

ภาคผนวก ง

เอกสารการสอบเทียบเครื่องมือตรวจวิเคราะห์



ALS Laboratory Group (Thailand) Co., Ltd.
104 Phahonyothin Rd., Phahonyothin Bldg.,
Klongkiet Suburb, Bangkok 10250 Thailand
T +66 2 760 3000 E +66 2 760 3197

รายการเครื่องมือที่ใช้ในการวิเคราะห์ / หมายเหตุ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Noise	Leq 2 hrs	Sound Level Meter	BKX_FS0676	2-Nov-21	2-Nov-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0681	1-Oct-21	1-Oct-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0679	15-Feb-23	15-Feb-24	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0679	7-Jun-21	7-Jun-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0676	2-Nov-21	2-Nov-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0675	17-May-21	17-May-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0675	4-Aug-21	4-Aug-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0682	1-Oct-21	1-Oct-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0672	17-Mar-23	17-Mar-24	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0676	2-Nov-21	2-Nov-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0681	1-Oct-21	1-Oct-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0682	13-Dec-21	13-Dec-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0682	1-Oct-21	1-Oct-22	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0678	15-Feb-23	15-Feb-24	12
Heat	Heat Stress	Heat Stress Monitor	BKX_FS0675	4-Aug-21	4-Aug-22	12
Illuminance	Illuminance	Lux Meter	BKX_FS1146	8-Sep-22	8-Sep-23	12
Water Lab	pH at 25 °C	pH meter	BKX_FS1145	8-Sep-21	8-Sep-22	12
Water Lab	Residual Free Chlorine	Chlorine Meter	BKX_EN0072	28-Jan-21	28-Jan-22	12
Water Lab	Dissolved Oxygen	Burette	BKX_LG0042	30-Mar-21	30-Mar-22	12
Water Lab	Dissolved Oxygen	Chamber (Cold Room)	BKX_EN0171	18-May-21	18-May-22	18

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Water Lab	Oil & Grease	Electronic Top-Loading Balance	BKX_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Oil & Grease	Water Bath	BKX_EN0148	31-Jan-22	1-Aug-23	18
Water Lab	Total Suspended Solids	Electronic Top-Loading Balance	BKX_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Suspended Solids	Oven	BKX_EN0007	1-Dec-21	1-Jun-23	18
Water Lab	Total Dissolved Solids 180°C	Electronic Top-Loading Balance	BKX_EN0003	3-Sep-21	3-Sep-22	12
Water Lab	Total Dissolved Solids 180°C	Oven	BKX_EN0007	1-Dec-21	1-Jun-23	18
Water Lab	Conductivity	Conductivity meter	BKX_EN0055	15-Nov-21	20-May-23	18
Water Lab	BOD (5 days at 20°C)	DO Meter	BKX_EN0205	19-Jan-21	20-Jul-22	18
Water Lab	BOD (5 days at 20°C)	Incubator	BKX_EN0005	4-Apr-23	4-Apr-24	18
Water Lab	Temperature	pH Meter	BKX_LG0004	10-Feb-22	10-Feb-23	12
Water Lab	Calcium	ICP-OES	BKX_EL0037	13-Sep-21	12-Mar-23	18
Water Lab	Calcium	Hot Block	BKX_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Calcium	Chamber (Cold Room)	BKX_EN0167	18-May-21	16-Nov-22	18
Water Lab	Magnesium	ICP-OES	BKX_EL0037	13-Sep-21	12-Mar-23	18
Water Lab	Magnesium	Hot Block	BKX_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Magnesium	Chamber (Cold Room)	BKX_EN0167	18-May-21	16-Nov-22	18
Water Lab	Sodium	ICP-OES	BKX_EL0037	13-Sep-21	12-Mar-23	18
Water Lab	Sodium	Hot Block	BKX_EL0054	7-Apr-22	7-Oct-23	18
Water Lab	Sodium	Chamber (Cold Room)	BKX_EN0167	18-May-21	16-Nov-22	18
Water Lab	SAR	ICP-MS	BKX_EL0043	30-Sep-21	29-Mar-23	18
Water Lab	SAR	Hot Block	BKX_EL0054	7-Apr-22	7-Oct-23	18

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Ambient	Total Suspended Particulate	High Volume	BKX_FS0372	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKX_FS0358	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKX_FS0367	-	-	On site Calibration
Ambient	Total Suspended Particulate	High Volume	BKX_FS0363	-	-	On site Calibration
Ambient	Total Suspended Particulate	Digital Balance	BKX_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Particulate Matter (PM-10)	High Volume	BKX_FS0387	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKX_FS0374	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKX_FS1061	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	High Volume	BKX_FS1063	-	-	On site Calibration
Ambient	Particulate Matter (PM-10)	Digital Balance	BKX_EN0004	25-Feb-22	25-Feb-23	12
Ambient	Nitrogen Dioxide	NO2 Analyzer	BKX_FS1092	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO2 Analyzer	BKX_FS0785	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO2 Analyzer	BKX_FS0789	4-Jan-22	4-Jul-22	6
Ambient	Nitrogen Dioxide	NO2 Analyzer	BKX_FS1090	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO2 Analyzer	BKX_FS1091	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO2 Analyzer	BKX_FS0784	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO2 Analyzer	BKX_FS0789	4-Jan-22	4-Jul-22	6
Ambient	Sulfur Dioxide	SO2 Analyzer	BKX_FS1088	4-Jan-22	4-Jul-22	6
Ambient	Wind Speed / Wind Direction	Wind Speed / Wind Direction	BKX_FS0918	30-Aug-21	28-Aug-23	18
Stack (CEM)	Oxides of Nitrogen	Analyzer - System calibration, Standard gas	-	-	-	-
Stack (CEM)	Sulfur Dioxide	Analyzer - System calibration, Standard gas	-	-	-	-

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Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Freq. Calibrate (Months)
Stack	Total Suspended Particulate	Console Control Unit	BKX_FS0485	5-Jun-22	5-Jul-22	6
Stack	Total Suspended Particulate	Digital Balance	BKX_EN0009	10-Dec-21	10-Dec-22	12
Noise	Leq 24 hrs	Sound Calibrator	BKX_FS0632	14-Jan-22	14-Jan-23	12
Noise	Leq 24 hrs	Sound Level Meter	BKX_FS0725	7-Sep-21	7-Sep-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKX_FS0924	12-Oct-21	12-Oct-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKX_FS0115	14-Dec-21	14-Dec-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKX_FS0109	14-Dec-21	14-Dec-22	12
Noise	Leq 24 hrs	Sound Level Meter	BKX_FS0018	28-Jun-21	28-Jun-22	12
Noise	Leq 8 hrs	Sound Calibrator	BKX_FS0633	14-Jan-22	14-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0115	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0623	12-Oct-21	12-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0098	7-Jul-22	7-Jul-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0115	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0097	9-Nov-21	9-Nov-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0117	14-Dec-21	14-Dec-22	12
Noise	Leq 8 hrs	Sound Calibrator	BKX_FS0632	14-Jan-22	14-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0630	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0675	2-Nov-21	2-Nov-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0929	28-Oct-21	28-Oct-22	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0922	12-Jan-22	12-Jan-23	12
Noise	Leq 8 hrs	Sound Level Meter	BKX_FS0926	7-Jul-21	7-Jul-22	12

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รายงานการสอบเทียบเครื่องมือการวัด / ทดสอบ

Sample Name	Parameter	Equipment Name	ID No.	Calibrated Date	Next Cal	Exp. Calibrate (Months)
Water Lab	SAR	Chamber (Cold Room)	BKK_EN0107	18-May-21	18-Nov-22	18
Water Lab	Total Chlorine	Ion Selective Electrode	BKK_EN0102	11-Mar-21	9-Sep-22	18

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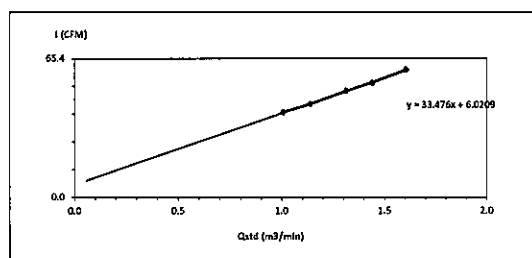
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High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg): 755
 Calibrate Location: กรุงเทพมหานคร Temperature (°C): 30
 Calibrate Date: 25-May-22 High Volume ID: BKK_FS0372
 Calibration Sheet No.: C-250522-BKK_FS0372 High Volume Model: TE-5009X
 Calibrator ID: BKK_FS0625 High Volume S/N: 5332
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H ₂ O (Inch)	Q _{ref} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	2.8	1.0980	40	Slope: 33.4762
2	3.6	1.1404	44	Intercept: 6.0209
3	4.8	1.3138	50	Correlation Coefficient: 0.9995
4	5.8	1.4422	54	
5	7.2	1.6046	60	



Calibrated by

(Mr. Bantha Namkhed)
Field Scientist (2)

Approved by

(Mr. Noppong Juntarapan)
Enviro Field Coordinator Scientist (3)

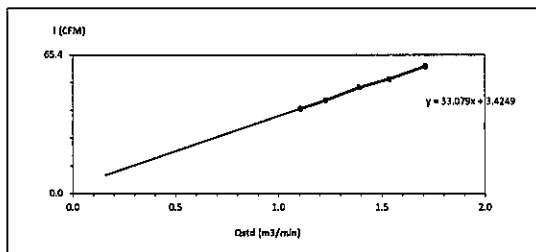
FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg): 755
 Calibrate Location: กรุงเทพมหานคร Temperature (°C): 30
 Calibrate Date: 25-May-22 High Volume ID: BKK_FS0358
 Calibration Sheet No.: C-250522-BKK_FS0358 High Volume Model: TE-5009X
 Calibrator ID: BKK_FS0625 High Volume S/N: 5193
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H ₂ O (Inch)	Q _{ref} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.4	1.1088	40	Slope: 33.0791
2	4.2	1.2302	44	Intercept: 3.4249
3	5.4	1.3923	50	Correlation Coefficient: 0.9993
4	6.6	1.5371	54	
5	8.2	1.7111	60	



Calibrated by

(Mr. Bantha Namkhed)
Field Scientist (2)

Approved by

(Mr. Noppong Juntarapan)
Enviro Field Coordinator Scientist (3)

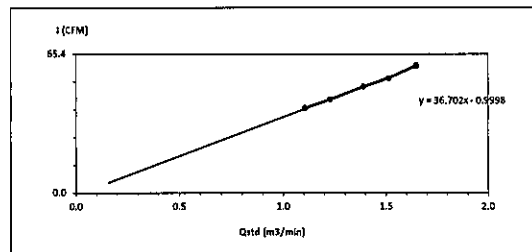
FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf IP NKK Co., Ltd. Barometric Pressure (mm Hg): 755
 Calibrate Location: กรุงเทพมหานคร Temperature (°C): 30
 Calibrate Date: 25-May-22 High Volume ID: BKK_FS0367
 Calibration Sheet No.: C-250522-BKK_FS0367 High Volume Model: TE-5009X
 Calibrator ID: BKK_FS0625 High Volume S/N: 4162
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H ₂ O (Inch)	Q _{ref} (m ³ /min)	I: Chart (CFM)	Linear Regression
1	3.4	1.1088	40	Slope: 36.7024
2	4.2	1.2302	44	Intercept: -0.9998
3	5.4	1.3923	50	Correlation Coefficient: 0.9986
4	6.4	1.5140	54	
5	7.6	1.6481	60	



Calibrated by

(Mr. Bantha Namkhed)
Field Scientist (2)

Approved by

(Mr. Noppong Juntarapan)
Enviro Field Coordinator Scientist (3)

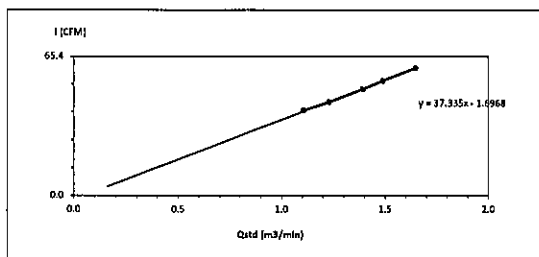
FORM NO.: F-06-073 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site: Gulf JP NKK Co. Ltd. Barometric Pressure (mm Hg): 755
 Calibrate Location: บ้านนาหมื่น Temperature (°C): 30
 Calibrate Date: 25-May-22 High Volume ID: BKK_F50363
 Calibration Sheet No.: C-250522-BKK_F50363 High Volume Model: TE-5002X
 Calibrator ID: BKK_F50625 High Volume S/N: 4160
 Calibrator Model: TE-5028A Calibrator Slope: 1.67326
 Calibrator S/N: 2585 Calibrator Intercept: -0.01954

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I Chart (CFM)	Linear Regression
1	3.4	1.1088	40	Slope: 37.3354 Intercept: -1.6968 Correlation Coefficient: 0.9995
2	4.2	1.2302	44	
3	5.4	1.3923	50	
4	6.2	1.4904	54	
5	7.6	1.6481	60	



Calibrated by: [Signature]
 (Mr. Bantha Wankhede)
 Field Scientist (2)

Approved by: [Signature]
 (Mr. Noppeng Juntarupen)
 Enviro Field Coordinator Scientist (3)

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



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Certificate of Calibration

Represent to Certificate of Calibration ,PTC07/22072

Certificate No.: PTC07/22072 Page: 1 of 3
 Equipment: Digital Balance Condition: Normal
 Manufacturer: METTLER TOLEDO Serial No: 1123091584
 Model: XP105 ID No: BKK_EN0004
 Type of Balance: Multi interval

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

Environment Condition: Temperature 21.0 °C ± 0.4 °C
 Humidity 62.8 %RH ± 3.7 %RH
 Air density 1.20 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakarn 40 Phatthanakarn Rd.,
khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18
 Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co., Ltd.
, NSC-ONSC Accreditation No.: Calibration 0189

Date Received: February 25, 2022
 Calibration Date: February 25, 2022
 Issued Date: March 01, 2022
 Calibration By: Mr. Rungroje Metakul

REVIEW BY: [Signature]
 APPROVED BY: [Signature]
 NEXT CAL DATE: 25/02/23



[Signature]
 (Mr. Kriangsak Kalasin)
 Reviewed by

Approved By: [Signature]
 (Mr. Keattisak Kerdlo)
 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.
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PTC-FMC-07-02 2 Feb 2020



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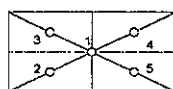
Certificate No.: PTC07/22072 Page: 2 of 3

Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Eccentricity test 30 (g)				
Position (g)				
1	2	3	4	5
0.0000	0.0000	0.0000	0.0000	0.0000
Maximum deviation: 0.0000				

Repeatability Test: Weight to be 1/2 ≤ L₁ ≤ Maximum capacity

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

Nominal test value (g)	Standard Deviation
100	0.00005

Error of Indication: from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
40	40.00005	40.0000	0.0000	0.00016	2.11
50	50.00001	50.0000	0.0000	0.00015	2.13
60	60.00003	60.0000	0.0000	0.00016	2.08
70	70.00003	70.0000	0.0000	0.00017	2.07
80	80.00005	80.0001	-0.0001	0.00019	2.04
90	90.00006	90.0001	0.0000	0.00020	2.03
100	100.00002	99.9999	0.0001	0.00018	2.06

Note: Weight of adjust (g)

PTC-FMC-07-02 2 Feb 2020



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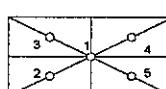
Certificate No.: PTC07/22072 Page: 3 of 3

Measurement Results:

Without Adjustment:

Function Calibration: Non Adjustment

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



Eccentricity test 30 (g)				
Position (g)				
1	2	3	4	5
0.00000	-0.00001	-0.00002	0.00000	0.00000
Maximum deviation: 0.00002				

Repeatability Test: Weight to be 1/2 ≤ L₁ ≤ Maximum capacity

Determination of the standard deviation of weighing balance., Readability 0.00001 (g)

Nominal test value (g)	Standard Deviation
20	0.00005

Error of Indication: from nominal value., Readability 0.00001 (g)

Nominal Value (g)	Conventional Mass (g)	Indication (g)	Correction of Balance (g)	Uncertainty (g)	k
0	0.000000	0.00000	0.00000	0.000016	2.52
0.1	0.100000	0.10000	0.00000	0.000019	2.00
0.5	0.499999	0.50000	0.00000	0.000019	2.00
2	2.000010	1.99999	0.00002	0.000024	2.00
5	5.000005	5.00001	0.00000	0.000027	2.00
10	10.000015	10.00001	0.00000	0.000031	2.00
20	20.000019	20.00001	0.00001	0.000042	2.00
30	30.000034	30.00006	-0.00003	0.000069	2.00

Note: Weight of adjust (g)

The End of Certificate

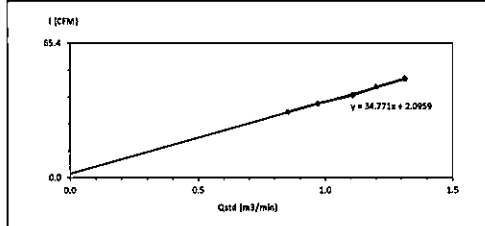
PTC-FMC-07-02 2 Feb 2020



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf/P NKK Co., Ltd. Barometric Pressure (mm Hg) : 755
Calibrate Location : สุพรรณบุรี Temperature (°C) : 30
Calibrate Date : 25-May-22 High Volume ID : BKK FS0387
Calibration Sheet No. : C-250522-BKK FS0387 High Volume Model : G1051
Calibrator ID : BKK FS0625 High Volume S/N : 1626
Calibrator Model : TE-5028A Calibrator Slope : 1.67326
Calibrator S/N : 2585 Calibrator Intercept : -0.01954

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.0	0.8550	32	Slope: 34.7709 Intercept: 2.0959 Correlation Coefficient: 0.9983
2	2.6	0.9721	36	
3	3.4	1.1088	40	
4	4.0	1.2010	44	
5	4.8	1.3138	48	



Calibrated by: [Signature]
(Mr. Bantha Namkhet)
Field Scientist (2)

