TN225	TN226	TN227	TN228	TN229	TN230
	Max	96.28	96.30	96.17	96.34	96.19
	Min	96.01	96.10	96.03	96.20	95.99
	Average	96.15	96.24	96.20	96.27	96.04
R6 Hole31-Hole36	TN231	TN232	TN233	TN234	TN235	TN236
	Max	96.84	96.97	97.03	96.40	96.33
	Min	96.33	96.46	96.71	96.08	95.96
	Average	96.68	96.81	96.87	96.24	96.10
R7 Hole37-Hole42	TN237	TN238	TN239	TN240	TN221	TN222
	Max	96.46	96.13	96.19	96.06	95.99
	Min	96.11	95.84	95.83	95.72	95.64
	Average	96.29	95.99	96.02	95.89	95.81
R8 Hole43-Hole48	TN223	TN224	TN225	TN226	TN227	TN228
	Max	96.91	96.38	96.13	96.19	96.34
	Min	96.57	96.21	95.80	95.87	95.88
	Average	96.73	96.40	95.96	96.03	96.18

Approved By: [Signature]

FM-L13 08/30-05-17

Maintenance works basic unit

- lightsight visual check inside the Mercur
- visual check if gold-traps are broken
- visual check if spectrometer is contaminated
- reactor cleaning
- check pump-hose, if necessary change it
- check drying-hose, output gas-liquid-separator
- test Bubble-Sensor
- check gas flows
- check volume flows, reagents
- recording stray light values
- measurement with 30 ng/l

☐ ☒ ☐

Maintenance works Autosampler

Serial No.: 201 237 (A3523)

- lubricate the dosing-winding (Teflon-grease-spray)
- clean the dosing cylinder, if necessary exchange it
- lubricate the winding system of the height drive with some drops of oil
- check the toothed belt
- check the position of the mechanical stopper (height: 13mm)
- check the pump rate of mixing pump (*14s AS52, typ.7s<20s AS52S, typ.10s)
- check the pump rate of washing cup
- check the electrical hose connections for good contact
- check the connectors of the magnetic valves
- check the dosing hose for buckling, if necessary exchange it

[illegible]

Device parameter		nominal value	actual value
visual check general tightness inside the Mercur		o.k.	<input checked="" type="checkbox"/> changed: <input type="checkbox"/>
visual check Goldtraps		o.k.	<input checked="" type="checkbox"/> changed: <input type="checkbox"/>
visual check spectrometer			
	cuvette	o.k.	<input checked="" type="checkbox"/> changed: <input type="checkbox"/>
	lens	o.k.	<input checked="" type="checkbox"/> changed: <input type="checkbox"/>
check pump hoses		o.k.	<input checked="" type="checkbox"/> changed: <input type="checkbox"/>
check hoses and hose connectors		o.k.	<input checked="" type="checkbox"/> changed: <input type="checkbox"/>
check and clean reactor		o.k.	<input checked="" type="checkbox"/> changed: <input checked="" type="checkbox"/>
check drying hose output Gas-liquid-separator		o.k.	<input checked="" type="checkbox"/> changed: <input type="checkbox"/>
check bubble-sensor		o.k.	<input checked="" type="checkbox"/> changed: <input type="checkbox"/>
Check gasflow			<input checked="" type="checkbox"/> not o.k.: <input type="checkbox"/>
	Valve 1	10 Nl/h	0.2294 l/min
	Valve 2	50 Nl/h	1.1962 l/min
	Valve 3	5 Nl/h	0.1931 l/min
	Valve 4	10 Nl/h	0.9210 l/min
Check liquidflow			
	Acid	2.5ml/min ± 1 ml	2.5 ml
	Rad.-agent	2.5ml/min ± 1 ml	2.3 ml
	Sample	10ml/min ± 2 ml	10.0 ml
Adventitious light - values	[V]	from file	
	100	0	0
	200	0	0
	300	0	0
	350	0	0
	400	1	1
	450	3	2
	500	7	6
	550	15	13
	575	21	19
	600	25	22

Device parameter	nominal value	actual value
Analytical parameters		
Conditions: max conc.: 12 µg/L PMT-voltage: 414 V		
Blank-solution		$F_1: 0.00023$
without enrichment / FBR 30 ng/L	$F > 0.0013$	$F_1: 0.00377$
	$RSD < 3 \%$	$RSD: 1.91 \%$
Conditions: max conc.: 1.7 µg/L PMT-voltage: 395 V		
Blank-solution		$F_1: 0.00279$
with enrichment / FBR 30 ng/L	$F > 0.009$	$F_1: 0.0297$
	$RSD < 3 \%$	$RSD: 0.232 \%$
Fok - factor (F_2 / F_1)	> 4	
Comments		
Reference Material Control:		
Mercury Calibration Std Part #: 9500-6941		
Lot #: 12-20 HG 92A.		

Sybil P. Olson
Signature Technician

7/6/2021
(DD/MM/YYYY)

Patchpreya H.
Signature Customer

7/6/2021
Place, Date (DD/MM/YYYY)

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CALIBRATION AND TESTING EQUIPMENT SERVICES

YUAN PINGZHAO AND HUANG JIN LIU, CHINESE UNIVERSITY OF PETROLEUM, BEIJING, CHINA

TEL. 0-2713-3600-24 FAX. 0-2719-9482

Cert. No.: 21TM2188
Page: 1 of 3

Certificate of Calibration

Equipment :	Autoclave	REVIEW BY	<u>Sithichak</u>
Manufacturer :	AES Laboratory	APPROVED BY	<u>[Signature]</u>
Model :	Mastercave 528	NEXT CAL. DATE	<u>on/10/25</u>
Serial No. :	34677152		
ID No. :	IKOX_ML0543		
Submitted by :	ALS Laboratory Group (Thailand) Co.,Ltd. 104 Phatthanakan 40, Phatthanakan Rd., Khweng Phatthanakan, Khet Suan Luang, Bangkok 10250 Thailand Media Preparation Room		
Location :			
Received Order :	1 December 2021		
Calibration Date :	1 December 2021		
Ambient Temperature :	26 ± 10 °C		
Relative Humidity :	(50 ± 30) %		
Calibrated by :	Khit Rutnaniaprapachai		
Approved by :	<u>[Signature]</u> Approved Signatory		
() Pornthippa Tameyakul (/) Meisee Butkhana () Suerit Imjai			
Issue Date :	7 December 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 consent of the head of Education and Training Services.