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

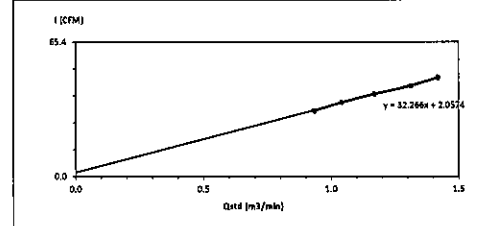
FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf/P NKK Co., Ltd. Barometric Pressure (mm Hg) : 755
Calibrate Location : สุพรรณบุรี Temperature (°C) : 30
Calibrate Date : 25-May-22 High Volume ID : BKK FS0374
Calibration Sheet No. : C-250522-BKK FS0374 High Volume Model : TE-5009X
Calibrator ID : BKK FS0625 High Volume S/N : 5195
Calibrator Model : TE-5028A Calibrator Slope : 1.67326
Calibrator S/N : 2585 Calibrator Intercept : -0.01954

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.4	0.9347	32	Slope: 32.2658 Intercept: 2.6574 Correlation Coefficient: 0.9987
2	3.0	1.0427	36	
3	3.8	1.1711	40	
4	4.8	1.3138	44	
5	5.6	1.4175	48	



Calibrated by: [Signature]
(Mr. Bantha Namkhet)
Field Scientist (2)

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

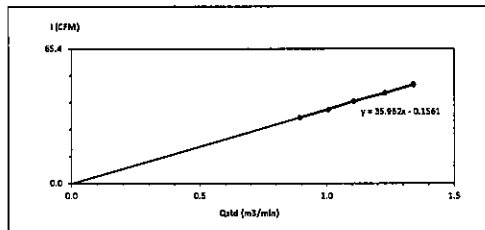
FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf/P NKK Co., Ltd. Barometric Pressure (mm Hg) : 755
Calibrate Location : สุพรรณบุรี Temperature (°C) : 30
Calibrate Date : 25-May-22 High Volume ID : BKK FS1061
Calibration Sheet No. : C-250522-BKK FS1061 High Volume Model : TE-5009X
Calibrator ID : BKK FS0625 High Volume S/N : 5504
Calibrator Model : TE-5028A Calibrator Slope : 1.67326
Calibrator S/N : 2585 Calibrator Intercept : -0.01954

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.2	0.9357	32	Slope: 35.9619 Intercept: -0.1561 Correlation Coefficient: 0.9997
2	2.8	1.0080	36	
3	3.4	1.1088	40	
4	4.2	1.2302	44	
5	5.0	1.2404	48	



Calibrated by: [Signature]
(Mr. Bantha Namkhet)
Field Scientist (2)

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

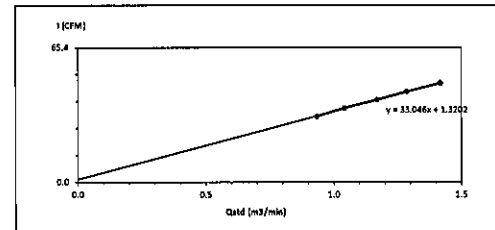
FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



High Volume Air Sampler Calibration Worksheet

Project Site : Gulf/P NKK Co., Ltd. Barometric Pressure (mm Hg) : 755
Calibrate Location : สุพรรณบุรี Temperature (°C) : 30
Calibrate Date : 25-May-22 High Volume ID : BKK FS1063
Calibration Sheet No. : C-250522-BKK FS1063 High Volume Model : TE-5009X
Calibrator ID : BKK FS0625 High Volume S/N : 5685
Calibrator Model : TE-5028A Calibrator Slope : 1.67326
Calibrator S/N : 2585 Calibrator Intercept : -0.01954

Test No.	Delta H ₂ O (Inch)	Q _{std} (m ³ /min)	I : Chart (CFM)	Linear Regression
1	2.4	0.9347	32	Slope: 33.0458 Intercept: 1.3292 Correlation Coefficient: 0.9995
2	3.0	1.0427	36	
3	3.8	1.1711	40	
4	4.6	1.2865	44	
5	5.6	1.4175	48	



Calibrated by: [Signature]
(Mr. Bantha Namkhet)
Field Scientist (2)

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

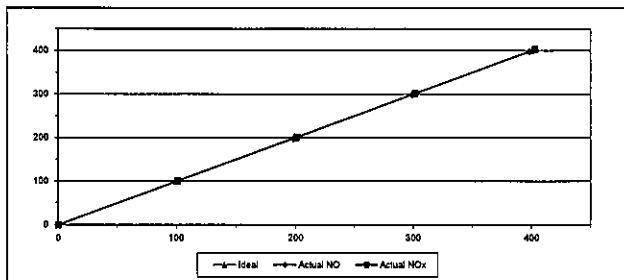
FORM NO: F 06-074 REVISION NO.: ISSUE DATE: 14/03/16



MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-22 Equipment Name NOx Analyzer
 Manufacturer HORIBA Model APNA-370
 Serial No. XLTWBBSJ Equipment ID BKK_F81062
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 847
 Std. Gas Concentration (PPM) 51.33 Cylinder No. LL38633
 Cylinder Pressure (psi) 1200 Certified By Algas Inc.
 Certified Date 18-Mar-14 Expired Date 18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.70	-0.30	-0.30	101.00	1.00	1.00
2	200.00	198.10	-1.90	-0.95	201.00	1.00	0.50
3	300.00	299.10	-0.90	-0.30	301.40	1.40	0.47
4	400.00	398.20	-1.80	-0.45	402.60	2.60	0.70
AVERAGE (%)				-0.38			0.55



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

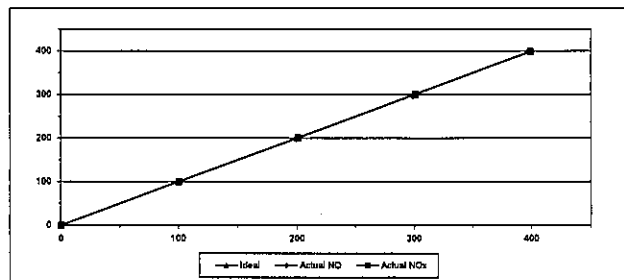
Approved By

(Mr. Sarayuth Jitranont)
Assistant General ManagerALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12

MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-22 Equipment Name NOx Analyzer
 Manufacturer HORIBA Model APNA-370
 Serial No. TLTATGDW Equipment ID BKK_F80785
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 847
 Std. Gas Concentration (PPM) 51.33 Cylinder No. LL38633
 Cylinder Pressure (psi) 1200 Certified By Algas Inc.
 Certified Date 18-Mar-14 Expired Date 18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	100.50	0.50	0.50
2	200.00	199.50	-0.50	-0.25	200.70	0.70	0.35
3	300.00	299.00	-1.00	-0.33	301.10	1.10	0.37
4	400.00	399.70	-0.30	-0.08	399.00	-0.70	-0.25
AVERAGE (%)				-0.36			0.21



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

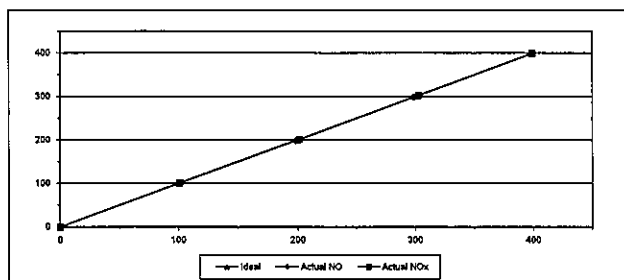
Approved By

(Mr. Sarayuth Jitranont)
Assistant General ManagerALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12

MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-22 Equipment Name NOx Analyzer
 Manufacturer HORIBA Model APNA-370
 Serial No. R26ED9EW Equipment ID BKK_F80789
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 847
 Std. Gas Concentration (PPM) 51.33 Cylinder No. LL38633
 Cylinder Pressure (psi) 1200 Certified By Algas Inc.
 Certified Date 18-Mar-14 Expired Date 18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	99.00	-1.00	-1.00	101.10	1.10	1.10
2	200.00	198.20	-1.80	-0.90	201.30	1.30	0.65
3	300.00	296.50	-3.50	-1.17	302.50	2.50	0.83
4	400.00	396.50	-3.50	-0.88	396.90	-3.10	-0.78
AVERAGE (%)				-0.54			0.48



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

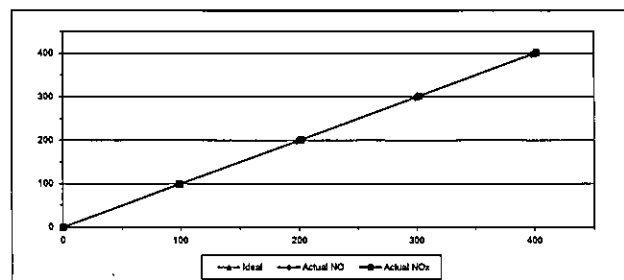
Approved By

(Mr. Sarayuth Jitranont)
Assistant General ManagerALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12

MULTIPOINT CALIBRATION REPORT

Calibration Date 4-Jan-22 Equipment Name NOx Analyzer
 Manufacturer HORIBA Model APNA-370
 Serial No. 8UDL58MU Equipment ID BKK_F81060
 Calibrator Manufacturer Teledyne API Model 700
 Serial No. 847
 Std. Gas Concentration (PPM) 51.33 Cylinder No. LL38633
 Cylinder Pressure (psi) 1200 Certified By Algas Inc.
 Certified Date 18-Mar-14 Expired Date 18-Mar-22

Point	CALIBRATION RESULTS						
	Ideal	Actual NO	Error NO	%Error NO	Actual NOx	Error NOx	%Error NOx
ZERO	0.00	0.10	0.10	0.10	0.10	0.10	0.10
1	100.00	98.70	-1.30	-1.30	99.10	-0.90	-0.90
2	200.00	198.30	-1.70	-0.85	201.50	1.50	0.75
3	300.00	299.30	-0.70	-0.23	302.20	2.20	0.73
4	400.00	398.00	-2.00	-0.50	401.70	1.70	0.42
AVERAGE (%)				-0.58			0.22



Calibrated By

(Mr. Jirawat Sakam)
Field Environmental Scientist (3)

Approved By

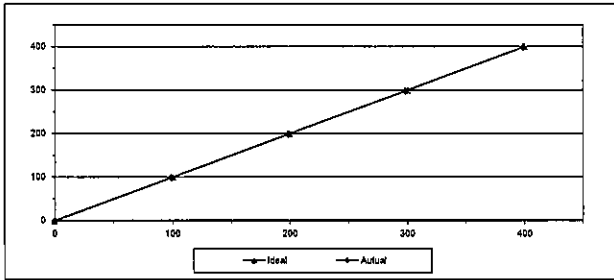
(Mr. Sarayuth Jitranont)
Assistant General ManagerALS Laboratory Group
FORM NO.: F 06-056 REVISION NO.: ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date: 4-Jan-22
Manufacturer: HORIBA
Serial No.: 8BVW9P1K
Calibrator Manufacturer: Teledyne API
Serial No.: 947
Std. Gas Concentration (PPM): 50.87
Cylinder Pressure (psi): 1200
Certified Date: 18-Mar-14
Equipment Name: SO2 Analyzer
Model: AP8A-370
Equipment ID: BKCF81091
Model: 700
Cylinder No.: LL36633
Certified By: Algas Inc.
Expired Date: 18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.50	-1.50	-1.50
2	200.00	198.30	-1.70	-0.85
3	300.00	297.90	-2.10	-0.70
4	400.00	398.50	-1.50	-0.38
AVERAGE (%)				-0.67



Calibrated By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By

(Mr.Sasayuth Jitranont)
Assistant General Manager

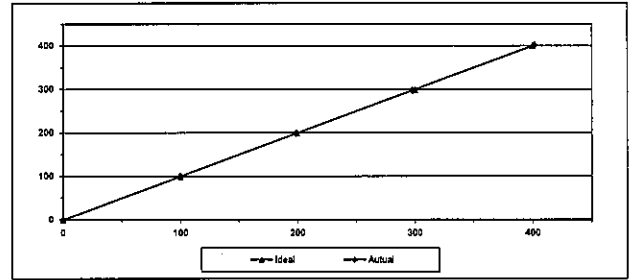
ALS Laboratory Group
FORM NO.: F 08-058 REVISION NO.: 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date: 4-Jan-22
Manufacturer: HORIBA
Serial No.: 3C723HB
Calibrator Manufacturer: Teledyne API
Serial No.: 947
Std. Gas Concentration (PPM): 50.87
Cylinder Pressure (psi): 1200
Certified Date: 18-Mar-14
Equipment Name: SO2 Analyzer
Model: AP8A-370
Equipment ID: BKCF80784
Model: 700
Cylinder No.: LL36633
Certified By: Algas Inc.
Expired Date: 18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	99.50	-0.40	-0.40
2	200.00	198.50	-1.50	-0.75
3	300.00	297.90	-2.10	-0.70
4	400.00	401.50	1.50	0.38
AVERAGE (%)				-0.28



Calibrated By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By

(Mr.Sasayuth Jitranont)
Assistant General Manager

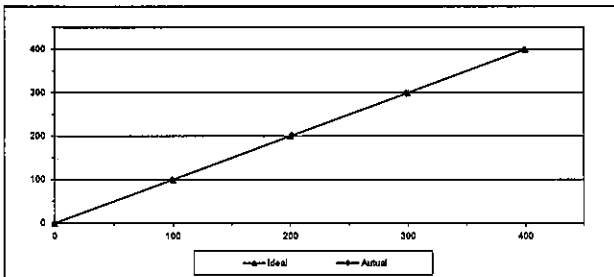
ALS Laboratory Group
FORM NO.: F 08-058 REVISION NO.: 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date: 4-Jan-22
Manufacturer: HORIBA
Serial No.: PFDWAYU4
Calibrator Manufacturer: Teledyne API
Serial No.: 947
Std. Gas Concentration (PPM): 50.87
Cylinder Pressure (psi): 1200
Certified Date: 18-Mar-14
Equipment Name: SO2 Analyzer
Model: AP8A-370
Equipment ID: BKCF80788
Model: 700
Cylinder No.: LL36633
Certified By: Algas Inc.
Expired Date: 18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.05	0.05	0.05
1	100.00	99.00	-1.00	-1.00
2	200.00	201.30	1.30	0.65
3	300.00	298.30	-1.70	-0.57
4	400.00	398.60	-1.40	-0.35
AVERAGE (%)				-0.24



Calibrated By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By

(Mr.Sasayuth Jitranont)
Assistant General Manager

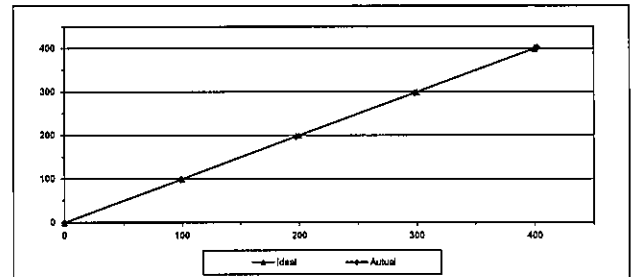
ALS Laboratory Group
FORM NO.: F 08-058 REVISION NO.: 1 ISSUE DATE: 02/04/12



MULTIPOINT CALIBRATION REPORT

Calibration Date: 4-Jan-22
Manufacturer: HORIBA
Serial No.: XGYYV1AU
Calibrator Manufacturer: Teledyne API
Serial No.: 947
Std. Gas Concentration (PPM): 50.87
Cylinder Pressure (psi): 1200
Certified Date: 18-Mar-14
Equipment Name: SO2 Analyzer
Model: AP8A-370
Equipment ID: BKCF81089
Model: 700
Cylinder No.: LL36633
Certified By: Algas Inc.
Expired Date: 18-Mar-22

Point	CALIBRATION RESULTS			
	Ideal	Actual	Error	%Error
ZERO	0.00	0.10	0.10	0.10
1	100.00	98.80	-1.20	-1.20
2	200.00	197.40	-2.60	-1.30
3	300.00	297.80	-2.20	-0.73
4	400.00	402.00	2.00	0.50
AVERAGE (%)				-0.53



Calibrated By

(Mr.Jirawut Sakam)
Field Environmental Scientist (3)

Approved By

(Mr.Sasayuth Jitranont)
Assistant General Manager

ALS Laboratory Group
FORM NO.: F 08-058 REVISION NO.: 1 ISSUE DATE: 02/04/12

CERTIFICATE OF CALIBRATION

Certificate No: WS-08082021
Page 1 of 2 pages

Measurement Item : Cup anemometer with data logger.

Manufacturer : Data logger: Novolyne,
Cup anemometer: Novolyne.

Model/Type : Data logger: 200-WS-25LB,
Cup anemometer: WS-02F.

Serial Number : Data logger: A5378,
Cup anemometer: -.

ID No : Data logger: BKH_F50918,
Cup anemometer: -.

Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanahan 40, Phatthanahan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Thailand.

Test Conditions : Wind tunnel cross test section area 600 cm²
Anemometer frontal area 100 cm²
Diameter of mounting pipe - mm
Blockage ratio of test object 0.111 [-]

Test Conditions : Air temperature 25.6 ±0.6 °C
Air pressure 1009.6 ±0.4 hPa
Relative air humidity 50.4 ±3.5 %RH

Calibration Procedure : Calibration was carried out base on:
ISO 91400-12-1 (2011) 2005 Power Performance Measurements of Capacity Producing Wind
Turbines.
MAGNET Anemometer Calibration Procedure - Version 2 2009.

Traceability : This calibration documents the traceable to national standards which realize the unit of
measurements according to the international system of units (SI) through National Institute of
Metrology (NIMT).

Measurement Date : Aug 30, 2021.
Issued Date : Aug 31, 2021.

Calibrated by
☒ Mr. Sorawat Thachalad
☐ Miss Orathai Wivattakaya



Approved Signatory: *[Signature]*
Mr. Parinya Booncharoen
Technical Support
and Calibration Manager

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

Continuation of Certificate of Calibration Number

Certificate No: WS-08082021
Page 2 of 2 pages

Result of calibration: ☒ Without adjustment ☐ With adjustment
Calibration in the range of 1 - 16 m/s at a calibration interval of 1 m/s.
The results of calibration and associated measurement uncertainties are reported in the table below.