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2112-0002OC-2
Procedure Used >

Cert. No.: 21TM2188
Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OT03 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44060450	21LM4/1	06 Mar 2022

- This certificate is valid only to the item calibrated on date and place of calibration.
 - This certification is traceable to the International System of Unit.
 - This result of calibration covers laboratory autoclaves for the sterilization of goods and material which could be infected with organisms categorized as Hazard Group 1, 2 and 3**
 - (* = Categorization of pathogens according to hazard and categories of containment, second edition, 1990)
 - It does not cover autoclaves for use with material infect with organisms in Hazard Group 4, for which complete containment and sterilization of infected condensate is considered to be essential.
- This result of calibration does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical or veterinary purposes which are directly concerned with patient care, or those used for fabrics subjected to sterilization which are required to be dry at the end of cycle.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source



	Environmental		
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	24	51	220
Finished of Calibration	25	53	221

Position	Description	Ref. Std. ID No.
1 =	Center of chamber	19-14TC-01
2 =	Temperature sensor	19-14TC-02
3 =	Exhaust port	19-14TC-03

Male

a 1085616



Equipment : Autoclave
Condition As-Received : Used Item
Reference : 2112-0002OC-2
Result of Calibration :- (*) Without Adjustment

Cert. No.: 21TM2188
Page: 3 of 3

Operating parameter Set : Temperature = 121.0 °C

Sterilization period = 15 minute

UUC* Setting (°C)	UUC* Reading (°C)	Position	Average* Standard Reading (°C)	Stability (± °C)	Pressure Reading (bar)	Uncertainty (± °C)	Coverage Factor k
121.0	120.7	1	120.792	0.078	1.1	0.75	2
		2	120.674				
		3	120.815				

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

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 %.

-000-

Male

a 1085615



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
SUHI PATHANAKAN ROAD SUB 1/L SUANLUANG SUANLUANG BANGKOK 10250
TEL. N 2717-3888-21 FAX. N 2719-8884



Cert. No.: 22TM102
Page: 1 of 3

Certificate of Calibration

Equipment : Incubator
Manufacturer : SHEL-LAB
Model : 1915A
Serial No. : 0200595
ID No. : BKK_ML0010

Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khut Suan Luang,
Bangkok 10250 Thailand

Location : Incubation & Micrological Reading
Received Order : 21 January 2022
Calibration Date : 21 January 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Krista Malee

Approved by :
Approved Signatory

() Ponthipha Tameyakul
() Malee Bulkras
() Suwit Injai

Issue Date : 3 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Technology Promotion Association (Thailand-Japan) Calibration and Testing Services.



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2201-0618OC-1
Procedure Used >

Cert. No.: 22TM102
Page: 2 of 3

Calibration were conducted using calibration procedure CP-OT02 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013711	21LM7	16 Jun 2022

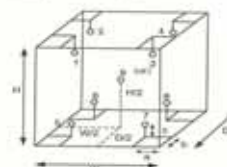
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Close



Probe Installation Details :		Dimension of Chamber :	
a =	10 cm	D =	0.90 m
b =	10 cm	W =	0.75 m
c =	10 cm	H =	1.2 m
		Capacity =	0.81 m ³

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	25
REL Humid. (%)	53	54
AC Supply (Volt)	220	221

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

Male

a 1092309

A 0037377



Equipment : Incubator
 Condition As-Received : Used Item
 Reference : 2201-06100C-1
 Result of Calibration : (*) Without Adjustment
 Function of UUC : Temperature Source
 Fresh air setting : Close

Cert. No.: 22TM100
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
35.0	35.0	35.0	0.043	0.41	0.42	0.30	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
35.0	34.801	34.868	34.862	35.012	35.040	35.010	35.084	35.040	35.178

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 %.

-o6o-

Malee

a 1092308



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
 CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
 1144 PATTANAKARN ROAD BUI 18, BANGKOK, THAILAND 10260, 10261
 TEL: 0-2717 3000-21 FAX: 0-2719 9444



Cert. No.: 21TM1101
 Page.: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
 Manufacturer : Binder
 Model : ED240/E2
 Serial No. : 00-15533
 ID No. : BKK_ML0013

Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
 104 Phatthanakan 40, Phatthanakan Rd.,
 Khwaeng Phatthanakan, Khet Suan Luang,
 Bangkok 10250 Thailand
 Location : Media Preparation Room

Received Order : 7 June 2021
 Calibration Date : 7 June 2021
 Ambient Temperature : (26 ± 10) °C
 Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hahib

Approved by : *Malee*
 Approved Signatory

() Parnthippa Tameyaki
 (/) Malee Butkrus
 () Suwit Injai

Issue Date : 21 June 2021

The Uncertainties are for a confidence probability of approximately 95 %

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A 0029135



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2106-01010C-2

Cert. No.: 21TM1101
 Page.: 2 of 3

Procedure Used :-
 Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY57013823	21LM3	26 Feb 2022

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.

Result of Calibration : (*) Without Adjustment

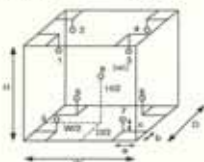
Function of UUC : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	26	27
REL.Humid. (%)	65	72
AC Supply (Volt)	220	222

Position :	Ref. Std. ID No.:
1	19-177C-01
2	19-177C-02
3	19-177C-03
4	19-177C-04
5	19-177C-05
6	19-177C-06
7	19-177C-07
8	19-177C-08
9 (ref.)	19-177C-09

Probe Installation Details :
 Dimension of Chamber :
 a = 5.0 cm
 b = 5.0 cm
 c = 5.0 cm
 D = 0.50 m
 W = 0.80 m
 H = 0.80 m
 Capacity = 0.24 m³



Malee

a 1059245



Equipment : Hot Air Oven
 Condition As-Received : Used Item
 Reference : 2106-01010C-2
 Result of Calibration : (*) Without Adjustment
 Function of UUC : Temperature Source

Cert. No.: 21TM1101
 Page.: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor k
180	180	180	0.67	2.4	3.3	1.5	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
180	179.315	181.249	178.694	180.035	179.941	180.511	178.429	180.268	179.065

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 %.

-o6o-

Malee

a 1059244



Certificate of Calibration

Cert. No.: 22TM453
Page: 1 of 3

Equipment : Water Bath
Manufacturer : Mammert
Model : WB 45
Serial No. : 1704.0285
ID No. : BKK_ML0052
Submitted by : ALB Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khet Suan Luang,
Bangkok 10250 Thailand
Location : Incubation & Microbiological Reading
Received Order : 21 February 2022
Calibration Date : 21 February 2022
Ambient Temperature : $(20 \pm 10) ^\circ\text{C}$
Relative Humidity : $(50 \pm 30) \%$

Calibrated by : Prawat Sodewichit

Approved by :
Approved Signatory

() Parnthipa Taneyakul
() Malee Sukrua
() Suwit Imjai

Issue Date : 25 February 2022

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.

A 0038346



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-06150C-2
Procedure Used :>

Calibration were conducted using in-house calibration procedure CP-OT04 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	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34970A	MY44035217	21LM30	23 Dec 2022

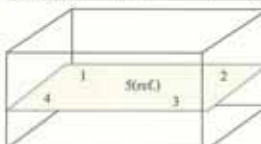
2. This certificate is valid only to the item calibrated on date and place of calibration.

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

Result of Calibration : (*) Without Adjustment

Function of UUC* : Temperature Source

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



Front

Position :	Ref. Std. S.N.:
1	N37P000726
2	N37P000727
3	N37P000728
4	N37P000729
S(ref.)	N37P000730

A 1097103



Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2202-06150C-2
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 22TM453
Page: 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	45.1	45.1	44.503	44.454	44.487	44.519	44.478

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor k
44.5	0.13	0.063	0.15	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 %.

-000-

Certificate of System Qualification

ES-00

System ID: MY10010005
Organization Name: ALB Laboratory Group (Thailand) Co., Ltd.
Organization Location: 104 Phatthanakan 40 Phatthanakan Rd., Bangkok 10250

Date: September 13, 2021 5:48:11 PM
EOP Name: AgilentRecommended
EOP Revision: ES.02.50
Overall Qualification Status: Pass

Preparation

Pass

Instrument Tests

Pass

Autosampler Operation

Pass

REVIEW BY:
APPROVED BY:
NEXT CAL. DATE: 12 Feb 23

BKK_EL0037

A 1097102

Instrument Details

Purpose

This section describes the as found system configuration.

Details

Spectrometer 1

Manufacturer	Agilent Technologies
Name	5100 SVDV
Model Number	G8010A
Sample Introduction	Double pass glass cyclonic spraychamber and seaspray nebulizer
Serial Number	MY16010005
Firmware Revision	5395

Chiller 1

Manufacturer	Agilent Technologies
Name	Other Unspecified
Other Unspecified Name	Chiller
Model Number	Other Unspecified
Other Unspecified Model Number	G3292-80201
Serial Number	2008-00159

Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU15440764

Switching Valve Accessory 1

Manufacturer	Agilent Technologies
Name	SVS 2+
Model Number	G8485A
Serial Number	AU16040115

Date: September 13, 2021 5:49:11 PM
System ID: MY16010005

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:	Kanyakorn Sukpathrajareem
Logged On User Name:	phimprapha.jeeraphong@agilent.com
Signature Creation Date:	September 13, 2021
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.

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Date: September 13, 2021 5:49:11 PM
System ID: MY16010005

User Name: phimprapha.jeeraphong
Hostname: ASBKKWX328
System ID: MY16010005
Print Date: September 13, 2021 5:49:12 PM

OQHW 5100 ICPOES ALS 08Sep21 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 8:48:59 AM	Audit	SessionCreated	Session	None
September 8, 2021 8:48:59 AM	Start	Configuration	Session	None
September 8, 2021 8:49:59 AM	Audit	Entitlement	Licensing	User is Field Engineer and does not require an unlock code
September 8, 2021 9:07:06 AM	Audit	EqpLoaded	Session	EQP details for primary technique [Et] - File path: [ProtocolPacks\Ex\Configured\ens02.50\Ex.02.50.esq], EQP File Name: [Ex.02.50.esq], EQP Name: [AgilentRecommended]
September 8, 2021 9:07:11 AM	End	Configuration	Session	None
September 8, 2021 9:07:15 AM	Start	Qualification	Session	OQ
September 8, 2021 9:07:15 AM	Start	Execution	Preparation : 5100 SVDV: Qualitative Test - No setpoints associated	None
September 8, 2021 9:54:35 AM	End	Execution	Preparation : 5100 SVDV: Qualitative Test - No setpoints associated	Run Count : 1
September 8, 2021 9:54:39 AM	Start	Execution	Instrument Tests : 5100 SVDV: Qualitative Test - No setpoints associated	None
September 8, 2021 9:51:27 AM	End	Execution	Instrument Tests : 5100 SVDV: Qualitative Test - No setpoints associated	Run Count : 1

Date: September 13, 2021 5:49:11 PM
System ID: MY16010005

User Name: phimprapha.jeeraphong
Hostname: ASBKKWX328
System ID: MY16010005
Print Date: September 13, 2021 5:49:12 PM

OQHW 5100 ICPOES ALS 08Sep21 Transaction log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 9:51:30 AM	Start	Execution	Autosampler Operation : Autosampler 1 - SPS4; Qualitative Test - No setpoints associated	None
September 8, 2021 9:51:36 AM	End	Execution	Autosampler Operation : Autosampler 1 - SPS4; Qualitative Test - No setpoints associated	Run Count : 1
September 8, 2021 9:51:36 AM	End	Qualification	Session	OQ
September 8, 2021 9:51:36 AM	Start	Reporting	Session	None
September 8, 2021 10:55:40 AM	Audit	AceClosed	Session	None
September 13, 2021 5:01:26 PM	Audit	AceRestarted	Session	None
September 13, 2021 5:01:26 PM	Audit	Session/Reloaded	Session	None
September 13, 2021 5:01:26 PM	Start	Qualification	Session	OQ
September 13, 2021 5:47:55 PM	Audit	Reporting	Session	Report Generated : Certificate

Date: September 13, 2021 5:49:11 PM
System ID: MY16010005



Agilent CrossLab Compliance Services

**Agilent
CrossLab**
From Insight to Outcome**EQUIPMENT QUALIFICATION REPORT (EQR)****Agilent CrossLab Compliance**

Qualification Type: ES-OQ

System ID: MY16010005

EQP Name: AgilentRecommended

EQP Details: Agilent Technologies System

EQP Revision: ES.02.50

EQP Release Date: March 2020

Date: September 13, 2021 5:50:41 PM

Report Type: Report

Org. Name: ALS Laboratory Group (Thailand) Co., Ltd.