Vane Reading m/s	Vane Reading m/s	Error m/s	Uncertainty m/s
2.021	1.8	-0.2	2.9
4.074	3.9	-0.2	1.6
5.98	6.0	0.0	0.99
8.03	8.0	0.0	0.84
10.03	10.2	0.2	0.88
11.99	12.3	0.3	0.95
13.98	14.4	0.4	0.47
16.00	16.0	0.0	0.45
16.02	16.5	0.6	0.69
16.98	16.4	-0.4	0.67
16.99	11.2	-0.2	0.69
6.97	9.0	0.0	0.97
7.01	7.0	0.0	0.90
5.085	6.0	-0.1	0.96
2.970	3.0	0.0	1.7
1.019	0.7	-0.3	5.4

UUC: Unit Under Calibration

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

Appendix 1: Instrumentations

NO	Sensor	Manufacturer	Model/Type	Calibration Date	Certificate Report Number	Range
1	Push state	YESTO INC	DS302145	Aug 07, 2021	WV-0034-21	5 - 30 m/s
2	Precision Differential Pressure Meter	Zepco	DP-2500	Aug 07, 2021	WV-0034-21	5 - 30 m/s
3	Air velocity introduction (flat wall)	TSI INC	8465-12	Aug 08, 2021	WV-0035-21	0 - 5 m/s
4	Temperature	Zagab	DSH-TIP	March 30, 2021	CL-077-04	30 - 70°C
5	Relative humidity	Zagab	DSH-TIP	March 30, 2021	RV-03632021	0 - 100 %RH
6	Atmospheric pressure	Zagab	DSH-TIP	March 30, 2021	BP-01612021	500 - 1100 hPa
7	Wind tunnel	CECOW	MP3300	-	-	0 - 60 Hz

End of certificate of calibration



CERTIFICATE OF CALIBRATION

Certificate No: WD-07082021
Page 1 of 2 pages

Measurement Item : Wind direction sensor with data logger.

Manufacturer : Data logger: Novolyne,
Wind direction sensor: Novolyne.

Model/Type : Data logger: 200-WS-25LB,
Wind direction sensor: WS-02F.

Serial Number : Data logger: A5378,
Wind direction sensor: -.

ID No : Data logger: BKH_F50918,
Wind direction sensor: -.

Customer : ALS laboratory group (Thailand) Co., Ltd.
104 Phatthanahan 40, Phatthanahan Rd, Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250
Thailand.

Environmental Condition:
The measurement was carried out in an ambient temperature of (23±3)°C, and relative humidity of (40±10)%.

Measurement Method:
The wind direction sensor calibration according to comparison method with reference angle measurement electronic theodolite and
the laser is used for air's control. The measurement were taken at 45° intervals in clockwise and counterclockwise
directions.

Note: The UUC was warmed 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: CO563-07-0045,
Certificate No: WWS63/0044.

Measurement Date : Aug 30, 2021.
Issued Date : Aug 31, 2021.

Performed by
☒ Mr. Sorawat Thachalad
☐ Miss Orathai Wivattakaya



Approved Signatory: *[Signature]*
Mr. Parinya Booncharoen
Technical Support
and Calibration Manager

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

Continuation of Certificate of Calibration Number

Certificate No: WD-07082021
Page 2 of 2 pages

Result of calibration: ☐ Without adjustment ☒ With adjustment.
Calibration in the range of 0 - 360 ° at a calibration interval of 45°.
The results of calibration and associated measurement uncertainties are reported in table below.

NO	Turning Direction	Nominal Angle (°)	Standard Reading (°)	UUC* Reading (°)	Error (°)	Uncertainty x(°)
1	Clockwise	0/360	360	359	-1	3.0
2		45	45	43	-2	3.0
3		90	90	87	-3	3.0
4		135	135	132	-3	3.0
5		180	180	180	0	3.0
6		225	225	224	-1	3.0
7		270	270	274	4	3.0
8		315	315	319	4	3.0
9	Counter Clockwise	0/360	360	359	-1	3.0
10		45	45	43	-2	3.0
11		90	90	87	-3	3.0
12		135	135	132	-3	3.0
13		180	180	180	0	3.0
14		225	225	228	3	3.0
15		270	270	274	4	3.0
16		315	315	319	4	3.0

UUC: Unit Under Calibration The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage fac-
tor $k=2$ providing a level of confidence of approximately 95%

End of Certificate of Calibration





Lot No. 2214528-1

ANALYZER CALIBRATION DATA

Client : Gulf JP NKK Co., Ltd. Location : Uda HRBQ 11
Date : 27 May 22 Test Operator : Anurat M.O₂ ANALYZER
Model : TELEDYNE API 200SH Serial No. : 482
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.11	0.08	0.12
Low-Level Gas	8.00	8.13	8.00	0.52
Span Gas	15.02	15.17	15.09	0.32

NO₂ ANALYZER
Model : TELEDYNE API T200H Serial No. : 482
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.02	0.02
Low-Level Gas	50.32	50.75	50.55	0.23
Span Gas	79.55	80.11	80.87	0.55

SO₂ ANALYZER
Model : TELEDYNE API T100H Serial No. : 324
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	50.27	50.00	50.22	0.22
Span Gas	79.95	80.67	80.00	0.67

CO ANALYZER
Model : TELEDYNE API T300M Serial No. : 377
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.04	0.03	0.01
Low-Level Gas	49.89	48.89	49.59	0.60
Span Gas	80.10	80.58	80.88	0.32

Calibrated by

Anurat M

(Mr. Anurat Moungpa)
Environmental Field Scientist (2)

FORM NO. F 05-002 REVISION NO. 2 ISSUE DATE: 3/6/19

ALS Laboratory Group



Lot No. 2214528-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client : Gulf JP NKK Co., Ltd. Location : Uda HRBQ 11
Date : 27 May 22 Test Operator : Anurat M.O₂ ANALYZER
Cylinder Conc. (%) : 15.02 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values	System Calibration Response	System Cal Bias (% of Span)	Final Values	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.11	0.00	0.44	0.00	0.00	0.44	0.00	0.00
Upscale Gas	15.17	15.10	0.28	15.12	0.20	0.44	0.00	0.00

NO₂ ANALYZER
Cylinder Conc. (ppm) : 79.55 Span (ppm) : 100

	NO ₂ Analyzer Calibration Response	Initial Values	System Calibration Response	System Cal Bias (% of Span)	Final Values	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.04	0.14	0.10	0.11	0.07	0.03	0.03	0.03
Upscale Gas	80.11	80.44	0.33	80.10	0.01	0.01	0.01	0.01

SO₂ ANALYZER
Cylinder Conc. (ppm) : 79.95 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values	System Calibration Response	System Cal Bias (% of Span)	Final Values	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	80.67	80.75	0.11	80.67	0.00	0.00	0.11	0.11

CO ANALYZER
Cylinder Conc. (ppm) : 80.10 Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values	System Calibration Response	System Cal Bias (% of Span)	Final Values	System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.04	0.02	0.02	0.03	0.01	0.01	0.01	0.01
Upscale Gas	80.58	80.75	0.22	81.00	0.44	0.44	0.22	0.22

Calibrated by

Anurat M

(Mr. Anurat Moungpa)

Environmental Field Scientist (2)

FORM NO. F 05-002 REVISION NO. 2 ISSUE DATE: 3/6/19

ALS Laboratory Group



EMISSION TEST RESULT

Client : Gulf JP NKK Co., Ltd. Run # : 1
Date : 27 May 22 Location : Uda HRBQ 11
Start Time : 10:30 Test Operator : Anurat M.
Finish Time : 10:50
O₂ Analyzer Model : TELEDYNE API T100H Serial No. : 324
NO₂/O₂ Analyzer Model : TELEDYNE API T300H Serial No. : 482
CO/CO₂ Analyzer Model : TELEDYNE API T300M Serial No. : 377

Time (min)	O ₂ (%)	CO ₂ (%)	NOx (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:30	14.23	3.99	12.51	0.07	0.40	
10:31	14.22	4.01	12.58	0.06	0.39	
10:32	14.22	3.98	12.77	0.08	0.26	
10:33	14.22	4.00	12.31	0.06	0.20	
10:34	14.24	4.05	12.26	0.07	0.29	
10:35	14.22	4.02	12.27	0.06	0.41	
10:36	14.21	4.06	12.31	0.06	0.42	
10:37	14.23	4.00	12.36	0.06	0.32	
10:38	14.22	4.02	12.33	0.05	0.31	
10:39	14.24	4.02	12.31	0.06	0.25	
10:40	14.23	4.00	12.36	0.05	0.27	
10:41	14.24	4.02	12.38	0.06	0.29	
10:42	14.24	4.05	12.44	0.06	0.34	
10:43	14.25	4.00	12.50	0.06	0.31	
10:44	14.25	3.99	12.53	0.06	0.23	
10:45	14.25	4.01	12.54	0.06	0.39	
10:46	14.24	4.01	12.59	0.07	0.22	
10:47	14.24	4.01	12.67	0.05	0.24	
10:48	14.24	4.04	12.66	0.06	0.31	
10:49	14.23	4.03	12.64	0.05	0.37	
10:50	14.23	4.02	12.67	0.06	0.43	
Average	14.23	4.01	12.71	0.06	0.32	

Anurat M

(Mr. Anurat Moungpa)

Environmental Field Scientist (2)

FORM NO. F 05-002 REVISION NO. 2 ISSUE DATE: 3/6/19

ALS Laboratory Group



EMISSION TEST RESULT

Client : Gulf JP NKK Co., Ltd. Run # : 2
Date : 27 May 22 Location : Uda HRBQ 11
Start Time : 10:51 Test Operator : Anurat M.
Finish Time : 11:15
O₂ Analyzer Model : TELEDYNE API T100H Serial No. : 324
NO₂/O₂ Analyzer Model : TELEDYNE API T300H Serial No. : 482
CO/CO₂ Analyzer Model : TELEDYNE API T300M Serial No. : 377

Time (min)	O ₂ (%)	CO ₂ (%)	NOx (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
10:51	14.23	4.03	12.65	0.06	0.41	
10:52	14.24	4.02	12.58	0.06	0.34	
10:53	14.23	4.02	12.51	0.07	0.38	
10:54	14.23	4.04	12.51	0.06	0.45	
10:55	14.22	3.99	12.67	0.07	0.44	
10:56	14.23	4.01	12.66	0.06	0.42	
10:57	14.23	3.99	14.26	0.06	0.44	
10:58	14.21	4.02	13.37	0.06	0.34	
10:59	14.22	4.01	12.74	0.06	0.35	
11:00	14.22	4.00	12.68	0.06	0.42	
11:01	14.25	4.02	12.58	0.06	0.25	
11:02	14.24	4.03	12.46	0.06	0.25	
11:03	14.23	4.02	12.46	0.06	0.35	
11:04	14.23	4.03	12.53	0.06	0.42	
11:05	14.22	4.02	12.60	0.06	0.37	
11:06	14.23	3.99	12.63	0.07	0.31	
11:07	14.23	4.02	12.60	0.07	0.34	
11:08	14.23	4.05	12.68	0.07	0.33	
11:09	14.23	4.02	12.69	0.07	0.33	
11:10	14.24	4.04	12.63	0.07	0.30	
11:11	14.23	4.02	12.49	0.06	0.35	
Average	14.23	4.02	12.65	0.06	0.36	

Anurat M

(Mr. Anurat Moungpa)

Environmental Field Scientist (2)

FORM NO. F 05-002 REVISION NO. 2 ISSUE DATE: 3/6/19

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf J.P. NKK Co., Ltd. Location: Udon HRBQ 11
Date: 27 May 22 Test Operator: Anusrit M.
Start Time: 11:12 Finish Time: 11:32
SO₂ Analyzer Model: TELEDYNE API T100H Serial No.: 324
NO_x/CO₂ Analyzer Model: TELEDYNE API T200H Serial No.: 482
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No.: 377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:12	14.24	4.01	12.48	0.06	0.35	
11:13	14.24	4.01	12.53	0.07	0.37	
11:14	14.23	4.02	12.57	0.06	0.36	
11:15	14.23	3.99	12.59	0.06	0.39	
11:16	14.24	3.85	12.62	0.05	0.40	
11:17	14.24	4.02	12.83	0.05	0.28	
11:18	14.24	4.01	12.50	0.06	0.28	
11:19	14.25	4.05	12.55	0.05	0.25	
11:20	14.25	4.01	12.47	0.06	0.39	
11:21	14.25	4.05	12.49	0.05	0.37	
11:22	14.24	4.03	12.51	0.05	0.33	
11:23	14.25	4.06	12.46	0.05	0.25	
11:24	14.25	4.02	12.36	0.06	0.32	
11:25	14.25	4.00	12.35	0.06	0.28	
11:26	14.24	4.00	12.42	0.05	0.34	
11:27	14.23	4.03	12.44	0.06	0.42	
11:28	14.22	3.99	12.47	0.05	0.47	
11:29	14.25	3.99	12.39	0.05	0.41	
11:30	14.24	4.05	12.22	0.05	0.32	
11:31	14.22	4.04	12.18	0.05	0.31	
11:32	14.22	4.02	12.21	0.05	0.33	
Average	14.24	4.01	12.48	0.06	0.35	

Anusrit M

(Mr. Anusrit Moungpak)

Environmental Field Scientist (2)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE: 306/19

ALS Laboratory Group



Lot No. 2214528-1

ANALYZER CALIBRATION DATA

Client: Gulf J.P. NKK Co., Ltd. Location: Udon HRBQ 12
Date: 28 May 22 Test Operator: Anusrit M.
SO₂ Analyzer Model: TELEDYNE API 200EH Serial No.: 482
Span (%) : 25

	Cylinder Value (%)	Initial Analyzers Calibration Response (%)	Final Analyzers Calibration Response (%)	Difference (Percent of Span)
Zero Gas	0.00	0.07	0.08	0.04
Low-Level Gas	8.00	6.02	8.11	0.35
Span Gas	15.02	15.55	15.52	0.16

NO_x ANALYZER Model: TELEDYNE API T200H Serial No.: 482
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.08	0.12	0.05
Low-Level Gas	50.32	49.23	50.00	0.77
Span Gas	79.55	78.89	78.11	0.12

SO₂ ANALYZER Model: TELEDYNE API T100H Serial No.: 324
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.00	0.00	0.00
Low-Level Gas	50.27	50.11	50.00	0.11
Span Gas	79.95	81.00	80.05	0.92

CO ANALYZER Model: TELEDYNE API T300M Serial No.: 377
Span (ppm) : 100

	Cylinder Value (ppm)	Initial Analyzers Calibration Response (ppm)	Final Analyzers Calibration Response (ppm)	Difference (Percent of Span)
Zero Gas	0.00	0.03	0.04	0.01
Low-Level Gas	49.99	50.23	50.12	0.11
Span Gas	80.10	80.55	81.00	0.44

Calibrated by

Anusrit M

(Mr. Anusrit Moungpak)

Environmental Field Scientist (2)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE: 306/19

ALS Laboratory Group



Lot No. 2214528-1

SYSTEM CALIBRATION BIAS AND DRIFT DATA

Client: Gulf J.P. NKK Co., Ltd. Location: Udon HRBQ 12
Date: 28 May 22 Test Operator: Anusrit M.