Org. Location: 104 Phatthanakan 40 Phatthanakan Rd., Bangkok 10250

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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		
Test	Status	Runs
Preparation : 5100 SVDV	Pass	1
Instrument Tests : 5100 SVDV	Pass	1
Autosampler Operation : Autosampler 1 - SPS4	Pass	1

Overall Qualification Status

Pass

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Service Details**Purpose**

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

General Details

Service Order No./Request: 6004823273

EQP Name: AgilentRecommended

EQP Revision: ES.02.50

Report Type: Report

Organization Details

Name: ALS Laboratory Group (Thailand) Co., Ltd.

Location: 104 Phatthanakan 40 Phatthanakan Rd., Bangkok 10250

Local Contact Details

Name: Khun Thitima Boonpeng

Job Title: Scientist 2, Life Sciences

Qualification Location: ICP Room

Operator Details

Name: Kanyakorn sukpathrajareem

Job Title: Field Service Engineer

Data Acquisition Details

Acquisition Software Name: ICP Expert

Acquisition Software Revision: 7.5.3.11953

Customer Data System (CDS): Es: ICP Expert

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Instrument Details

Purpose

This section describes the as found system configuration.

Details

Spectrometer 1

Manufacturer	Agilent Technologies
Name	5100 SVDV
Model Number	G8010A
Sample Introduction	Double pass glass cyclonic spraychamber and seaspray nebulizer
Serial Number	MY16010005
Firmware Revision	5395

Chiller 1

Manufacturer	Agilent Technologies
Name	Other Unspecified
Other Unspecified Name	Chiller
Model Number	Other Unspecified
Other Unspecified Model Number	G3292-80201
Serial Number	2008-00159

Autosampler 1

Manufacturer	Agilent Technologies
Name	SPS4
Model Number	G8410A
Serial Number	AU15440764

Switching Valve Accessory 1

Manufacturer	Agilent Technologies
Name	SVS 2+
Model Number	G8485A
Serial Number	AU16040115

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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
ES.02.50	Autosampler Operation
ES.02.50	Instrument Tests
ES.02.50	Preparation

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Preparation

Purpose

This test records a status for each preparation task for the Agilent ICP-OES.

Configuration Details

Model/Serial No.: G8010A MY16010005

Results

Criteria	Observed Result	Expected Result	Status
Does the plasma ignite successfully in the first three attempts?	Yes	Yes	Pass
Was the detector calibration performed and completed successfully?	Yes	Yes	Pass
Was the instrument calibration performed and completed successfully?	Yes	Yes	Pass

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Test Evidence

Image Details: Was the detector calibration performed and completed successfully?
Date and Time: September 8, 2021 9:07:42 AM
Host Name: ASBKWX328



Date: September 13, 2021 5:50:41 PM
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Image Details: Was the instrument calibration performed and completed successfully?

Date and Time: September 8, 2021 9:33:30 AM

Host Name: ASBKKWX328

Overall Test Status: **Pass** Runs: 1

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Instrument Tests

Purpose

This test records a status for each of the automated tests within the Agilent ICP-OES CDS. For detailed test criteria, refer to the attached report.

Configuration Details

Model/Serial No.: G8010A MY16010005

Results	Observed Result	Expected Result	Status
Are the Functional Tests results within acceptance criteria?			
Subsystem Communications	<input type="text"/>	<input type="text"/>	<input type="text"/>
Air Flow	<input type="text"/>	<input type="text"/>	<input type="text"/>
Water Flow	<input type="text"/>	<input type="text"/>	<input type="text"/>
Gas Flows	<input type="text"/>	<input type="text"/>	<input type="text"/>
RF Generator	<input type="text"/>	<input type="text"/>	<input type="text"/>
Camera	<input type="text"/>	<input type="text"/>	<input type="text"/>
Optics	<input type="text"/>	<input type="text"/>	<input type="text"/>

Are the Instrument Performance Tests results within acceptance criteria?

Resolution	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sensitivity	<input type="text"/>	<input type="text"/>	<input type="text"/>
Precision	<input type="text"/>	<input type="text"/>	<input type="text"/>

Overall Test Status

Pass Runs: 1Date: September 13, 2021 5:50:41 PM
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Autosampler Operation

Purpose

This test verifies that the autosampler operates properly.

Configuration Details

Model/Serial No.: G8410A AU15440764

Results

Criteria	Observed Result	Expected Result	Status
Does the autosampler successfully move to the specified location(s)?	<input type="text"/>	<input type="text"/>	<input type="text"/>

Overall Test Status

Pass Runs: 1Date: September 13, 2021 5:50:41 PM
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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.

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Attachments

Location	Category	Document Name	Page
EQR	General	Certificate of Qualification for ACE	1
EQR	General	Certificate of Qualification for ACE	1
EQR	General	Operator's training certificate and qualifications	1
EQR	Material	Certificate of Analysis Wavelength calibration solution	4
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EQR	General	Instrument's Test Report	4

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General

Document Name: Certificate of Qualification for ACE



Agilent Technologies

Agilent Compliance Engine Self Qualification

Date: September 8, 2021 10:10:10 AM
Drive Serial #: EAP04572 Platform Revision: A.03.01

Individual self-qualification reports for each specific technique installed are also available upon request. They provide additional details on the general report from the concise summary and are structured by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and OQ program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified systems.

Technique Type	Tests Completed	Result
UV-Vis Spectrophotometer	13	Conforms
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Software	8	Conforms
Emission Spectroscopy	3	Conforms
Infrared Spectroscopy	7	Conforms

Overall Qualification Status

Conforms

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General

Document Name: Certificate of Qualification for ACE



Certificate of Completion

Learner Name: Kanyakorn Sukpathanjareon
Title Of Course: AN-CB-SS-II-030-A: ACE 3.X User Update Training
Completion Date: June 25, 2020
Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

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 employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

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General

Document Name: Operator's training certificate and qualifications



Certificate of Completion

Learner Name: Kanyakorn Sukpathanjareon
Title Of Course: ANV-CE-ICPOES-2-008-A: Agilent 5100 ICP-OES Support Novoplyte Training
Completion Date: November 2, 2017
Certified By Company: Learning at Agilent

All Service and Support training certificates have the following specific limitations.

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 employee has ongoing access to Agilent's Safety Alerts, Service Notes, internal technical updates, update training, current documentation, technical support, current parts, and parts updates. Completion of training alone, without being employed by Agilent Technologies, does not qualify an individual to safely install, service or maintain Agilent products.

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Materials

Document Name: Certificate of Analysis Wavelength calibration solution



CERTIFICATE OF ANALYSIS

Agilent Product Name: Wavelength Calibration Solution for ICP-OES & MP-AES, 5 mg/L, 100mL
 Agilent Part No: 801003700
 Lot No: 8010037041

Product Specifications

Analyte	Starting Material	CAS #	Certified Conc.	Analyte	Starting Material	CAS #	Certified Conc.
Al	Al(NO ₃) ₃	7784-32-2	5.000 ± 0.020 mg/L	Mo	Mo	7439-98-1	5.001 ± 0.020 mg/L
As	As	7440-38-2	5.001 ± 0.020 mg/L	Nb	(NH ₄) ₂ NbO ₇	12100-78-4	5.007 ± 0.020 mg/L
Ba	Ba(NO ₃) ₂	10035-10-8	5.000 ± 0.020 mg/L	Ni	Ni	7440-02-2	5.004 ± 0.020 mg/L
Be	Be	7440-42-9	5.002 ± 0.020 mg/L	Pb	Pb	7784-84-7	4.999 ± 0.020 mg/L
Ca	Ca	7440-48-4	4.998 ± 0.020 mg/L	Sa	Sa	7784-49-2	5.004 ± 0.020 mg/L
Co	Co(NO ₃) ₂	13458-04-4	5.000 ± 0.020 mg/L	Si	SiHCl ₃	10663-70-4	5.000 ± 0.020 mg/L
Cu	Cu	7440-50-8	5.007 ± 0.020 mg/L	Zn	Zn	7440-66-4	5.002 ± 0.020 mg/L
K	KNO ₃	7757-25-1	50.00 ± 0.20 mg/L				

Matrix: 1% HNO₃

Intended Use: This solution is intended for use as a certified reference material or calibration standard for inductively coupled plasma optical emission spectroscopy (ICP-OES), inductively coupled plasma mass spectrometry (ICP-MS), atomic absorption spectroscopy (flame AAS or GFAAS), microwave plasma atomic emission spectroscopy (MP-AES), x-ray fluorescence spectroscopy (XRF), and other techniques for elemental analysis.