O₂ ANALYZER Cylinder Conc. (%) : 15.02 Span (%) : 25

	O ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.07	0.04	0.12	0.00	0.28	0.16
Upscale Gas	15.55	15.00	0.48	15.12	0.85	0.48

NO_x ANALYZER Cylinder Conc. (ppm) : 79.55 Span (ppm) : 100

	NO _x Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.05	0.11	0.05	0.16	0.10	0.05
Upscale Gas	78.95	79.22	0.23	79.00	0.01	0.22

SO₂ ANALYZER Cylinder Conc. (ppm) : 79.55 Span (ppm) : 100

	SO ₂ Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.00	0.00	0.00	0.00	0.00	0.00
Upscale Gas	81.00	80.67	0.33	80.77	0.23	0.10

CO ANALYZER Cylinder Conc. (ppm) : 80.10 Span (ppm) : 100

	CO Analyzer Calibration Response	Initial Values System Calibration Response	System Cal Bias (% of Span)	Final Values System Calibration Response	System Cal Bias (% of Span)	Drift (% of Span)
Zero Gas	0.04	0.02	0.02	0.03	0.01	0.01
Upscale Gas	80.55	80.78	0.22	80.99	0.43	0.21

Calibrated by

Anusrit M

(Mr. Anusrit Moungpak)

Environmental Field Scientist (2)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE: 306/19

ALS Laboratory Group



EMISSION TEST RESULT

Client: Gulf J.P. NKK Co., Ltd. Location: Udon HRBQ 12
Date: 28 May 22 Test Operator: Anusrit M.
Start Time: 11:00 Finish Time: 11:20
SO₂ Analyzer Model: TELEDYNE API T100H Serial No.: 324
NO_x/CO₂ Analyzer Model: TELEDYNE API T200H Serial No.: 482
CO/CO₂ Analyzer Model: TELEDYNE API T300M Serial No.: 377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:00	14.15	3.98	13.98	0.03	0.57	
11:01	14.17	3.97	13.98	0.03	0.50	
11:02	14.18	3.96	13.96	0.02	0.44	
11:03	14.14	3.96	13.90	0.03	0.50	
11:04	14.15	3.95	13.92	0.02	0.49	
11:05	14.15	4.00	13.98	0.02	0.47	
11:06	14.15	3.97	13.85	0.02	0.50	
11:07	14.15	3.99	13.98	0.02	0.50	
11:08	14.15	3.97	13.92	0.03	0.51	
11:09	14.15	3.99	13.81	0.04	0.57	
11:10	14.15	3.94	13.85	0.02	0.55	
11:11	14.15	3.95	13.83	0.02	0.55	
11:12	14.15	3.99	13.84	0.03	0.55	
11:13	14.15	3.97	13.95	0.02	0.55	
11:14	14.15	4.01	13.95	0.00	0.51	
11:15	14.15	4.00	13.80	0.00	0.50	
11:16	14.15	3.96	13.84	0.02	0.55	
11:17	14.16	3.94	13.92	0.02	0.55	
11:18	14.17	3.95	13.99	0.00	0.50	
11:19	14.16	3.94	13.99	0.00	0.53	
11:20	14.16	3.97	14.01	0.02	0.57	
Average	14.16	3.97	13.91	0.02	0.55	

Anusrit M

(Mr. Anusrit Moungpak)

Environmental Field Scientist (2)

FORM NO. F-06-002 REVISION NO. 2 ISSUE DATE: 306/19

ALS Laboratory Group



EMISSION TEST RESULT

Client	Quif JP KHK Co., Ltd.	Run #	2
Date	28 May 22	Location	UJae HR&S 12
Start Time	11:21	Test Operator	Amnat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	11:41
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	324
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	482
		Serial No.	377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:21	14.15	3.98	14.02	0.03	0.55	
11:22	14.15	3.96	14.05	0.03	0.56	
11:23	14.15	3.97	14.05	0.02	0.54	
11:24	14.15	4.00	13.99	0.03	0.53	
11:25	14.15	3.99	14.00	0.02	0.71	
11:26	14.14	3.95	13.99	0.02	0.53	
11:27	14.15	3.99	13.98	0.02	0.47	
11:28	14.15	3.95	13.88	0.03	0.49	
11:29	14.15	4.01	13.78	0.03	0.56	
11:30	14.14	3.97	13.78	0.03	0.80	
11:31	14.14	4.00	13.79	0.03	0.55	
11:32	14.15	4.00	13.80	0.03	0.47	
11:33	14.15	3.98	13.78	0.04	0.42	
11:34	14.15	3.87	13.73	0.02	0.47	
11:35	14.15	3.88	13.79	0.04	0.58	
11:36	14.15	3.97	13.87	0.03	0.63	
11:37	14.15	3.94	13.81	0.02	0.62	
11:38	14.15	3.98	13.91	0.03	0.62	
11:39	14.15	3.95	13.88	0.04	0.58	
11:40	14.15	3.95	13.85	0.04	0.59	
11:41	14.15	3.99	13.86	0.03	0.53	
Average	14.15	3.97	13.88	0.03	0.57	

Amnat M

(Mr. Amnat Moungsai)

Environmental Field Scientist (2)

FORM NO.: F-05-082 REVISION NO.: 2 ISSUE DATE: 3/26/19

ALS Laboratory Group



EMISSION TEST RESULT

Client	Quif JP KHK Co., Ltd.	Run #	3
Date	28 May 22	Location	UJae HR&S 12
Start Time	11:42	Test Operator	Amnat M.
SO ₂ Analyzer Model	TELEDYNE API T100H	Finish Time	12:02
NO _x /O ₂ Analyzer Model	TELEDYNE API T200H	Serial No.	324
CO/CO ₂ Analyzer Model	TELEDYNE API T300M	Serial No.	482
		Serial No.	377

Time (min)	O ₂ (%)	CO ₂ (%)	NO _x (ppm)	SO ₂ (ppm)	CO (ppm)	Remark
11:42	14.15	3.97	13.85	0.03	0.51	
11:43	14.17	3.95	13.84	0.04	0.53	
11:44	14.17	4.00	13.82	0.03	0.52	
11:45	14.15	3.98	13.81	0.03	0.48	
11:46	14.15	3.97	13.89	0.03	0.49	
11:47	14.15	3.98	13.88	0.04	0.50	
11:48	14.17	3.93	13.83	0.04	0.48	
11:49	14.17	3.95	13.87	0.04	0.57	
11:50	14.15	3.98	13.91	0.03	0.51	
11:51	14.17	3.95	13.87	0.03	0.53	
11:52	14.16	3.95	13.97	0.03	0.53	
11:53	14.16	3.95	13.98	0.04	0.58	
11:54	14.17	3.99	13.95	0.04	0.58	
11:55	14.15	4.02	13.89	0.04	0.52	
11:56	14.17	3.94	13.79	0.03	0.47	
11:57	14.15	3.95	13.81	0.04	0.53	
11:58	14.15	3.98	13.84	0.03	0.54	
11:59	14.15	3.95	13.65	0.03	0.45	
12:00	14.15	3.97	13.86	0.03	0.40	
12:01	14.15	4.01	13.97	0.03	0.51	
12:02	14.15	3.95	13.88	0.03	0.47	
Average	14.17	3.97	13.89	0.03	0.51	

Amnat M

(Mr. Amnat Moungsai)

Environmental Field Scientist (2)

FORM NO.: F-05-082 REVISION NO.: 2 ISSUE DATE: 3/26/19

ALS Laboratory Group



an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
6441 Easton Road
Bldg 1
Plumsteadville, PA 18949
Airgas.comCERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E3HA0002 Reference Number: 160-401754137-1
Cylinder Number: GN0024388 Cylinder Volume: 247.2 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2215 PSIG
PGVP Number: A12020 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Mar 26, 2020
Expiration Date: Mar 26, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/31, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 ppm, i.e. 0.1 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	50.32 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/25/2020
CARBON MONOXIDE	50.00 PPM	49.99 PPM	G1	+/- 0.5% NIST Traceable	03/19/2020
NITRIC OXIDE	50.00 PPM	50.32 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/25/2020
SULFUR DIOXIDE	50.00 PPM	50.27 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/25/2020
NITROGEN	Balance				

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
NTRM	11010130	KAL004536	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
NTRM	13010405	KAL003984	97.80 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	13010405	KAL003984	97.80 PPM NOX/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	18010235	KAL004419	97.59 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO - 000928781	FTIR	Mar 12, 2020
MKS FTIR - NO - 000928781	FTIR	Mar 05, 2020
MKS FTIR - NOX - 000928781	FTIR	Mar 05, 2020
MKS FTIR - SO2 - 000928781	FTIR	Mar 19, 2020

Tried Data Available Upon Request

NOTES: Gross Weight: 47.7 Kg. Net Weight: 7.5 Kg.



Approved for Release

Page 1 of 160-401754137-1



an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
6441 Easton Road
Bldg 1
Plumsteadville, PA 18949
Airgas.comCERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E3HA0002 Reference Number: 160-401754138-1
Cylinder Number: GN0024383 Cylinder Volume: 247.2 CF
Laboratory: 124 - Plumsteadville - PA Cylinder Pressure: 2215 PSIG
PGVP Number: A12020 Valve Outlet: 660
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Mar 26, 2020
Expiration Date: Mar 26, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 800R-12/31, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 ppm, i.e. 0.1 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	50.00 PPM	78.86 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/25/2020
CARBON MONOXIDE	50.00 PPM	80.10 PPM	G1	+/- 0.5% NIST Traceable	03/19/2020
NITRIC OXIDE	50.00 PPM	78.86 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/25/2020
SULFUR DIOXIDE	50.00 PPM	79.95 PPM	G1	+/- 0.8% NIST Traceable	03/19/2020, 03/25/2020
NITROGEN	Balance				

Type	Lot ID	Cylinder No.	Concentration	Uncertainty	Expiration Date
NTRM	11010130	KAL004536	97.31 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 04, 2022
NTRM	13010405	KAL003984	97.80 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	13010405	KAL003984	97.80 PPM NOX/NITROGEN	+/- 0.8%	Jul 23, 2025
NTRM	18010235	KAL004419	97.59 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Dec 23, 2021

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
MKS FTIR - CO - 000928781	FTIR	Mar 12, 2020
MKS FTIR - NO - 000928781	FTIR	Mar 05, 2020
MKS FTIR - NOX - 000928781	FTIR	Mar 05, 2020
MKS FTIR - SO2 - 000928781	FTIR	Mar 19, 2020

Tried Data Available Upon Request

NOTES: Gross Weight: 47.7 Kg. Net Weight: 7.5 Kg.



Approved for Release

Page 1 of 160-401754138-1

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E02N82E3HA0000 Reference Number: 82-401018725-1
Cylinder Number: ND60016 Cylinder Volume: 248.4 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2214 PSIG
PGVP Number: B52017 Valve Outlet: 590
Gas Code: O2,BALN Certification Date: Oct 23, 2017
Expiration Date: Oct 23, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volumetric basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
OXYGEN	8.000 %	8.003 %	O1	10/23/2017
NITROGEN	Balance			
Total Relative Uncertainty				
±0.4% NIST Traceable				
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRMplus	69060208	CC282337	8.961 % OXYGEN/NITROGEN	±0.3%
				Nov 08, 2018
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Analytical Principle	
Horba MPA 610-02-TTMMJ041			Paramagnetic	
			Last Multipoint Calibration	
			Sep 28, 2017	

Tried Data Available Upon Request

NOTES:
This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/031. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate. All values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT NO. 2090.02

[Signature]
Approved for Release

Page 1 of 82-401018725-1

CERTIFICATE OF ANALYSIS Grade of Product: EPA Protocol

Part Number: E02N82E3HA0001 Reference Number: 82-401018720-1
Cylinder Number: GN0003788 Cylinder Volume: 249.8 CF
Laboratory: 124 - Riverton (SAP) - NJ Cylinder Pressure: 2214 PSIG
PGVP Number: B52017 Valve Outlet: 590
Gas Code: O2,BALN Certification Date: Oct 23, 2017
Expiration Date: Oct 23, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/031, using the assay procedures listed. Analytical methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volumetric basis unless otherwise noted.
Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Assay Dates
OXYGEN	18.00 %	18.02 %	O1	10/23/2017
NITROGEN	Balance			
Total Relative Uncertainty				
±0.4% NIST Traceable				
CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Uncertainty
NTRMplus	69060208	CC282337	8.961 % OXYGEN/NITROGEN	±0.3%
				Nov 08, 2018
ANALYTICAL EQUIPMENT				
Instrument/Make/Model			Analytical Principle	
Horba MPA 610-02-TTMMJ041			Paramagnetic	
			Last Multipoint Calibration	
			Sep 28, 2017	

Tried Data Available Upon Request

NOTES:
This calibration std. has been certified in accordance with the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/031. All testing processes and measurements conform to the requirements of ISO/IEC 17025 and to Airgas ISO 9001:2000 and relate only to items identified on this certificate. All values are certified to be NIST Traceable with total uncertainty as detailed under Analytical Uncertainty. This document shall not be reproduced in full without written approval of the issuer.



TESTING CERT NO. 2090.02

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Approved for Release

Page 1 of 82-401018720-1

CONSOLE CONTROL UNIT CALIBRATION TEST REPORT

Calibration Date : 6 Jan 22 Barometric Pressure (mm.Hg) : 759
Next Calibration Date : 5 Jul 22 Relative Humidity (%) : 61.0
Temperature (°C) : 34.0
Reference Dry Gas Meter Data
Serial No. : BKK_FS1122
Correction Factor (%) : A2003240
Next Calibration Date : 1 Mar 22
Reference Dry Gas Meter Data
Serial No. : BKK_FS0485
Correction Factor (%) : 1.0000
Model No. : XC-572-V

ΔH (mm.H ₂ O)		Minutes		Reference Dry Gas Meter Calibration		Console Control Dry Gas Meter		Dry Gas Meter Correction		Office Calibration	
				Vr (L/min)		Tr (°C)		To (°C)		Factor (%)	
				Initial	Final	Initial	Final	Initial	Final		
15	12.29	150.00	0.00	273168.0	273984.0	30.0	30.0	30.0	30.0	45.9038	44.0117
25	9.40	150.00	0.00	272872.0	273416.0	31.0	31.0	31.0	31.0	0.9593	0.9594
50	5.14	150.00	0.00	273348.0	273840.0	33.0	33.0	33.0	33.0	0.9666	0.9666
80	5.10	150.00	0.00	273917.0	274760.0	33.0	33.0	33.0	33.0	0.9723	0.9723
120	4.10	150.00	0.00	274120.0	273966.0	34.0	34.0	34.0	34.0	0.9665	0.9665

Y Ratio of reading of reference to dry gas meter: tolerance for individual values ± 0.02 from average.
ΔHg Office pressure differential that equates to 21.24 in. of air @ 25°C and 750 mm of mercury. mmH₂O: tolerance for individual values ± 5.08 from average.
Procedure: 40 CFR 60 APP A METH SEC 5.3 & 7

Calibrated by: *[Signature]* (Mr. Chawalit Wongchan)
Field Scientist (2)
Approved by: *[Signature]* (Mr. Samart Roo-ngan)
Specialist (1)



Stopwatch Calibration Test Report

Calibration Date : 6 Jan 22 Next Cal. Date : 5 Jul 22
Barometric Pressure (mm.Hg) : 759 Temperature (°C) : 31.0
Relative Humidity (%) : 61.0

Reference Stopwatch Data
Stopwatch ID No. : E18061
Model : F808
Serial No. : -
Calibration Date : 8 Sep 20
Certificate No. : E-2009018
Console Control Meter Data
Dry Gas Meter No. : BKK_FS0485
Model : XC-572-V
Serial No. : 1310055

Run No.	Time Actual (m:ss.ms)	Time Reading (m:ss)	Diff. (ms)	Diff. (min)
1	5:00:11	5:00	11	0.00018
2	5:00:08	5:00	8	0.00013
3	5:00:09	5:00	9	0.00015
4	5:00:11	5:00	11	0.00018
5	5:00:10	5:00	10	0.00017
6	5:00:08	5:00	8	0.00013
7	5:00:08	5:00	8	0.00013
8	5:00:12	5:00	12	0.00020
9	5:00:08	5:00	8	0.00013
10	5:00:08	5:00	8	0.00013
Average			0.00016	
SD			0.00003	

Calibrate by:

[Signature]
Mr. Chawalit Wongchan
Field Scientist (2)

Approved by:

[Signature]
Mr. Samart Roo-ngan
Specialist (1)



DIGITAL TEMPERATURE CALIBRATION DATA SHEET

Calibration Date :	5 Jan 22	Ambient Temperature (°C) :	32
Calibration sheet No. :	C-050122-BKK_FS0466	Relative Humidity (%) :	68
Digital Temperature ID :	BKK_FS0466	Reference Temperature ID :	BKK_FS0409
Serial No. :	1310055	Serial No. :	7088004
Model :	XC-572-V	Model :	FLUKE 714
		Next Calibrate :	13 Jan 22

Location	Reference Temperature °C	Digital Temperature °C	Error °C	Remark
Stock	0	0	0	
	25	24	-1	
	50	49	-1	
	100	99	-1	
	150	149	-1	
	200	199	-1	
	250	249	-1	
	300	295	-2	
	500	498	-2	
	1000	998	-2	
	1200	1198	-2	
Probe	100	98	-2	
	125	122	-2	
	150	148	-2	
Oven	100	99	-1	
	125	124	-1	
	150	150	0	
Filter	100	100	0	
	125	124	-1	
	150	149	-1	
Exit	0	-1	-1	
	10	9	-1	
	20	19	-1	
Meter	0	0	0	
	25	25	0	
	50	50	0	
AUX	0	-1	-1	
	25	25	0	
	50	50	0	

Calibrated by

Chawalit

(Mr.Chawalit Wongchan)
Field Scientist (2)

Approved by

Mr. Samart Roongnan

(Mr.Samart Roongnan)
Specialist (1)

FORM NO. F 04-027 REVISION NO. - ISSUE DATE: 9/10/02



Pitot Tube Calibration Data

Pitot Tube Identification Number :	BKK_FS0469	Calibration Date :	5 Jan 22
Lab test duct Number :	258-1-13-01	Standard Pitot ID :	BKK_FS0441
Calibration Sheet No. :	C-050122-BKK_FS0469	Cp Standard :	0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H ₂ O)	Type s pitot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Cp				0.842	0.842

$$Cp(S) = Cp \cdot \sqrt{\frac{\Delta P(Std)}{\Delta P(S)}}$$

$$Cp(A) - Cp(B) \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by

Chawalit

(Mr.Chawalit Wongchan)
Field Scientist (2)

Approved by

Mr. Samart Roongnan

(Mr.Samart Roongnan)
Specialist (1)

FORM NO. F 04-028 REVISION NO. - ISSUE DATE: 9/10/02



Pitot Tube Calibration Data

Pitot Tube Identification Number :	BKK_FS0490	Calibration Date :	5 Jan 22
Lab test duct Number :	258-1-13-01	Standard Pitot ID :	BKK_FS0441
Calibration Sheet No. :	C-050122-BKK_FS0490	Cp Standard :	0.99

Type S Pitot Tube Coefficient Data					
	Type s pitot tube Leg A,B	Standard pitot tube (ΔP, mm.H ₂ O)	Type s pitot tube (ΔP, mm.H ₂ O)	Cp (s) Leg A	Cp (s) Leg B
Test 1	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 2	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Test 3	A	12.00	16.60	0.842	-
	B	12.00	16.60	-	0.842
Cp				0.842	0.842

$$Cp(S) = Cp \cdot \sqrt{\frac{\Delta P(Std)}{\Delta P(S)}}$$

$$Cp(A) - Cp(B) \text{ must BE } \leq 0.01$$

$$\text{Average deviation(A or B)} = \frac{\sum [Cp(s) - Cp(A \text{ or } B)]}{3} \text{ must BE } \leq 0.01$$

Calibrated by

Chawalit

(Mr.Chawalit Wongchan)
Field Scientist (2)

Approved by

Mr. Samart Roongnan

(Mr.Samart Roongnan)
Specialist (1)

FORM NO. F 04-029 REVISION NO. - ISSUE DATE: 9/10/02



PROBE NOZZLE DIAMETER CALIBRATION DATA SHEET

Calibration Date	5 Jan 22	Nozzle Set ID.:	BKK_FS0491
Calibration Sheet No. :	C-050122-BKK_FS0491	Vernier Caliper ID.:	BKK_FS0626

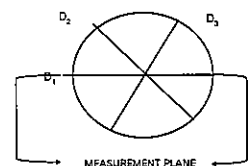
Nozzle ID #	Nozzle Diameter (cm.)			HI - Lo ΔD	(D ₁ + D ₂ + D ₃)/3 D _{avg}
	D ₁	D ₂	D ₃		
1	0.315	0.315	0.315	0.000	0.315
2	0.475	0.475	0.475	0.000	0.475
3	0.635	0.635	0.635	0.000	0.635
4	0.790	0.790	0.790	0.000	0.790
5	0.955	0.955	0.955	0.000	0.955
6	1.110	1.110	1.110	0.000	1.110
7	1.270	1.270	1.270	0.000	1.270
8	1.600	1.600	1.600	0.000	1.600

Where :

D₁, D₂, D₃ = Three different nozzle diameters at 60 degrees to each other, each measured the nearest 0.025 mm.