Certification & Traceability: This CRM was manufactured under a quality management system that is registered to ISO 9001, ISO 17024 and ISO/IEC 17025. This CRM was prepared to the certified concentrations shown above by gravimetric methods using single-element concentrates that were certified using the "High Performance ICP-OES" protocol developed by NIST and are directly traceable to the NIST SRM listed below. This solution was stabilized using high purity nitric acid (HNO₃) and stored with filtered (0.22µm), 18-M-ohm deionized water. The balances used in the preparation of this CRM are calibrated regularly with traceability to NIST. All volumetric dilutions are performed in Class A calibrated glassware. The certified concentrations were determined based upon gravimetric procedures. Secondary verification of the certified concentrations was performed using ICP-OES that was calibrated and/or referenced against NIST SRMs: 2016a, 2016b, 2016c, 2016d, 2016e, 2016f, 2016g, 2016h, 2016i, 2016j, 2016k, 2016l, 2016m, 2016n, 2016o, 2016p, 2016q, 2016r, 2016s, 2016t, 2016u, 2016v, 2016w, 2016x, 2016y, 2016z, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i, 2017j, 2017k, 2017l, 2017m, 2017n, 2017o, 2017p, 2017q, 2017r, 2017s, 2017t, 2017u, 2017v, 2017w, 2017x, 2017y, 2017z, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2018g, 2018h, 2018i, 2018j, 2018k, 2018l, 2018m, 2018n, 2018o, 2018p, 2018q, 2018r, 2018s, 2018t, 2018u, 2018v, 2018w, 2018x, 2018y, 2018z, 2019a, 2019b, 2019c, 2019d, 2019e, 2019f, 2019g, 2019h, 2019i, 2019j, 2019k, 2019l, 2019m, 2019n, 2019o, 2019p, 2019q, 2019r, 2019s, 2019t, 2019u, 2019v, 2019w, 2019x, 2019y, 2019z, 2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h, 2020i, 2020j, 2020k, 2020l, 2020m, 2020n, 2020o, 2020p, 2020q, 2020r, 2020s, 2020t, 2020u, 2020v, 2020w, 2020x, 2020y, 2020z, 2021a, 2021b, 2021c, 2021d, 2021e, 2021f, 2021g, 2021h, 2021i, 2021j, 2021k, 2021l, 2021m, 2021n, 2021o, 2021p, 2021q, 2021r, 2021s, 2021t, 2021u, 2021v, 2021w, 2021x, 2021y, 2021z, 2022a, 2022b, 2022c, 2022d, 2022e, 2022f, 2022g, 2022h, 2022i, 2022j, 2022k, 2022l, 2022m, 2022n, 2022o, 2022p, 2022q, 2022r, 2022s, 2022t, 2022u, 2022v, 2022w, 2022x, 2022y, 2022z, 2023a, 2023b, 2023c, 2023d, 2023e, 2023f, 2023g, 2023h, 2023i, 2023j, 2023k, 2023l, 2023m, 2023n, 2023o, 2023p, 2023q, 2023r, 2023s, 2023t, 2023u, 2023v, 2023w, 2023x, 2023y, 2023z, 2024a, 2024b, 2024c, 2024d, 2024e, 2024f, 2024g, 2024h, 2024i, 2024j, 2024k, 2024l, 2024m, 2024n, 2024o, 2024p, 2024q, 2024r, 2024s, 2024t, 2024u, 2024v, 2024w, 2024x, 2024y, 2024z, 2025a, 2025b, 2025c, 2025d, 2025e, 2025f, 2025g, 2025h, 2025i, 2025j, 2025k, 2025l, 2025m, 2025n, 2025o, 2025p, 2025q, 2025r, 2025s, 2025t, 2025u, 2025v, 2025w, 2025x, 2025y, 2025z, 2026a, 2026b, 2026c, 2026d, 2026e, 2026f, 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2037g, 2037h, 2037i, 2037j, 2037k, 2037l, 2037m, 2037n, 2037o, 2037p, 2037q, 2037r, 2037s, 2037t, 2037u, 2037v, 2037w, 2037x, 2037y, 2037z, 2038a, 2038b, 2038c, 2038d, 2038e, 2038f, 2038g, 2038h, 2038i, 2038j, 2038k, 2038l, 2038m, 2038n, 2038o, 2038p, 2038q, 2038r, 2038s, 2038t, 2038u, 2038v, 2038w, 2038x, 2038y, 2038z, 2039a, 2039b, 2039c, 2039d, 2039e, 2039f, 2039g, 2039h, 2039i, 2039j, 2039k, 2039l, 2039m, 2039n, 2039o, 2039p, 2039q, 2039r, 2039s, 2039t, 2039u, 2039v, 2039w, 2039x, 2039y, 2039z, 2040a, 2040b, 2040c, 2040d, 2040e, 2040f, 2040g, 2040h, 2040i, 2040j, 2040k, 2040l, 2040m, 2040n, 2040o, 2040p, 2040q, 2040r, 2040s, 2040t, 2040u, 2040v, 2040w, 2040x, 2040y, 2040z, 2041a, 2041b, 2041c, 2041d, 2041e, 2041f, 2041g, 2041h, 2041i, 2041j, 2041k, 2041l, 2041m, 2041n, 2041o, 2041p, 2041q, 2041r, 2041s, 2041t, 2041u, 2041v, 2041w, 2041x, 2041y, 2041z, 2042a, 2042b, 2042c, 2042d, 2042e, 2042f, 2042g, 2042h, 2042i, 2042j, 2042k, 2042l, 2042m, 2042n, 2042o, 2042p, 2042q, 2042r, 2042s, 2042t, 2042u, 2042v, 2042w, 2042x, 2042y, 2042z, 2043a, 2043b, 2043c, 2043d, 2043e, 2043f, 2043g, 2043h, 2043i, 2043j, 2043k, 2043l, 2043m, 2043n, 2043o, 2043p, 2043q, 2043r, 2043s, 2043t, 2043u, 2043v, 2043w, 2043x, 2043y, 2043z, 2044a, 2044b, 2044c, 2044d, 2044e, 2044f, 2044g, 2044h, 2044i, 2044j, 2044k, 2044l, 2044m, 2044n, 2044o, 2044p, 2044q, 2044r, 2044s, 2044t, 2044u, 2044v, 2044w, 2044x, 2044y, 2044z, 2045a, 2045b, 2045c, 2045d, 2045e, 2045f, 2045g, 2045h, 2045i, 2045j, 2045k, 2045l, 2045m, 2045n, 2045o, 2045p, 2045q, 2045r, 2045s, 2045t, 2045u, 2045v, 2045w, 2045x, 2045y, 2045z, 2046a, 2046b, 2046c, 2046d, 2046e, 2046f, 2046g, 2046h, 2046i, 2046j, 2046k, 2046l, 2046m, 2046n, 2046o, 2046p, 2046q, 2046r, 2046s, 2046t, 2046u, 2046v, 2046w, 2046x, 2046y, 2046z, 2047a, 2047b, 2047c, 2047d, 2047e, 2047f, 2047g, 2047h, 2047i, 2047j, 2047k, 2047l, 2047m, 2047n, 2047o, 2047p, 2047q, 2047r, 2047s, 2047t, 2047u, 2047v, 2047w, 2047x, 2047y, 2047z, 2048a, 2048b, 2048c, 2048d, 2048e, 2048f, 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2070g, 2070h, 2070i, 2070j, 2070k, 2070l, 2070m, 2070n, 2070o, 2070p, 2070q, 2070r, 2070s, 2070t, 2070u, 2070v, 2070w, 2070x, 2070y, 2070z, 2071a, 2071b, 2071c, 2071d, 2071e, 2071f, 2071g, 2071h, 2071i, 2071j, 2071k, 2071l, 2071m, 2071n, 2071o, 2071p, 2071q, 2071r, 2071s, 2071t, 2071u, 2071v, 2071w, 2071x, 2071y, 2071z, 2072a, 2072b, 2072c, 2072d, 2072e, 2072f, 2072g, 2072h, 2072i, 2072j, 2072k, 2072l, 2072m, 2072n, 2072o, 2072p, 2072q, 2072r, 2072s, 2072t, 2072u, 2072v, 2072w, 2072x, 2072y, 2072z, 2073a, 2073b, 2073c, 2073d, 2073e, 2073f, 2073g, 2073h, 2073i, 2073j, 2073k, 2073l, 2073m, 2073n, 2073o, 2073p, 2073q, 2073r, 2073s, 2073t, 2073u, 2073v, 2073w, 2073x, 2073y, 2073z, 2074a, 2074b, 2074c, 2074d, 2074e, 2074f, 2074g, 2074h, 2074i, 2074j, 2074k, 2074l, 2074m, 2074n, 2074o, 2074p, 2074q, 2074r, 2074s

Comments

Date/Time:	September 13, 2021 5:27:56 PM
Test:	General
Comment:	Start OQ on 08 Sep 21 and found water flow fail, So repair job complete for 13 Sep 21 and OQ continue to complete.

Date: September 13, 2021 5:50:41 PM
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General

Document Name:	Instrument's Test Report
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Report Summary

Instrument Model	Agilent 5100/5110 SVDV ICP-OES
Instrument ID	G8010A/G8014A
Instrument Serial Number	MY16010005
Software Version	7.5.3.11953
Firmware Version	S395
Tested By	Kanyakorn S.
Test started on	9/8/2021 9:51:21 AM
Test Completed On	9/8/2021 9:56:35 AM

Result Summary

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

Subsystem Communications Test

Pass

Optics Test

Pass

	Radial	Axial	SVDV
Intensity	3162.178	3162.050	3416288
Wavelength	737.212	737.212	737.212

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Resolution Test			Pass
Element Wavelength	Specification	Width	
N (174.213 nm)	≤ 9.40	7.54	
As (188.980 nm)	≤ 8.30	6.43	
C (193.027 nm)	≤ 11.50	8.89	
Mo (200.032 nm)	≤ 8.20	6.50	
Cr (206.159 nm)	≤ 13.40	11.05	
Zn (213.857 nm)	≤ 8.70	7.27	
Pb (220.353 nm)	≤ 9.80	7.52	
Co (228.615 nm)	≤ 17.20	12.65	
Ba (230.424 nm)	≤ 9.40	7.80	
Mn (257.610 nm)	≤ 13.30	9.99	
Mn (260.568 nm)	≤ 20.30	16.63	
Cr (267.716 nm)	≤ 11.00	8.53	
Cu (324.754 nm)	≤ 25.00	18.14	
Cu (327.399 nm)	≤ 14.20	11.75	
Sr (338.071 nm)	≤ 33.50	26.54	
Ba (455.403 nm)	≤ 44.00	33.67	
Sr (460.733 nm)	≤ 38.00	22.38	
Ba (493.408 nm)	≤ 38.00	25.86	
Ba (614.171 nm)	≤ 42.00	28.49	
Ar (675.283 nm)	≤ 74.00	60.58	
K (766.491 nm)	≤ 80.00	66.42	

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Document Name: Instrument's Test Report

Sensitivity Test

Pass

Radial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 46.0	SRBR	88.8	960.1	94.9
Se (196.026 nm)	≥ 41.0	SRBR	55.6	709.4	113.8
Zn (213.857 nm)	≥ 142.0	SRBR	2095.3	20674.4	197.9
Pb (220.353 nm)	≥ 46.0	SRBR	100.6	1592.6	152.2
Mn (257.610 nm)	≥ 3518.0	SRBR	6641.7	127413.8	365.9
Al (396.152 nm)	≥ 3.4	SBR	6.9	24237.9	3081.8
Ba (493.408 nm)	≥ 34.0	SBR	95.1	1015416.2	10563.7
K (766.491 nm)	≥ 1.8	SBR	4.4	82043.9	15321.8

Axial					
Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.980 nm)	≥ 208.0	SRBR	292.4	5108.5	273.5
Se (196.026 nm)	≥ 159.0	SRBR	199.9	3903.2	321.0
Zn (213.857 nm)	≥ 243.0	SRBR	793.6	12455.9	237.0
Cr (213.857 nm)	≥ 1743.0	SRBR	4924.5	130652.8	696.4
Cd (214.439 nm)	≥ 4227.0	SRBR	4508.6	87692.4	375.1
Pb (220.353 nm)	≥ 320.0	SRBR	327.3	7693.1	480.3
Mn (257.610 nm)	≥ 10625.0	SRBR	19008.8	632091.9	1164.7
Cr (267.716 nm)	≥ 1049.0	SRBR	4115.3	173999.6	1791.9
Cu (324.754 nm)	≥ 19.0	SBR	48.6	189303.3	3960.0
Al (396.152 nm)	≥ 6.0	SBR	16.7	156852.5	8877.5
Ba (493.408 nm)	≥ 60.0	SBR	168.0	5374075.7	31797.5
K (766.491 nm)	≥ 24.0	SBR	94.8	2536127.0	38564.9

Precision Test

Pass

Radial		
Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 2.60	1.08
Se (196.026 nm)	≤ 2.60	1.35
Zn (213.857 nm)	≤ 1.50	0.62
Pb (220.353 nm)	≤ 2.60	0.72
Mn (257.610 nm)	≤ 1.50	0.44

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Al (396.152 nm)	≤ 1.50	0.45
Ba (493.408 nm)	≤ 1.50	0.48
K (766.491 nm)	≤ 1.50	0.34

Axial

Element Wavelength	Specification	Measured Value % RSD
As (188.980 nm)	≤ 1.50	0.64
Se (196.028 nm)	≤ 1.50	0.58
Zn (206.200 nm)	≤ 1.50	0.29
Zn (213.857 nm)	≤ 1.50	0.38
Cd (214.439 nm)	≤ 1.50	0.30
Pb (220.353 nm)	≤ 1.50	0.47
Mn (257.610 nm)	≤ 1.50	0.78
Cr (267.716 nm)	≤ 1.50	0.30
Cu (324.754 nm)	≤ 1.50	0.45
Al (396.152 nm)	≤ 1.50	0.35
Ba (493.408 nm)	≤ 1.50	0.50
K (766.491 nm)	≤ 1.50	0.46

Report Detail

Tests Run - Operator: Kanyakorn S.

Subsystem Communications Test- Started

SubSystem Status

Main Power Module - Passed
Gas Control Module - Passed
RF Generator - Passed
pre-optics Module - Passed
Optics/Camera Control Module - Passed
Peristaltic Pump - Passed
Subsystem Communications Test Completed - Passed

Optics Test- Started

Test View Mode Intensities Status

LED Off - Passed
Shutter opened - Passed
Peak Intensity Radial mode 3062176.14 - Passed
Shutter closed - Passed
Peak Intensity (closed shutter) Radial mode 55.00 - Passed
Shutter opened - Passed
Optical Argon Ratio: Calculated Value = 2.55, Factory Value = 2.60
Peak Intensity Axial mode 3162050.49 - Passed

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Document Name:

Instrument's Test Report

Radial-Axial Intensity Ratio (Range 0-100) - 1.03 - Passed
Peak Intensity Simultaneous mode 3419267.63 - Passed
Shutter closed - Passed
Optics Test Completed - Passed
Instrument Performance- Started
Instrument Performance Completed - Passed

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General

Document Name:

Instrument's Test Report

Report Summary

Instrument Model Agilent 5100/5110 SVDV ICP-OES
Instrument ID G8010A/G8014A
Instrument Serial Number MY16010005
Software Version 7.5.3.11953
Firmware Version 5395
Tested By Kanyakorn S.
Test started on 9/13/2021 5:33:48 PM
Test Completed On 9/13/2021 5:46:50 PM

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	Pass
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)	50% Air Flow (relative speed)
11.00	16.00

Water Flow Test

Pass

RF Water Flow (L/min)	Camera Water Flow (L/min)	Water Inlet Temperature (°C)
1.21	1.14	23.01

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Instrument's Test Report

Gas Flows Test					
Pass					
Nebulizer Target Flow	Actual Flow	Back Pressure	Auxiliary Target Flow	Actual Flow	Back Pressure
0.70	0.71	276.73	2.00	2.00	106.21
Makeup Target Flow	Actual Flow	Back Pressure	Plasma Target Flow	Actual Flow	Back Pressure
2.00	2.00	106.63	16.00	17.96	19.78

RF Generator Test

Pass

RF Power Supply Test	Passed
RF Power Supply (V)	130.332
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	26.917
Work Coil Current (A)	44.873
RF Power Supply Current (A)	1.990

Camera Test

Pass

Black Level Test	Note Test	Photo Response Test
Passed	Passed	Passed

Optics Test

Pass

Radial	Axial	SVDV
Intensity 2955633	3009947	3265038
Wavelength 737.212	737.212	737.212

Report Detail

Tests Run - Operator: Kanyakorn S.