ΔD = Maximum distance between any two diameters, must be ≤ 0.100 mm.

D_{avg} = (D₁ + D₂ + D₃)/3



Calibrated by

Chawalit

(Mr.Chawalit Wongchan)
Field Scientist (2)

Approved by

Mr. Samart Roongnan

(Mr.Samart Roongnan)
Specialist (1)

FORM NO. F 04-030 REVISION NO. - ISSUE DATE: 9/10/02

Certificate of Calibration

Represent to Certificate of Calibration : PTC/07/21161

Certificate No.: PTC/07/21161 Page: 1 of 2
Equipment: Digital Balance Condition: Normal
Manufacturer: Sartorius Serial No: 33304165
Model: SECURA224-1S ID No: BKK_EN0309
Type of Balance: Single Interval



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

Environment Condition: Temperature 23.8 °C ± 0.4 °C
Humidity 58.1 %RH ± 0.7 %RH
Air density 1.18 kg/m³

Calibration Place: ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakarn 40, Phatthanakarn Rd.,
Khwaeng Phatthanakarn, Khet Suan Luang, Bangkok 10250.

The Method used: In house method, PTC-WI-07, base on Euramet cg. 18
Traceability: This certificate is traceable to the SI Units through Thai Calibration Service Co., Ltd.
NSC-ONSC Accreditation No.: Calibration 0189

Date Received: December 16, 2021
Calibration Date: December 16, 2021
Issued Date: December 20, 2021
Calibration By: Mr. Keattisak Kerdio

REVIEW BY: *Sarant M.*
APPROVED BY: *K. Kerdio*
NEXT CAL. DATE: 12/12/22



Mr. Keattisak Kerdio
(Mr. Keattisak Kerdio)
Reviewed by

Approved By: *K. Kerdio*
(Mr. Keattisak Kerdio)
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 recognised 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.

PTC-MC/07-02 21-020

Represent to Certificate of Calibration : PTC/07/21161

Certificate No.: PTC/07/21161

Page: 2 of 2

Measurement Results:

Without Adjustment :

Function Calibration: Internal Calibration

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

Eccentricity test		100 (g)				
		Position (g)				
		1	2	3	4	5
		0.0000	0.0000	0.0000	-0.0001	-0.0001
		Maximum deviation:				
		0.0001				

Repeatability Test : Weight to be 1/2 ≤ L₁ ≤ Maximum capacity

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

Nominal test value (g)	Standard Deviation
200	0.00004

Error of indication : from nominal value, Readability 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	0.00013	2.37
0.01	0.01000	0.0100	0.0000	0.00028	2.00
0.1	0.10000	0.1000	0.0000	0.00015	2.12
1	1.00000	1.0000	0.0000	0.00014	2.18
2	2.00000	2.0000	0.0000	0.00014	2.20
5	5.00001	5.0000	0.0000	0.00014	2.20
10	10.00000	10.0000	0.0000	0.00014	2.20
20	20.00003	20.0000	0.0000	0.00014	2.18
50	50.00004	50.0000	0.0000	0.00015	2.11
100	100.00004	100.0000	0.0000	0.00018	2.05
200	200.00011	200.0000	0.0001	0.00025	2.00

Note: Weight of adjust (g)

The End of Certificate

PTC-MC/07-02 21-020

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No.: ACC22003
Pages : 1 of 3

Calibration Certificate

Equipment: SOUND CALIBRATOR
Manufacturer: RION
Model: NC-74
Serial No.: 34178119
ID No.: BKK_FS0632

Condition As Found: GOOD

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

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

Received Date: 05 JANUARY 2022
Calibration Date: 14 JANUARY 2022
Date of Issue: 17 JANUARY 2022

REVIEW BY: *Phanpim P.*
APPROVED BY: *T. Peichura*
NEXT CAL. DATE: 14/1/23

Calibrated by: Nathakorn Pichuraisan

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

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

QF-TS12-04-04-020664

SITHIPORN ASSOCIATES CO., LTD. CALIBRATION LABORATORY

Continuation of Calibration Certificate

Cert. No.: ACC22003
Job No.: VC65AC0041
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	33511D	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	33461A	MY60034273	I-1518072525 E	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-42KA1	34360495	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).

QF-TS12-04-04-020664

T. Peichura

Continuation of Calibration Certificate

Cert. No. : ACC22083
Job No. : VC65AC0841
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	93.94	-0.06	0.14	0.40

2. Frequency

Specified Frequency (Hz)	Measured value (Hz)	Deviated value (%)	Uncertainty (%)	Tolerance limit (%)
1000	1001.0	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.73	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 Srinthom Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1079 e-mail:center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21089
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00584982 / 170133 / 72947
ID No. : BKK_FS0925

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 : 26 AUGUST 2021
Calibration Date : 07-08 SEPTEMBER 2021
Date of Issue : 08 SEPTEMBER 2021

REVIEW BY : *Nathakorn*
APPROVED BY : *Nathakorn*
NEXT CAL DATE : 7/9/22

Calibrated by : Nathakorn Pisupaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21089
Job No. : VC64AC0862
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	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-42KA1	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

Continuation of Calibration Certificate

Cert. No. : ACL21089
Job No. : VC64AC0862
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

Continuation of Calibration Certificate

Cert. No. : ACL21089
Job No. : VC64AC0062
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (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	11.3
C-weight	17.8
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)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	±1.5
1000	0.0	0.0	0.0	±1.0
8000	1.1	1.2	1.2	±5.0

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21089
Job No. : VC64AC0062
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21089
Job No. : VC64AC0062
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
128.0	128.0	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	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	27.0	0.0	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21089
Job No. : VC64AC0062
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	107.9	-0.1	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 : -3.0
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, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	135.9	-0.5	±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. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21089
Job No. : VC64AC0062
Pages : 8 of 8

11. Overload indication

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

451-451/1 Sirinthorn Rd.,Bangbunru, Bangplue Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21123
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00572609 / 157781 / 48096
ID No. : BKK_FS0924

Condition As Found : GOOD

Customer : ALS 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 : 29 SEPTEMBER 2021
Calibration Date : 12-14 OCTOBER 2021
Date of Issue : 15 OCTOBER 2021

REVIEW BY	<i>Nathakorn P.</i>
APPROVED BY	<i>T. Petchurai</i>
NEXT CAL DATE	12/10/22

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21123
Job No. : VC64AC0071
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	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	8846A	1997025	EEL-BP_06/0264	05-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-42KA1	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

Continuation of Calibration Certificate

Cert. No. : ACL21123
Job No. : VC64AC0071
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

Continuation of Calibration Certificate

Cert. No. : ACL21123
Job No. : VC64AC0071
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)
17.2

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

Frequency Weighting	Measured value (dB)
A - weight	12.6
C - weight	18.7
Flat	24.6

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	0.5	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.0	-0.9	-0.9	± 5.0

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL21123
Job No. : VC64AC0071
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	-0.1	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	-0.1	0.0	0.0	±2.0
4000	-0.1	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	94.1	0.1	± 0.3

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL21123
Job No. : VC64AC0071
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	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.2	0.2	± 1.1

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL21123
Job No. : VC64AC0071
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	107.9	-0.1	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	136.4	0.0	± 3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
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. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL21171
Job No. : VC64AC0071
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.8	89.5	-0.3	±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



451-451/1 Sithiporn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL21171
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858525 / 158776 / 158777
ID No.: BKK_FS0115

Condition As Found : GOOD

Customer : ALS 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 : 09 DECEMBER 2021
Calibration Date : 14-15 DECEMBER 2021
Date of Issue : 16 DECEMBER 2021

REVIEW BY: *Nathakorn P.*
APPROVED BY: *T. Petchurani*
NEXT CAL DATE: 14/12/22

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thnakul Petchurani)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21171
Job No. : VC65AC0033
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	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	8846A	1997025	EEL-BP_06/0264	03-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	03-Feb-22
Measuring Amplifier	NA-42KA1	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

Continuation of Calibration Certificate

Cert. No. : ACL21171
Job No. : VC65AC0033
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

Continuation of Calibration Certificate

Cert. No. : ACL21171
Job No. : VC65AC0033
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)
13.4

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	17.8
Flat	23.2

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	0.5	±1.5
1000	-0.1	-0.1	-0.1	±1.0
8000	-2.8	-2.7	-2.7	±5.0

QF-TS12-04-04-020664

T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL21171
Job No. : VC65AC0033
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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. : ACL21171
Job No. : VC65AC0033
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	39.0	0.0	±1.1
34.0	34.0	0.0	±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	26.9	-0.1	±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. : ACL21171
Job No. : VC65AC0033
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	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	128.0	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	136.3	-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	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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T. Rth.

Continuation of Calibration Certificate

Cert. No. : ACL21171
Job No. : VC65AC0033
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

451-451/1 Sindhorn Rd., Banglumru, Bangkok Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: center@sitthiporn.com http://www.sitthiporn.com



Cert. No. : ACL21168
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-S2 / Pre-amplifier NH-24
Serial No. : 00858519 / 158770 / 58771
ID No. : BKK_FS0109

Condition As Found : GOOD

Customer : ALS 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 : 09 DECEMBER 2021
Calibration Date : 14-15 DECEMBER 2021
Date of Issue : 16 DECEMBER 2021

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thanakul Peichurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21168
Job No. : VC65AC0033
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	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	8846A	1997025	EEL.BP.06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774E	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	03-Feb-22
Measuring Amplifier	NA-42KA1	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

Continuation of Calibration Certificate

Cert. No. : ACL21168
Job No. : VC65AC0033
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

Continuation of Calibration Certificate

Cert. No. : ACL21168
Job No. : VC65AC0033
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)
16.3

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

Frequency Weighting	Measured value (dB)
A-weight	13.1
C-weight	19.6
Flat	25.0

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	0.5	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.0	-1.1	-0.9	±5.0

QF-TS12-04-04-020664

P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL21168
Job No. : VC65AC0033
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	-0.1	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	0.1	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

P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL21168
Job No. : VC65AC0033
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	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±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	28.9	-0.1	±1.1
28.0	28.0	0.0	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL21168
Job No. : VC65AC0033
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	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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, 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	133.1	0.1	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.3	-0.1	±2.0

QF-TS12-04-04-020664

P.L.A.

Continuation of Calibration Certificate

Cert. No. : ACL21168
Job No. : VC65AC0033
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.8	0.3	±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

451-451/1 Sitrinthorn Rd., Bangbunru, Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21062
Pages : 1 of 9

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RJON
Model : NL-21/ Microphone UC-52 / Preamplifier NH-21
Serial No. : 00710220 / 75619 / 23998
ID No. : BKK_FS0018

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHAENG 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 : 22 JUNE 2021
Calibration Date : 28-30 JUNE 2021
Date of Issue : 05 JUNE 2021

REVIEW BY	<i>Manee P.</i>
APPROVED BY	<i>T. Petchurai</i>
NEXT CAL. DATE	28/10/22

Calibrated by : Nathakorn Pisutpaian

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

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21062
Job No. : VC64AC0048
Pages : 2 of 9

Calibration Procedure : CP-AC-02

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	EP-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EP-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	33461A	MY53220116	EEL.BP. 04/0264	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-07774B	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

Continuation of Calibration Certificate

Cert. No. : ACL21062
Job No. : VC64AC0048
Pages : 3 of 9

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

Continuation of Calibration Certificate

Cert. No. : ACL21062
Job No. : VC64AC0048
Pages : 4 of 9

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)
22.2

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

Frequency Weighting	Measured value (dB)
A-weight	21.7
C-weight	22.3
Flat	24.8

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 curves (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	-0.1	0.0	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	2.9	3.0	3.0	±5.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21062
Job No. : VC64AC0048
Pages : 5 of 9

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	-0.2	-0.1	0.0	±2.0
125	-0.1	0.0	0.0	±1.5
250	-0.1	-0.1	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.1	0.1	0.1	±2.0
4000	0.1	0.1	0.1	±3.0
8000	0.1	0.2	0.2	±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

Continuation of Calibration Certificate

Cert. No. : ACL21062
Job No. : VC64AC0048
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
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

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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	94.0	94.0	0.0	±0.5
120	94.0	94.0	0.0	±0.5
110	94.0	94.0	0.0	±0.5
100	94.0	94.0	0.0	±0.5
90	94.0	94.0	0.0	±0.5

Level linearity on each level range

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
130	43.0	43.0	0.0	±0.5
120	33.0	33.0	0.0	±0.5

9. Tone burst response

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

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Continuation of Calibration Certificate

Cert. No. : ACL21062
Job No. : VC64AC0048
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10. Peak C round level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.00	0.0	-
One	136.4	136.00	-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	135.2	-0.2	±2.0

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.3	-0.2	±1.5

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21062
Job No. : VC64AC0048
Pages : 9 of 9

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

SITHIPORN ASSOCIATES CO.,LTD.
CALIBRATION LABORATORY

451-451/1 Sirdinthon Rd., Bangbunru, Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACC22004
Pages : 1 of 3

Calibration Certificate

Equipment : SOUND CALIBRATOR
Manufacturer : RION
Model : NC-74
Serial No. : 34178120
ID No. : BKK_FS0633

Condition As Found : GOOD

Customer : ALS 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 : 05 JANUARY 2022
Calibration Date : 14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

Calibrated by : Nathakorn Pitsupaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACC22004
Job No. : VC65AC0041
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	MY53202742	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	33461A	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-42KA1	34560495	AA-3003-21	16-Feb-22
Audio Analyzer	AVR-3360A	V74436069	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).

QF-TS12-04-04-020664

Cert. No. : ACC22084
Job No. : VC65AC0041
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	1001.3	0.1	0.1	1.0

3. Total distortion

Measured value (%)	Uncertainty (%)	Tolerance limit (%)
1.19	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

T. R. R.

451-451/1 Sirinthorn Rd., Bangbunru, Bangkok Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiphorn.com http://www.sithiphorn.comCert. No. : ACL21121
Pages : 1 of 8

Calibration Certificate

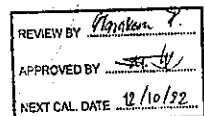
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00572457 / 170214 / 72795
ID No. : BKK_FS0923

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PHATTHANAKAN 40, PHATTHANAKAN ROAD,
KHUWAENG 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 : 29 SEPTEMBER 2021
Calibration Date : 12-14 OCTOBER 2021
Date of Issue : 15 OCTOBER 2021



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. R. R.
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Cert. No. : ACL21121
Job No. : VC64AC0071
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	MY532032742	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	8846A	1997025	EEL-BP. 06/0264	05-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-42KA1	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. R. R.

Cert. No. : ACL21121
Job No. : VC64AC0071
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. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21121
Job No. : VC64AC0071
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)
13.8

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	22.8

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	0.2	0.1	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-1.0	-0.9	-0.9	±5.0

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T. Ratan.

Continuation of Calibration Certificate

Cert. No. : ACL21121
Job No. : VC64AC0071
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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	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±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	0.1	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. Ratan.

Continuation of Calibration Certificate

Cert. No. : ACL21121
Job No. : VC64AC0071
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	132.9	-0.1	± 1.1
132.0	131.9	-0.1	± 1.1
131.0	130.9	-0.1	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.1	0.1	± 1.1
25.0	25.1	0.1	± 1.1

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T. Ratan.

Continuation of Calibration Certificate

Cert. No. : ACL21121
Job No. : VC64AC0071
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	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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, Lepeak (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	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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T. Ratan.

Continuation of Calibration Certificate

Cert. No. : ACL21121
Job No. : VC64AC0071
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	89.6	-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



451-451/1 Sirinthon Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL21066
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00658241 / 158767 / 58769
ID No. : BKK_FS0098

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 : 06 JULY 2021
Calibration Date : 07-08 JULY 2021
Date of Issue : 13 JULY 2021

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

(Thanakul Petchurai)

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Continuation of Calibration Certificate

Cert. No. : ACL21066
Job No. : VC64AC0051
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	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EELBP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EELBP_03/0264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EELBP_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-42KA1	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

Continuation of Calibration Certificate

Cert. No. : ACL21066
Job No. : VC64AC0051
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

Continuation of Calibration Certificate

Cert. No. : ACL21066
Job No. : VC64AC0051
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.9

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	18.2
Flat	23.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.6	0.6	0.6	±1.5
1000	0.0	0.0	0.0	±1.0
8000	-1.8	-1.7	-1.7	±5.0

QF-TS12-04-04-020664

T. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21066
Job No. : VC64AC0051
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21066
Job No. : VC64AC0051
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	53.9	-0.1	±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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21066
Job No. : VC64AC0051
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	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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	128.1	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	135.3	-1.1	±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	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. Petch.

Continuation of Calibration Certificate

Cert. No. : ACL21066
Job No. : VC64AC0051
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirintham Rd., Bangbunru, Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiphom.com http://www.sithiphom.com



Cert. No. : ACL21172
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00858526 / 175176 / 85721
ID No. : BKK_FS0116

Condition As Found : GOOD

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

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

REVIEW BY *Nathakorn P.*
APPROVED BY *T. Petchurai*
NEXT CAL DATE 14/12/22

Received Date : 09 DECEMBER 2021
Calibration Date : 14-15 DECEMBER 2021
Date of Issue : 16 DECEMBER 2021

Calibrated by : Nathakorn Pisutpaisan

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21172
Job No. : VC65AC0033
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	MY53202742	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	8846A	1997025	EEL.BP. 06/0264	05-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

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. : ACL21172
Job No. : VC65AC0033
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

Continuation of Calibration Certificate

Cert. No. : ACL21172
Job No. : VC65AC0033
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)
15.1

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

Frequency Weighting	Measured value (dB)
A-weight	13.4
C-weight	19.7
Flat	25.1

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	0.0	0.0	± 1.0
8000	1.9	2.0	2.0	±5.0

QF-TS12-04-04-020664

T. Bth.

Continuation of Calibration Certificate

Cert. No. : ACL21172
Job No. : VC65AC0033
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	-0.2	-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	0.1	0.0	0.0	±3.0
8000	0.1	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	93.9	94.0	0.1	±0.3

QF-TS12-04-04-020664

T. Bth.

Continuation of Calibration Certificate

Cert. No. : ACL21172
Job No. : VC65AC0033
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	109.1	0.1	±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	29.9	-0.1	±1.1
29.0	28.9	-0.1	±1.1
28.0	27.9	-0.1	±1.1
27.0	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Bth.

Continuation of Calibration Certificate

Cert. No. : ACL21172
Job No. : VC65AC0033
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, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.4	0.0	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
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. Bth.

Continuation of Calibration Certificate

Cert. No. : ACL21172
Job No. : VC65AC0033
Pages : 8 of 8

11. Overload Indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sirinthorn Rd, Bangbunru, Bangkok Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21149
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00658240 / 157780 / 48095
ID No. : BKK_FS0097

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 : 08 NOVEMBER 2021
Calibration Date : 09-10 NOVEMBER 2021
Date of Issue : 12 NOVEMBER 2021

REVIEW BY	<i>Thanakul P.</i>
APPROVED BY	<i>T. Petchurai</i>
NEXT CAL DATE	9/11/22

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
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	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-0P_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-0P_03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL-0P_06/0264	05-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-42KAL	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

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
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

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
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)
19.4

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

Frequency Weighting	Measured value (dB)
A-weight	13.1
C-weight	18.8
Flat	24.3

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	0.4	0.3	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.7	-0.6	-0.6	±5.0

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

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

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
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	131.9	-0.1	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.1	0.1	± 1.1
28.0	28.1	0.1	± 1.1
27.0	27.1	0.1	± 1.1
26.0	26.2	0.2	± 1.1
25.0	25.2	0.2	± 1.1

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
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	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21149
Job No. : VC65AC0015
Pages : 8 of 8

11. Overload Indication

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

QP-TS12-04-04-020664

451-451/1 Sithiporn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-6800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21173
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00858527 / 158778 / 58779
ID No.: BKK_FS0117

Condition As Found : GOOD

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

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

REVIEW BY : *Nathom P.*
APPROVED BY : *T. Petchurai*
EXT CAL DATE : 14 / 12 / 22

Received Date : 09 DECEMBER 2021
Calibration Date : 14-15 DECEMBER 2021
Date of Issue : 16 DECEMBER 2021

Calibrated by : Nathom Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21173
Job No. : VC65AC0033
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	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53320104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53320076	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-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

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

Continuation of Calibration Certificate

Cert. No. : ACL21173
Job No. : VC65AC0033
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	✓	-	#DIV/0!	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

QP-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21173
Job No. : VC65AC0033
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)
16.8

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

Frequency Weighting	Measured value (dB)
A-weight	11.2
C-weight	17.4
Flat	23.0

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	1.0	1.0	1.0	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-3.1	-3.1	-3.0	±5.0

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21173
Job No. : VC65AC0033
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	-0.1	0.0	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	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. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21173
Job No. : VC65AC0033
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	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

T. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21173
Job No. : VC65AC0033
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	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	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Leqpeak (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	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. R. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL21173
Job No. : VC65AC0033
Pages : 8 of 8

11. Overload indication

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

12. High level stability

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

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

End of Calibration Certificate

QF-TS12-04-04-020664

451-451/1 Sitrinthorn Rd., Bangsumru, Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL22043
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UG-32 / Transducer UG-21
Serial No. : 00873053 / 171587 / 17329
ID No. : BKK_FS0930

Condition As Found : GOOD

Customer : ALS LABORATORY GROUP (THAILAND) CO., LTD.
104 PIATTHANAKAN 40, PIATTHANAKAN 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 : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

REVIEW BY : *Thakorn P.*
APPROVED BY : *Thakorn P.*
NEXT CAL DATE : 12/1/25

Calibrated by : Natchorn Pisutpaisan

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

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22043
Job No. : VC65AC0041
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 test 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	EP-001231	10-Feb-22
Waveform Generator	33511B	MY52302742	EP-001121	10-Feb-22
Digital Multimeter	33461A	MY5220104	EEL-BP-000742	10-Feb-22
Digital Multimeter	33461A	MY5220076	EEL-BP-000742	10-Feb-22
Digital Multimeter	33461A	MY60024273	I-151807234511	10-Feb-22
Programmable Attenuator	MAT-1070	62100114	1500-02741453	08-Mar-22
Condenser Microphone	4180	2977900	AA-10082113	05-Feb-22
Measuring Amplifier	NA-42KA1	34560495	AA-1001321	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. : ACL22043
Job No. : VC65AC0041
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	0.6
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	0.6
For > 10 kHz to 20 kHz	-	-	-	0.7
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.3
6. Long-term stability	✓	-	0.1	0.3
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

Continuation of Calibration Certificate

Cert. No. : ACL22043
Job No. : VC65AC0041
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (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

Frequency Weighting	Measured value (dB)
A-weight	13.3
C-weight	19.4
Flat	24.7

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	0.0	0.0	0.0	± 1.0
8000	-0.3	-0.3	-0.2	± 5.0

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22043
Job No. : VC65AC0041
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	-0.1	0.0	± 2.0
125	0.0	0.0	0.0	± 1.5
250	0.0	0.0	0.0	± 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	0.1	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	± 0.3
C-weight	94.0	0.0	± 0.3
Flat	94.0	0.0	± 0.3

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	± 0.1
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. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22043
Job No. : VC65AC0041
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	± 1.5
136.0	136.0	0.0	± 1.5
135.0	135.0	0.0	± 1.5
134.0	134.0	0.0	± 1.5
133.0	133.0	0.0	± 1.5
132.0	132.0	0.0	± 1.5
131.0	131.0	0.0	± 1.5
129.0	129.0	0.0	± 1.5
124.0	124.0	0.0	± 1.5
119.0	119.0	0.0	± 1.5
114.0	114.0	0.0	± 1.5
109.0	109.0	0.0	± 1.5
104.0	104.0	0.0	± 1.5
99.0	99.0	0.0	± 1.5
94.0	94.0	0.0	± 1.5
89.0	89.0	0.0	± 1.5
84.0	84.1	0.1	± 1.5
79.0	79.0	0.0	± 1.5
74.0	74.1	0.1	± 1.5
69.0	69.1	0.1	± 1.5
64.0	64.0	0.0	± 1.5
59.0	59.1	0.1	± 1.5
54.0	54.0	0.0	± 1.5
49.0	49.0	0.0	± 1.5
44.0	44.0	0.0	± 1.5
39.0	39.0	0.0	± 1.5
34.0	34.0	0.0	± 1.5
30.0	30.0	0.0	± 1.5
29.0	29.0	0.0	± 1.5
28.0	28.0	0.0	± 1.5
27.0	27.0	0.0	± 1.5
26.0	25.9	-0.1	± 1.5
25.0	25.0	0.0	± 1.5

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22043
Job No. : VC65AC0041
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	93.9	-0.1	± 1.5

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
	2	8	117.0	117.0	0.0	± 1.5
	200	800	134.0	134.0	0.0	± 1.5
Slow	2	8	108.0	108.0	0.0	± 1.5
	200	800	127.6	127.6	0.0	± 1.5
	0.25	1	99.0	98.9	-0.1	± 1.5
SEL	2	8	108.0	108.0	0.0	± 1.5
	200	800	128.0	128.0	0.0	± 1.5

10. Peak C sound level

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	-
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	135.4	135.1	-0.3	± 2.0
Negative half cycle	135.4	135.2	-0.2	± 2.0

QF-TS12-04-04-020664

T. Pich.

Continuation of Calibration Certificate

Cert. No. : ACL22043
Job No. : VC65AC0041
Pages : 8 of 8

11. Overload Indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limit (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±0.3

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limit (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

451-451/1 Sirdinorn Rd, Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21146
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00572566 / 170403 / 72904
ID No. : BKK_FS0875

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 : 01 NOVEMBER 2021
Calibration Date : 02-04 NOVEMBER 2021
Date of Issue : 05 NOVEMBER 2021

Calibrated by : Nathakorn Pisupaisan

Approved by :

T. Retana
(Thanakul Peichurui)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21146
Job No. : VC65AC0011
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	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	06-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-Feb-22
Programmable Attenuator	MAT-1070	62100114	LS00-07774E	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

Continuation of Calibration Certificate

Cert. No. : ACL21146
Job No. : VC65AC0011
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

Continuation of Calibration Certificate

Cert. No. : ACL21146
Job No. : VC65AC0011
Pages : 4 of 8

Result of calibration:

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (dB)
93.9 (93.9)	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	9.9
C-weight	16.3
Flat	21.9

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.5	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	-1.8	-1.8	-1.7	±5.0

QF-TS12-04-04-020664

T. Rata.

Continuation of Calibration Certificate

Cert. No. : ACL21146
Job No. : VC65AC0011
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	-0.1	-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	0.1	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. Rata.

Continuation of Calibration Certificate

Cert. No. : ACL21146
Job No. : VC65AC0011
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	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	28.1	0.1	± 1.1
27.0	27.0	0.0	± 1.1
26.0	26.0	0.0	± 1.1
25.0	25.0	0.0	± 1.1

QF-TS12-04-04-020664

T. Rata.

Continuation of Calibration Certificate

Cert. No. : ACL21146
Job No. : VC65AC0011
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	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	± 1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	± 1.0
	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	136.0	-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. Rata.

Continuation of Calibration Certificate

Cert. No. : ACL21146
Job No. : VC65AC0011
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	89.7	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. P.T.L.

451-451/1 Sirinthorn Rd, Banghumbury, Bangkok Bangkok 10700 THAILAND.
Tel:0-2435-9800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.com



Cert. No. : ACL21138
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No. : 00672789 / 170666 / 73129
ID No. : BKK_FS0929

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 : 21 OCTOBER 2021
Calibration Date : 28-29 OCTOBER 2021
Date of Issue : 01 NOVEMBER 2021

REVIEW BY : *Nathakorn P.*
APPROVED BY : *[Signature]*
NEXT CAL. DATE : 28/10/22

Calibrated by : Nathakorn Pisupaisan

Approved by :

T. Petchur
(Thanakul Petchur)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21138
Job No. : VC65AC0008
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	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53230104	EEL.BP. 03/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL.BP. 06/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-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-42KA1	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. P.T.L.

Continuation of Calibration Certificate

Cert. No. : ACL21138
Job No. : VC65AC0008
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. P.T.L.

Continuation of Calibration Certificate

Cert. No. : ACL21138
Job No. : VC65AC0008
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	17.8
Flat	23.7

3. Acoustical signal tests of frequency weightings

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

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21138
Job No. : VC65AC0008
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	0.0	±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	0.1	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	±0.2
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	±0.1
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

Continuation of Calibration Certificate

Cert. No. : ACL21138
Job No. : VC65AC0008
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	132.9	-0.1	±1.1
132.0	131.9	-0.1	±1.1
131.0	130.9	-0.1	±1.1
129.0	129.0	0.0	±1.1
124.0	124.0	0.0	±1.1
119.0	119.0	0.0	±1.1
114.0	114.0	0.0	±1.1
109.0	109.0	0.0	±1.1
104.0	104.0	0.0	±1.1
99.0	99.0	0.0	±1.1
94.0	94.0	0.0	±1.1
89.0	89.0	0.0	±1.1
84.0	84.0	0.0	±1.1
79.0	79.0	0.0	±1.1
74.0	74.0	0.0	±1.1
69.0	69.0	0.0	±1.1
64.0	64.0	0.0	±1.1
59.0	59.0	0.0	±1.1
54.0	54.0	0.0	±1.1
49.0	49.0	0.0	±1.1
44.0	44.0	0.0	±1.1
39.0	39.0	0.0	±1.1
34.0	34.0	0.0	±1.1
30.0	30.0	0.0	±1.1
29.0	29.0	0.0	±1.1
28.0	28.0	0.0	±1.1
27.0	27.0	0.0	±1.1
26.0	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21138
Job No. : VC65AC0008
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	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
	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, Lepeak (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	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21138
Job No. : VC65AC0008
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	89.6	-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

451-451/1 Sindhorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL22039
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-32 / Pre-amplifier NH-24
Serial No. : 00572452 / 171618 / 72790
ID No. : BKK_FS0922

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 : 12-14 JANUARY 2022
Date of Issue : 17 JANUARY 2022

REVIEW BY : [Signature]
APPROVED BY : [Signature]
NEXT CAL DATE : 12/1/23

Calibrated by : Nathakorn Pisulpaisan

Approved by :

[Signature]
(Thanakul Petchurai)

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

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22039
Job No. : VC65AC0041
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.	Date
Waveform Generator	33210A	MY48017076	EF-0012-21	10-Feb-22
Waveform Generator	33511B	MY52302742	EF-0013-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL-BP-03-02-21	10-Feb-22
Digital Multimeter	33461A	MY53220076	EEL-BP-03-02-21	08-Feb-22
Digital Multimeter	34461A	MY60024273	I-15180723251-21	15-Sep-22
Programmable Attenuator	MAT-1070	62100114	1500-07774B	08-Mar-22
Condenser Microphone	4180	2977900	AA-1008-21	03-Feb-22
Measuring Amplifier	NA-42KAI	34560495	AA-9000-21	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. : ACL22039
Job No. : VC65AC0041
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	0.6
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	0.6
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.3
6. Long-term stability	✓	-	0.1	0.3
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	✓	-	0.15	0.1

QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL22039
Job No. : VC65AC0041
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limits (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

Frequency Weighting	Measured value (dB)
A-weight	12.0
C-weight	18.8
Flat	24.4

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)			
	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	-0.5	-0.5	-0.4	±5.0

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22039
Job No. : VC65AC0041
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	0.0	0.0	±0.3
125	0.0	0.0	0.0	±0.3
250	0.0	0.0	-0.1	±0.3
500	0.0	0.0	0.0	±0.3
1000	0.0	0.0	0.0	±0.3
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	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	±0.3

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. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22039
Job No. : VC65AC0041
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	53.9	-0.1	±1.1
49.0	49.0	0.0	±1.1
44.0	43.9	-0.1	±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	26.9	-0.1	±1.1
26.0	25.9	-0.1	±1.1
25.0	24.8	-0.2	±1.1

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22039
Job No. : VC65AC0041
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	±0.3

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	±0.3
	2	8	117.0	117.0	0.0	±0.3
	200	800	134.0	134.0	0.0	±0.3
Slow	2	8	108.0	108.0	0.0	±0.3
	200	800	127.6	127.6	0.0	±0.3
	0.25	1	99.0	98.9	-0.1	±0.3
SEL	2	8	108.0	108.0	0.0	±0.3
	200	800	128.0	128.0	0.0	±0.3

10. Peak C sound level

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	-
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	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

T. Reth.

Continuation of Calibration Certificate

Cert. No. : ACL22839
Job No. : VC65AC0041
Pages : 8 of 8

11. Overload Indication

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

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limit (dB)
A-weight	137.0	137.0	0.0	±0.5

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 Sirinthorn Rd., Bangbunru, Bangplud Bangkok 10700 THAILAND.
Tel: 0-2435-8800 Fax: 0-2433-1679 e-mail: cal-center@sithiporn.com http://www.sithiporn.com

Cert. No. : ACL21065
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RJON
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00584983 / 175177 / 85722
ID No. : BKK_FS0926

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 : 06 JULY 2021
Calibration Date : 07-08 JULY 2021
Date of Issue : 13 JULY 2021

Calibrated by :

Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanskul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21065
Job No. : VC64AC0051
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	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EELBP_05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220076	EELBP_03/0264	08-Feb-22
Digital Multimeter	33461A	MY53220116	EELBP_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-42KA1	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

Continuation of Calibration Certificate

Cert. No. : ACL21065
Job No. : VC64AC0051
Pages : 3 of 8

Summary of Measurement Results

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

Continuation of Calibration Certificate

Cert. No. : ACL21065
Job No. : VC64AC0051
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

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

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
13.4

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	18.4
Flat	23.8

3. Acoustical signal tests of frequency weightings

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

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.3	0.3	0.3	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	-0.9	-0.8	-0.8	±5.0

QF-TS12-04-04-020664

T. P. Th...

Continuation of Calibration Certificate

Cert. No. : ACL21065
Job No. : VC64AC0051
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	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. P. Th...

Continuation of Calibration Certificate

Cert. No. : ACL21065
Job No. : VC64AC0051
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	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	26.0	0.0	±1.1
25.0	25.0	0.0	±1.1

QF-TS12-04-04-020664

T. P. Th...

Continuation of Calibration Certificate

Cert. No. : ACL21065
Job No. : VC64AC0051
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	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	136.0	-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. P. Th...

Continuation of Calibration Certificate

Cert. No. : ACL21065
Job No. : VC64AC0051
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

QF-TS12-04-04-020664

451-451/1 Sirinithom Rd, Bangbunruj, Bangkok 10700 THAILAND.
Tel:0-2435-8800 Fax:0-2433-1679 e-mail:cal-center@sithiporn.com http://www.sithiporn.comCert. No. : ACL21144
Pages : 1 of 8

Calibration Certificate

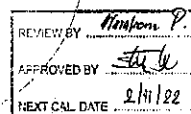
Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Pre-amplifier NH-24
Serial No. : 00572551 / 170383 / 72889
ID No. : BKK_FS0876

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 : 01 NOVEMBER 2021
Calibration Date : 02-04 NOVEMBER 2021
Date of Issue : 05 NOVEMBER 2021



Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. Petchurai
(Thanakul Petchurai)

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QF-TS12-04-04-020664

Continuation of Calibration Certificate

Cert. No. : ACL21144
Job No. : VC65AC0011
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	MY52302742	EF-0011-21	10-Feb-22
Digital Multimeter	33461A	MY53220104	EEL.BP. 05/0264	10-Feb-22
Digital Multimeter	33461A	MY53220976	EEL.BP. 03/0264	08-Feb-22
Digital Multimeter	8846A	1997025	EEL.BP. 06/0264	05-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-42KA1	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

Continuation of Calibration Certificate

Cert. No. : ACL21144
Job No. : VC65AC0011
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

Continuation of Calibration Certificate

Cert. No. : ACL21144
Job No. : VC65AC0011
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)
15.7

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

Frequency Weighting	Measured value (dB)
A-weight	12.6
C-weight	18.7
Flat	24.3

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	-1.0	-1.0	-0.9	±5.0

QF-TS12-04-04-020664

T. Rotor.

Continuation of Calibration Certificate

Cert. No. : ACL21144
Job No. : VC65AC0011
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	-0.1	0.0	0.0	±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	0.1	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. Rotor.