Subsystem Communications Test- Started

SubSystem Status

Main Power Module - Passed
Gas Control Module - Passed
RF Generator - Passed
pre-optics Module - Passed
Optics/Camera Control Module - Passed

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Peristaltic Pump - Passed
Subsystem Communications Test Completed - Passed

Air Flow - Started
Fan Speed(%) Air Flow(velocity speed) Status
30% 11 - Passed
60% 16 - Passed
Air Flow Completed - Passed

Water Flow - Started
RF Water Flow(L/min) = 1.21
Camera Water Flow (L/min) = 1.14
Water Inlet Temperature = 23.01
RF Water Flow(L/min) (off) = 0.00
Water Flow Completed - Passed

Gas Flows - Started
Channel Target Actual Pressure Failure Status

Auxiliary Gas 0.00 0.06 N/A N/A - Passed
Auxiliary Gas 2.00 2.00 N/A N/A - Passed
Nebulizer Gas 0.00 0.07 0.00 N/A - Passed
Nebulizer Gas 0.70 0.71 276.73 N/A - Passed
Plasma Gas 18.00 17.96 N/A N/A - Passed
Plasma Gas 0.00 1.18 N/A N/A - Passed
Makeup Gas 0.00 0.08 N/A N/A - Passed
Makeup Gas 2.00 2.00 N/A N/A - Passed
Purge Gas 0.70 0.70 N/A N/A - Passed
Purge Gas 3.70 3.70 N/A N/A - Passed
All Channel Flows ON - Passed
All Channel Flows OFF - Passed
Gas Flows Completed - Passed

RF Generator - Started
RF generator turned off - Passed
RF generator turned on - Passed
Bias Control = 0 V - Passed
RF Power Supply - Set Value = 150V, Actual Value = 130.33V - Passed
RF Oscillator Started - Passed
RF Oscillator Frequency(MHz) = 25.92, Workcoil Current(Amps) = 44.87, RF Power Supply Current(Amps) = 2.00 - Passed
RF Oscillator stopped - Passed
RF generator turned off - Passed
RF Generator Completed - Passed

Camera Test - Started
Black level test - PASSED
Noise test - PASSED
Photo response test - PASSED
Camera Test Completed - Passed

Optics Test - Started
Test View Mode Intensities Status
LED Off - Passed

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Plasma Ignite Started
Plasma Ignite - Passed
Waiting 0 min for plasma warm up
Shutter opened - Passed
Peak Intensity Radial mode 2965032.60 - Passed
Shutter closed - Passed
Peak Intensity(closed shutter) Radial mode 55.46 - Passed
Shutter opened - Passed
Optical Argon Ratio: Calculated Value = 2.53, Factory Value = 2.60
Peak Intensity Axial mode 3009417.29 - Passed
Radial-Axial Intensity Ratio (Range 0-100) - 1.01 - Passed
Peak Intensity Simultaneous mode 3265038.45 - Passed
Shutter closed - Passed
Optics Test Completed - Passed

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Electronic Signature

Purpose

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Logged On User Name: phimpapha.jeersaphong@agilent.com
Signature Creation Date: September 13, 2021
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User Name: phimpapha.jeersaphong

Hostname: ASBXXXX328

System ID: MY16010005

Print Date: September 13, 2021 5:50:44 PM

OQHW 5100 ICPOES ALS 08Sep21 Transaction log :

Time

Transaction State

Activity Performed

Type of Transaction

Optional Information

September 8, 2021 8:48:59 AM

Audit

SessionCreated

Session

None

September 8, 2021 8:48:59 AM

Start

Configuration

Session

None

September 8, 2021 8:48:59 AM

Audit

Enrollment

Licensing

User is Field Engineer and does not require an unlock code

September 8, 2021 9:07:06 AM

Audit

EqpLoaded

Session

EQP details for primary technique [Ex] - File path: [ProtocolPacks\Ex\Configurat on\02.50\Ex.02.50.eqp], EQP File Name: [Ex.02.50.eqp], EQP Name: [AgilentRecommended]

September 8, 2021 9:07:11 AM

End

Configuration

Session

None

September 8, 2021 9:07:15 AM

Start

Qualification

Session

OQ

September 8, 2021 9:07:15 AM

Start

Execution

Preparation : 5100 SVDV: Qualitative Test - No setpoints associated

None

September 8, 2021 9:34:35 AM

End

Execution

Preparation : 5100 SVDV: Qualitative Test - No setpoints associated

Run Count : 1

September 8, 2021 9:34:39 AM

Start

Execution

Instrument Tests : 5100 SVDV: Qualitative Test - No setpoints associated

None

September 8, 2021 9:51:27 AM

End

Execution

Instrument Tests : 5100 SVDV: Qualitative Test - No setpoints associated

Run Count : 1

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User Name: phmgrapha.jesaphong System ID: MY16010005
Hostname: ASBKKW0328 Print Date: September 13, 2021 5:50:44 PM

QHW 5100 ICPOES ALS 08Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 9:51:30 AM	Start	Execution	Autosampler Operation : Autosampler 1 - SP54: Qualitative Test - No setpoints associated	None
September 8, 2021 9:51:36 AM	End	Execution	Autosampler Operation : Autosampler 1 - SP54: Qualitative Test - No setpoints associated	Run Count : 1
September 8, 2021 9:51:38 AM	End	Qualification	Session	OQ
September 8, 2021 9:51:38 AM	Start	Reporting	Session	None
September 8, 2021 10:55:40 AM	Audit	AccClosed	Session	None
September 13, 2021 5:01:26 PM	Audit	AccRestarted	Session	None
September 13, 2021 5:01:26 PM	Audit	SessionReloaded	Session	None
September 13, 2021 5:01:28 PM	Start	Qualification	Session	OQ
September 13, 2021 5:47:55 PM	Audit	Reporting	Session	Report Generated : Certificate

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User Name: phmgrapha.jesaphong System ID: MY16010005
Hostname: ASBKKW0328 Print Date: September 13, 2021 5:50:44 PM

QHW 5100 ICPOES ALS 08Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2021 5:48:13 PM	Audit	Reporting	Session	Report Signed : Certificate PDF Name: QHW 5100 ICPOES ALS 08Sep21_20210913_Certificate_1.pdf User Name: phmgrapha.jesaphong@agilent.com Full Name of Signer: Kanyphon Sukphatjareem Reason for signature: Executed protocol and published this original version of document
September 13, 2021 5:49:25 PM	Audit	Reporting	Session	Report Generated : Report

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Date: September 13, 2021 5:50:41 PM
System ID: MY16010005

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