Continuation of Calibration Certificate

Cert. No. : ACL21144
Job No. : VC65AC0011
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	89.1	0.1	±1.1
84.0	84.1	0.1	±1.1
79.0	79.0	0.0	±1.1
74.0	74.1	0.1	±1.1
69.0	69.1	0.1	±1.1
64.0	64.0	0.0	±1.1
59.0	59.1	0.1	±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	26.0	0.0	±1.1
25.0	24.9	-0.1	±1.1

QF-TS12-04-04-020664

T. Rotor.

Continuation of Calibration Certificate

Cert. No. : ACL21144
Job No. : VC65AC0011
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	117.0	0.0	1.0; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5; -5.0
	2	8	108.0	108.0	0.0	1.0; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lepeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.1	-0.3	±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	135.2	-0.2	±2.0

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T. Rotor.

Continuation of Calibration Certificate

Cert. No. : ACL21144
Job No. : VC65AC0011
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

QF-TS12-04-020664



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CERTIFICATE OF CALIBRATION

Certificate No. : CL-075-64
Page 1 of 2

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer : DeltaOHM
Model : HD32.2
Serial No. : 16002004
ID No : BKK_F50851

Customer
Name : ALS laboratory group (thailand) Co., Ltd.
Address : 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date : 6 SEP 2021
Calibration date : 1 OCT 2021
Issue date : 4 OCT 2021

Reference Used During Calibration
1. Standard Temperature Probe Model: STS 100 A500, Serial No.: 667652 09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI 1000 A MK II, Serial No.: 671407 00591 Due date: 04 June 2022

Calibration Condition
Temperature : (23±3) °C
Relative Humidity : (55±15)%

Calibration Procedure
The temperature calibration was done by in-house calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90

Traceability
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-003621, Certificate number: ER-0032-21

REVIEW BY	<i>[Signature]</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	1/10/22

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Orathai Wiwatwattaya

Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Technical Support
and Calibration Manager



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Certificate No. : CL-075-64
Page 2 of 2

Result of Calibration : ☒ Without Adjustment ☐ With Adjustment

Calibration Range : 20 °C - 40 °C

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 16008207.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.052	20.0	0.1	0.099
30	25.043	25.0	0.0	0.099
30	30.034	30.0	0.0	0.099
30	35.031	35.0	0.0	0.099
30	40.019	39.9	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16010559.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.050	20.2	0.2	0.099
70	24.984	24.9	0.0	0.099
70	29.816	29.7	0.1	0.099
70	34.768	34.6	0.2	0.099
70	39.749	39.5	0.2	0.099

Table 3: This equipment was connected with Glove (thermometer probe Model: TP3276.2 S/N: 16008594).
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.052	20.1	0.0	0.099
110	25.043	25.0	0.0	0.099
110	30.034	30.0	0.0	0.099
110	35.031	34.9	0.1	0.099
110	40.019	40.0	0.0	0.099

UUC* : Unit Under Calibration
The reported expanded uncertainty is based on standard uncertainty multiplied by a coverage factor $k=2$ providing a level of confidence of approximately 95%.

* End of Certificate *



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CERTIFICATE OF CALIBRATION

Certificate No. : CL-017-65
Page 1 of 2

Equipment Name : Heat Stress Monitor with Sensor
Manufacturer : DeltaOHM
Model : HD32.2
Serial No. : 15036019
ID No : BKK_F50678

Customer
Name : ALS laboratory group (thailand) Co., Ltd.
Address : 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date : 10 JAN 2022
Calibration date : 15 FEB 2022
Issue date : 17 FEB 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS 100 A500, Serial No.: 667652 09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition
Temperature : (23±3) °C
Relative Humidity : (55±15)%

Calibration Procedure
The temperature calibration was done by in-house calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-003621, Certificate number: ER-0032-21

REVIEW BY	<i>[Signature]</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL. DATE	15/2/23

Calibrated by
☒ Mr. Sorawit Thachalad
☐ Miss Orathai Wiwatwattaya

Approved Signatory:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager



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Certificate No.: CL-017-65
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 16008205.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.040	20.1	0.1	0.099
30	25.034	25.1	0.1	0.099
30	30.019	30.1	0.1	0.099
30	35.018	35.1	0.1	0.099
30	40.004	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16010558.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.051	20.1	0.0	0.099
70	24.990	25.0	0.0	0.099
70	29.917	29.9	0.0	0.099
70	34.873	34.8	0.1	0.099
70	39.864	39.7	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16008185.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.042	20.1	0.1	0.099
110	25.032	25.1	0.1	0.099
110	30.019	30.1	0.1	0.099
110	35.020	35.1	0.1	0.099
110	40.001	40.1	0.1	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



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CERTIFICATE OF CALIBRATION

Certificate No.: CL-039-64
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaOHM
Model: HD32.2
Serial No: 15036021
ID No: BKH_FS0679

Customer
Name: ALS laboratory group (thailand) Co., Ltd.
Address: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 26 May 2021
Calibration date: 07 June 2021
Issue date: 10 June 2021

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 20 May 2021

Calibration Condition
Temperature: (23±3)°C
Relative Humidity: (55±15)%

REVIEW BY: Manom P.
APPROVED BY: [Signature]
NEXT CAL. DATE: 7/6/22

Calibration Procedure
The temperature calibration was done by in-house calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0071-20

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Orathai Wiatwittaya



Approved Signatory: [Signature]
Mr. Patsiya Booncharoen
Technical Support
And Calibration Manager

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Certificate No.: CL-039-64
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20°C - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 16008209.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.047	20.0	0.0	0.14
30	25.034	24.9	-0.1	0.19
30	30.018	29.9	-0.1	0.14
30	35.008	34.9	-0.1	0.14
30	39.989	39.9	-0.1	0.14

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15097322.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.037	20.2	0.2	0.14
70	24.874	24.8	-0.1	0.14
70	29.818	29.5	-0.2	0.14
70	34.767	34.4	-0.4	0.14
70	39.716	39.2	-0.5	0.14

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16008203.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.047	20.1	0.1	0.14
110	25.034	25.1	0.1	0.14
110	30.018	30.1	0.1	0.14
110	35.006	35.1	0.1	0.14
110	39.989	40.1	0.1	0.14

UUC*: Unit Under Calibration

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

★ End of Certificate ★



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CERTIFICATE OF CALIBRATION

Certificate No.: CL-091-64
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaOHM
Model: HD32.2
Serial No: 15035016
ID No: BKH_FS0676

Customer
Name: ALS laboratory group (thailand) Co., Ltd.
Address: 104 Phatthanakan 40, Phatthanakan Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 30 OCT 2021
Calibration date: 2 NOV 2021
Issue date: 3 NOV 2021

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition
Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure
The temperature calibration was done by in-house calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS 90.

Traceability
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0032-21

REVIEW BY: Manom P.
APPROVED BY: [Signature]
NEXT CAL. DATE: 2/11/22

Calibrated by
☐ Mr. Sorawit Thachalad
☒ Miss Orathai Wiatwittaya



Approved Signatory: [Signature]
Mr. Patsiya Booncharoen
Technical Support
and Calibration Manager

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Certificate No.: CL-091-64
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 20030504.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.062	20.1	0.0	0.099
30	25.047	25.1	0.1	0.099
30	30.036	30.1	0.1	0.099
30	35.030	35.1	0.1	0.099
30	40.023	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16009383.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.063	20.2	0.1	0.099
70	24.896	24.9	0.0	0.099
70	29.618	29.7	0.1	0.099
70	34.757	34.6	-0.2	0.099
70	39.723	39.5	0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 20009276.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.062	20.1	0.0	0.099
110	25.047	25.1	0.1	0.099
110	30.036	30.1	0.1	0.099
110	35.031	35.1	0.1	0.099
110	40.023	40.1	0.1	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



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CERTIFICATE OF CALIBRATION

Certificate No.: CL-031-64
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 15006301
ID No: BKK_FSO662

Customer
Name: ALS laboratory group (thailand) Co., Ltd.
Address: 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 14 MAY 2021
Calibration date: 17 MAY 2021
Issue date: 21 MAY 2021

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 20 May 2021

Calibration Condition
Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale was based on ITS-90.

Traceability

The measurement results are traceable to the International system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0071-20

REVIEW BY	<i>Phonkarn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	17/5/22

Calibrated by

☒ Mr. Sorawit Thachalad
☐ Mr. Bangkok Mailthong

Approved Signatory:

Mr. Parinya Booncharoen
Technical Support
And Calibration Manager



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Certificate No.: CL-031-64
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 °C - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 14039058.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.046	20.0	0.0	0.12
30	25.032	25.0	0.0	0.12
30	30.013	30.0	0.0	0.12
30	34.998	35.0	0.0	0.12
30	39.978	40.0	0.0	0.12

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15008013.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.052	20.3	0.2	0.099
70	25.034	25.0	0.0	0.099
70	30.019	29.6	-0.4	0.099
70	35.000	34.3	-0.7	0.099
70	39.992	39.0	-1.0	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 14039052.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.058	20.0	0.0	0.099
110	25.028	25.0	0.0	0.099
110	30.023	30.0	0.0	0.099
110	35.015	35.0	0.0	0.099
110	39.989	40.0	0.0	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



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CERTIFICATE OF CALIBRATION

Certificate No.: CL-063-64
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: Delta OHM
Model: HD32.2
Serial No: 15036014
ID No: BKK_FSO675

Customer
Name: ALS laboratory group (thailand) Co., Ltd.
Address: 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 3 AUG 2021
Calibration date: 4 AUG 2021
Issue date: 5 AUG 2021

Reference Used During Calibration

1. Standard Temperature Probe Model: STS-100 A500, Serial No.: 667682-09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No.: 671407-00591 Due date: 04 June 2022

Calibration Condition
Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure

The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale was based on ITS-90.

Traceability

The measurement results are traceable to the International system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0036-21, Certificate number: ER-0032-21

REVIEW BY	<i>Phonkarn P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	4/8/22

Calibrated by

☒ Mr. Sorawit Thachalad
☐ Miss Orathai Wiatwattaya

Approved Signatory:

Mr. Parinya Booncharoen
Technical Support
And Calibration Manager



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Certificate No.: CL-063-64
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20°C - 40°C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 16008216.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.057	20.0	-0.1	0.099
30	25.053	25.0	-0.1	0.099
30	30.045	30.0	0.0	0.099
30	35.038	34.9	-0.1	0.099
30	40.035	39.9	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16010563.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.057	20.0	-0.1	0.099
70	24.894	24.9	0.0	0.099
70	29.842	29.8	0.0	0.099
70	34.782	34.7	-0.1	0.099
70	39.740	39.6	-0.1	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16009200.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.058	20.1	0.0	0.099
110	25.053	25.1	0.0	0.099
110	30.045	30.1	0.1	0.099
110	35.038	35.1	0.1	0.099
110	40.035	40.1	0.1	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



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CERTIFICATE OF CALIBRATION

Certificate No.: CL-075-64
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaOHM
Model: H032.2
Serial No: 15003005
ID No: BKK_FS0692

Customer:
Name: ALS laboratory group (thailand) Co., Ltd.
Address: 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 8 SEP 2021
Calibration date: 1 OCT 2021
Issue date: 4 OCT 2021

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No: 667692 09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No: 671407-00591 Due date: 04 June 2022

Calibration Condition
Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS 90.

Traceability
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0036 21. Certificate number: ER-0032-21

REVIEW BY	<i>Parinya P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	1/10/22

Calibrated by
☒ Mr. Sorawit Thuchalea
☒ Miss Orathai Wiatwittaya



Approved Signature:

[Signature]
Mr. Parinya Booncharoen
Technical Support
and Calibration Manager

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Certificate No.: CL-076-64
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20°C - 40°C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 16008205.
Dimension: Diameter 14 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.058	19.9	-0.2	0.099
30	25.041	24.9	-0.1	0.099
30	30.023	29.9	-0.1	0.099
30	35.024	34.9	-0.1	0.099
30	40.034	39.9	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 16009355.
Dimension: Diameter 14 mm. Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.055	20.1	0.0	0.099
70	24.881	24.8	-0.1	0.099
70	29.837	29.7	-0.1	0.099
70	34.776	34.5	-0.3	0.099
70	39.741	39.5	-0.2	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 16008196.
Dimension: Diameter 8 mm. Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.058	20.1	0.0	0.099
110	25.040	25.1	0.1	0.099
110	30.024	30.1	0.1	0.099
110	35.023	35.1	0.1	0.099
110	40.034	40.1	0.1	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



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CERTIFICATE OF CALIBRATION

Certificate No.: CL-053-05
Page 1 of 2

Equipment Name: Digital thermometer with RTD
Manufacturer: DeltaOHM
Model: H032.2
Serial No: 15006710
ID No: BKK_FS0872

Customer:
Name: ALS laboratory group (thailand) Co., Ltd.
Address: 104 Phatthanasak 40, Phatthanasak Rd., Khwaeng Suan Luang, Khet Suan Luang, Bangkok 10250 Thailand.

Received date: 15 MAR 2022
Calibration date: 17 MAR 2022
Issue date: 18 MAR 2022

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No: 667692 09, Due date: 25 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No: 671407-00591 Due date: 04 June 2022

Calibration Condition
Temperature: (23±3)°C
Relative Humidity: (55±15)%

Calibration Procedure
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS 90.

Traceability
The measurement results are traceable to the international system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: TT-0036 21. Certificate number: ER-0032-21

REVIEW BY	<i>Parinya P.</i>
APPROVED BY	<i>[Signature]</i>
NEXT CAL DATE	1/15/23

Calibrated by
☒ Mr. Sorawit Thuchalea
☒ Miss Orathai Wiatwittaya



Approved Signature:

[Signature]
Mr. Parinya Booncharoen
Calibration Department Manager

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Certificate No.: CL-053-65
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15015852
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.082	20.0	-0.1	0.099
30	25.077	25.1	0.0	0.099
30	30.069	30.0	-0.1	0.099
30	35.064	35.0	-0.1	0.099
30	40.058	40.0	-0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 14036714.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.082	20.2	0.1	0.099
70	25.075	25.0	-0.1	0.099
70	30.058	29.9	-0.4	0.099
70	35.062	34.4	-0.7	0.099
70	40.036	39.6	-0.4	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15021832.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.082	20.1	0.0	0.099
110	25.077	25.1	0.0	0.099
110	30.069	30.1	0.0	0.099
110	35.064	35.1	0.0	0.099
110	40.056	40.1	0.0	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



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CERTIFICATE OF CALIBRATION

Certificate No.: CL-094-64
Page 1 of 2

Equipment Name: Heat Stress Monitor with Sensor
Manufacturer: DeltaGHM
Model: HD32.2
Serial No: 15008300
ID No: BKK_FSO661

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

Received date: 8 DEC 2021
Calibration date: 13 DEC 2021
Issue date: 14 DEC 2021

Reference Used During Calibration
1. Standard Temperature Probe Model: STS-100 A500, Serial No: 667682-09, Due date: 26 Mar 2022
2. Digital Temperature Indicator Model: DTI-1000-A MK II, Serial No: 871407-00591 Due date: 04 June 2022

Calibration Condition
Temperature: (23±3) °C
Relative Humidity: (55±15)%

Calibration Procedure
The temperature calibration was done by In-House calibration method as WI-CL-001 according to comparison method with standard digital temperature indicator and standard temperature probe. The temperature scale use was based on ITS-90.

Traceability
The measurement results are traceable to the International system of units (SI) through National Institute of Metrology Thailand (NIMT) Certificate number: IT-0036-21, Certificate number: ER 0032-21

REVIEW BY: *Manon P.*
APPROVED BY: *Manon P.*
NEXT CAL DATE: 13/12/22

Calibrated by:
☒ Mr. Sarawit Thachad
☐ Miss Orathai Winitwitaya



Approved Signatory: *Manon P.*
Mr. Parinya Booncharoen
Technical Support
and Calibration Manager

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Certificate No.: CL-094-64
Page 2 of 2

Result of Calibration: ☒ Without Adjustment ☐ With Adjustment

Calibration Range: 20 - 40 °C

Function:

Table 1: This equipment was connected with wet bulb probe Model: HP3201.2 S/N: 15003275.
Dimension: Diameter 14 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
30	20.061	20.1	0.0	0.099
30	25.051	25.1	0.0	0.099
30	30.036	30.1	0.1	0.099
30	35.033	35.1	0.1	0.099
30	40.025	40.1	0.1	0.099

Table 2: This equipment was connected with temperature probe Model: TP3207.2 S/N: 15031950.
Dimension: Diameter 14 mm, Length 150 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
70	20.059	20.1	0.0	0.099
70	24.877	24.9	0.0	0.099
70	29.822	29.8	0.0	0.099
70	34.778	34.6	-0.2	0.099
70	39.739	39.6	-0.1	0.099

Table 3: This equipment was connected with Globe thermometer probe Model: TP3276.2 S/N: 15008168.
Dimension: Diameter 8 mm, Length 170 mm.

Immersion Depth (mm)	Standard Reading (°C)	UUC Reading (°C)	Error (°C)	Uncertainty (°C)
110	20.061	20.1	0.0	0.099
110	25.053	25.1	0.0	0.099
110	30.035	30.1	0.1	0.099
110	35.033	35.1	0.1	0.099
110	40.025	40.1	0.1	0.099

UUC*: Unit Under Calibration

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

★ End of Certificate ★



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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TEL: 0-2373-3800-34 FAX: 0-2373-9454



Certificate of Calibration

Certificate No.: 21PH435
Page: 1 of 2

Equipment: Lux Meter
Manufacturer: PEAKMETER
Model: PM6612L
Serial No.: H12A-K20118
ID No.: BKK_F81146

Condition As-Received: New Item
Received Date: 24 August 2021
Calibration Date: 08 September 2021

Reference: 2108-0737WSC
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %

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

Procedure used: Calibration were conducted using In-house calibration procedure CP-PM01 by measuring against luminous-intensity standard lamp (source-based method) According to the Inverse square law measurement method.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Photometry & Encoder	LMguide 9.6 m	120RC003	61-140006-1	30 Apr 2022
2) High-accuracy Irradiance Standard	OL-FEL-U	F-1472	TP-1045-20	20 Oct 2021

2. This result of calibration was made on requested at the point specified by customer.

3. Test Equipment: Programmable Voltage/Current Source (Model: OL83A, SN: 09220284).

4. Test Equipment: Illuminance Meter (Model: 51002, SN: 080129).

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

6. This Certification is traceable to the International System of Unit maintained at -National Institute of Metrology Thailand (NIMT)

REVIEW BY: *Manon P.*
APPROVED BY: *Manon P.*
NEXT CAL DATE: 8/9/22

Calibrated by: Nuntawat Khanchai
Issue Date: 10 September 2021

Approved Signatory: *Manon P.*
Phalinee Prabpai
Chaitawan Khunpluek

B 0269210



Cert. No.: 21PH435
Page.: 2 of 2

Result of calibration: (*) Without adjustment () After adjustment

Function : Illuminance Measurement	Range : Autorange		
Standard Value	UUC* Reading	Error	Uncertainty
(lx)	(lx)	(lx)	(± lx)
0	0.00	0.00	0.060
15	14.88	-0.02	0.20
100	100.4	0.4	1.3
500	502	2	6.5
1000	1005	5	13
2000	2000	0	27
3000	3000	0	40
4000	4010	10	52
5000	5010	10	65

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

Light source factor setting : L0 = 1.000
UUC* = Unit Under Calibration.

-000-

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

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : SevenCompact S220
Serial No. : BS20948428
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 :

REVIEW BY	Sinik P.
APPROVED BY	K.L.A.I.
NEXT CAL. DATE	9/4/22

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

Calibrated by : Warakorn Lemgagrakul

Approved by :

(/) Malee Butkruea
() Sathip Meangmal
() Warakorn Lemgagrakul

Issue Date : 31 March 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 & 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.	Due Date
1) Document Process Calibrator	1385032	130RC022	20E4213	24 Nov 2021
2) Ref. Standard Thermometer	4982054	110RC044	20I1233	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. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	706694	08 Sep 2022
pH 6.885	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
			mV	pH		
pH Meter S/N: BS20948428	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: 9265091	4.008	4.010	150.3	0.0048	2.00
	6.885	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 %.

-000-

a 1048958

LABX 2280107

Test Report

Customers	: ALS Laboratory Group (Thailand) Co., Ltd.	Manufacturer	: HACH
Equipment	: Chlorine Meter	ID No.	: BKK_L00042
Controller Model	: DR300	Sensor Serial No.	: -
Controller Serial No.	: 20040A01722	Period	: -
Date of test	: 25/01/2022	Humidity	: 58.0 %RH
Environment temperature	: 25.9 °C		

Results

Instrument Checked

Item	Characteristic	Before	After	Remark
1	Visual Inspect	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
2	Power Supply (4.5 - 8.5 VDC)	8.0 VDC	8.0 VDC	
3	Display Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
4	Keyboard Check	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
5	Function System Program	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

Warning and Error Checked

Item	Event	Before	After
6	Error Int	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear	<input checked="" type="checkbox"/> None <input type="checkbox"/> Appear

Check with Standard

Item	Characteristic	Before	After	Remark
7	Blank (0.00 mg/l)	0.00 mg/l	0.00 mg/l	
8	Standard C2 No. 1 (0.25 ± 0.09 mg/l)	0.22 mg/l	0.24 mg/l	
9	Standard C2 No. 2 (0.54 ± 0.10 mg/l)	0.50 mg/l	0.50 mg/l	
10	Standard C2 No. 3 (1.72 ± 0.14 mg/l)	1.83 mg/l	1.67 mg/l	
11	Blank (0.00 mg/l)	0.00 mg/l	0.00 mg/l	
12	Standard C2 No. 1 (2.2 ± 0.2 mg/l)	2.1 mg/l	2.2 mg/l	
13	Standard C2 No. 2 (4.1 ± 0.3 mg/l)	3.9 mg/l	4.0 mg/l	
14	Standard C2 No. 3 (7.0 ± 0.6 mg/l)	6.8 mg/l	7.0 mg/l	

REVIEW BY: Chayadha P.
APPROVED BY: [Signature]
NEXT CAL DATE: 28/1/23



LABX 2280107

Summary of checked

- ☒ The instrument can work normally and efficiently. (เครื่องมือสามารถทำงานได้อย่างมีประสิทธิภาพ)
- ☐ The instrument can work but it's needing to maintenance. (เครื่องมือสามารถทำงานได้แต่ต้องบำรุงรักษา)
- ☐ The instrument could not work it's resulting to repair. (เครื่องมือไม่สามารถทำงานได้เนื่องจากระบบชำรุด)

Remark:

Standard Equipment Used

Equipment	Equipment I.D.
Standard Chlorine DPD-CHLORINE-LR	Lot No. A0187 Exp. date: Jun-22
Standard Chlorine DPD-CHLORINE-HR	Lot No. A0184 Exp. date: Jun-22
Digital multi meter	S/N: 21180088 Due date: 19-Mar-22
Thermo hygrometer	S/N: 45148347 Due date: 30-JA-22

Test By:

WILAKOL S.

Approved by:

[Signature]

(Miss Wilalak Sawangpun)

(Mr. Suanun Sertysangkool)

Service Engineer

Position: Assistant Service Division Manager



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES & EQUIPMENT CALIBRATION AND TESTING SERVICES
5344 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL: 0-2717-900-27 FAX: 0-2716-9104



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.
Khwaeng Phatthanakan, Khel 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-ngueunkam Wongsa

Approved by: [Signature]
Approved Signatory

- () Ponthippa Tameyakul
- (x) Malee Butkruea
- () Ponpan Palpim
- () Srisuda Khambha

Issue Date: 31 March 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 & Equipment Calibration and Testing Services.

A 0026589



Equipment: Burette
Received Date: 24 March 2021
Condition As-Received: Used Item
Calibration Date: 30 March 2021
Reference: 2103-1008DSC-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-Hygrometer	TH 803	09153022	140EC004	20H1434	NIST, NIMT	19 June 2021
3) Thermometer		1594592	140EC010	20H1191	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 %.

-080-

[Signature]

a 1048960



Metrological Center

SCI ECO Services Company Limited

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Saraburi Tel: +66 3827 3096 Fax: +66 3627 3100
Bangkok Tel: +668 8205 8851, +669 8247 2380
Website: www.sci-eco.co.th E-Mail: calibrate@scg.co.th



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 : Watcharapong Songthong (Technician)

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

Date of Issue : 20 MAY 2021

REVIEW BY	<u>Sirirak P.</u>
APPROVED BY	<u>V.L.A.</u>
NEXT CAL. DATE	<u>16/11/22</u>

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 117/15-02-64



Metrological Center

SCI ECO Services Company Limited

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



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
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

(X) without adjustment () after adjustment

Approved By : Boonchai

FM-L15 117/15-03-63



Metrological Center

SCI ECO Services Company Limited

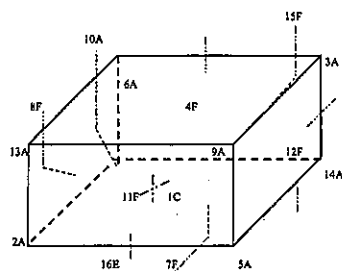
33/2 Moo 3, T.Banpa, A.Kaengkhoh, Saraburi 18110, Thailand.



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 : Boonchai

FM-L15 117/15-03-63



Metrological Center

SCI ECO Services Company Limited

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



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	2.00

* The Accredited 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 : Boonchai

FM-L15 117/15-03-63



SARTORIUS

Certificate of Calibration

REVIEW BY: Siriruk P.
APPROVED BY: KL AL
NEXT CAL DATE: 3/9/23

Model Number: **MSU2245-000-DA** Certificate No.: **218C0263**
Description: **Analytical Balance** Issued Date: **Monday, September 06, 2021**
Serial Number: **27405555 # BKK_EN0003** Reference No.: **502052**
Manufacturer: **Sartorius** Page No.: **1 of 2**

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

Calibrated Place: **Lab Room**

Calibrated By: **Mr. Chonchai Inthana** Calibration Procedure No.: **This calibration was conducted by**
Calibration Date: **Friday, September 03, 2021** Using in-house calibration procedure number (M-003)
Based on UKAS LAB 14

Metrological data: Ambient Conditions:
Capacity: **220 g** Readability: **0.0001 g** Temperature: **23.5 °C ± 5.0 °C**
Humidity: **59.1 % RH ± 10.0 % RH**
Pressure: **±**

Reasons for calibration: ☐ New Installation ☐ Service / Repaired ☒ No Calibration Maintenance
Equipment Condition: ☒ Good Operation ☐ Fail

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 realise the unit of measurement according to the International System of Units (SI). Report of Tolerance came from list of Sartorius Metrological Specifications.

Model Number	Description	Traceability	Certificate No.	Due Date
YCS011-522-00	Sartorius weight set, 1mg - 200g E2, YCS011-522-00	Sartorius	119934 D-K-1998-01-00	10-Sep-2021
MHB-3825D	Humidity/Balometer/Temp. Lutron MHB-3825D	SPCC	KSPR2111869	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 17025-RF-22 26/03/2020 R2
Mr. Chonchai Inthana (Technical Manager)

SARTORIUS

Certificate of Calibration

Model Number: **MSU2245-000-DA** Certificate No.: **218C0263**
Description: **Analytical Balance** Issued Date: **Monday, September 06, 2021**
Serial Number: **27405555 # BKK_EN0003** Reference No.: **502052**
Manufacturer: **Sartorius** Page No.: **2 of 2**

Calibration Results: Without Adjustment

Repeatability			Eccentricity (Off-center loading error)		
The repeatability is the ability of a weighing instrument to display nearly identical readouts under standard 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.			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: (Low Load)	20.0000 g	200.0001 g	Nominal value:	50 g	
20 g	20.0001 g	200.0000 g	Tolerance	0.0004 g	
Tolerance	0.0001 g	0.0001 g			
Nominal Value: (High Load)	200 g	200.0001 g			
200 g	20.0001 g	200.0000 g			
Tolerance	0.0001 g	0.0001 g			
Standard Deviation	0.00005	0.00005			

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	100.0002	100.0002	0.0000	0.00018
200	200.0001	200.0001	0.0000	0.00029

End of Report
ISO 17025-RF-22 26/03/2020 R2



Metrological Center

SCI ECO Services Company Limited

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Bangkok Tel: +668 9205 6851, +668 9247 2380

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



Certificate No. T220139

Page 1 of 3

Certificate of Calibration

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

REVIEW BY: Siriruk P.
APPROVED BY: KL AL
NEXT CAL DATE: 1/8/23

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-L15 11/15-02-64



Metrological Center

SCI ECO Services Company Limited

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



Certificate No. T220139

Page 2 of 3

Calibration Report

Equipment: **Liquid Bath (Water)**
Date of Calibration: **31 January 2022**
Environment: **Temperature: 22.4-23.9 °C**
Line Voltage: 221.4-225.4 V
Relative Humidity: 55-65 %RH

Condition of this results of calibration:

- This equipment was calibrated by insert five resistance thermometer detectors into its water bath, the other one thermocouple type T use for ambient temperature measurement. The calibration was done in according to WI-T36 (based on ASTM E715-80 (Reapproved 2001)). All data shown 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 M34 (CHI-CH15) T210115 2 February 2022
DATA LOGGER 34970A T47 T210115 2 February 2022
- This certificate is traceable to:
National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS 17025 CALIBRATION 0244.)
- Condition of calibrated item: good
Equipment Description:
Time Constant: **1** Hour **5** Minute At **60** °C
- Adjustment:
(X) without adjustment () after adjustment

Approved By: /Sujjar Nakkakred

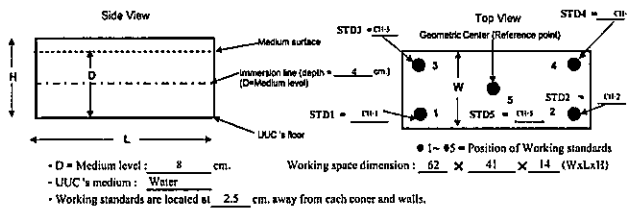
FM-L15 11/15-05-63



Certificate No. T220139

Page 3 of 3

Calibration Report



Measurement Results:

Calibration Point	Average Standard Reading at each position (°C)				
	CII-1	CII-2	CII-3	CII-4	CII-5
60	59.95	60.04	60.12	60.01	59.89
85	85.17	84.89	85.34	84.78	84.93
95	93.46	93.14	93.81	93.05	93.28

Liquid Bath (Water)		Temperature Distribution			
Setting (°C)	Reading (°C)		Stability (°C)	Uniformity (°C)	Uncertainty (°C)
	Min, Max	Average			
61.0	60.9, 61	61.0	0.10	0.19	0.25
96.0	95.9, 96.1	96.0	0.12	0.39	0.32
95.0	94.8, 95.1	94.9	0.14	0.51	0.38

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

Approved By: _____

FM-L15 117/15-05-63



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

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmort
Model : UFE 500
Serial No. : G511.1574
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 : Khit Ruttanapreapachal

Approved by : _____
Approved Signatory

() Pornthippa Tameyakul
() Malee Butkrua
() Suwit Injai

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
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-0102 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	21LM4/1	06 Mar 2022

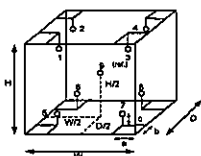
2. This certificate is valid only to the item calibrated on date and place of calibration.

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 = 0.58 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

a 1085618



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2112-0002OC-1
Result of Calibration : () Without Adjustment
Function of UUC : Temperature Source
Fresh air setting : Close

Cert. No.: 21TM2189
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
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

Measured Temperature (°C)									
Calibration Point (°C)	Position								
	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	120.836	120.519	120.661	120.524	121.182	120.855	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	178.792	179.374	179.575	179.376	180.843	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 %.

-680-

a 1085617



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

Certificate of Calibration

Equipment : Conductivity Meter
Manufacturer : Mettler Toledo
Model : SevenCompact
Serial No. : B429832157
ID No. : BKK_EN0065
Condition As-Received : Used Item
Received Date : 17 November 2021
Calibration Date : 19 November 2021
Reference : 2111-0568DSC-6
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khel Suan Luang,
Bangkok 10250 Thailand

Ambient Temperature : $(25 \pm 2.5) ^\circ\text{C}$
Relative Humidity : $(50 \pm 15) \%$
Calibration Procedure : In-house method :
- CP-CH6 : based on direct measurement by
using reference material (RM)

Calibrated by : Walalak Sirithuan

Approved by :
(/) Malee Butkruea
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 23 November 2021
The Uncertainties are for a confidence probability of approximately 95%.

This certificate may not be reproduced without the full, except with the prior written approval of the head of Calibration and Testing Equipment Services

A 0007977



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

Condition of this result of calibration

1. Reference Standard Instrument :-

Instrument	Serial No.	ID No.	Certificate No.	Due date
1) Thermometer	9549224	130RC003	211451	15 Apr 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 :-

- Conductivity calibration solution, Thermo Scientific (traceable to NIST)

Conductivity Solution	Manufacturer	Lot No.	Exp. date
84 $\mu\text{S/cm}$	Thermo Scientific	081/02	23 Feb 2022
1413.0 $\mu\text{S/cm}$	Thermo Scientific	171/02	30 Apr 2024
12.880 mS/cm	Thermo Scientific	230/01	07 June 2023

- Control Conductivity calibration solution temperature by Water bath $(25 \pm 0.1) ^\circ\text{C}$

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

Calibration results

Function : Conductivity Measurement

(*) After Adjustment at 1413 $\mu\text{S/cm}$

Conductivity Electrode Serial No.: 5821270404

Standard Conductivity Solution	Before Adjustment UUC* Reading	After Adjustment UUC* Reading	Uncertainty of Measurement (\pm)	Coverage factor k
84 $\mu\text{S/cm}$	85.82 $\mu\text{S/cm}$	85.52 $\mu\text{S/cm}$	4.3 $\mu\text{S/cm}$	2.00
1413 $\mu\text{S/cm}$	1419 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	15 $\mu\text{S/cm}$	2.00
12.88 mS/cm	12.82 mS/cm	12.79 mS/cm	0.14 mS/cm	2.00

Remark - UUC* = Unit Under Calibration

- Adjustment Cell constant = 0.559929 cm^{-1}

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

-000-

a 1083372



Cert.No.: 21TW8
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-5
Submitted by : ALS Laboratory Group (Thailand) Co., Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khel Suan Luang,
Bangkok 10250 Thailand

Laboratory Condition : Temperature $(25 \pm 5) ^\circ\text{C}$
Humidity $(50 \pm 20) \%$
Test Procedure : In-house method : CP-CH9
by Comparison Technique with Azide Modification Method

Calibrated by : Walalak Sirithuan

Approved by :
Approved Signatory

(/) Malee Butkruea
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 25 January 2021

B 0251901



Cert.No.: 21TW8
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 was 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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a 1037070



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5144 PATTANAKARN ROAD SOI 11, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-27 FAX. 0-2719-9444



NSC-TIS-TIS 17025
CALIBRATION 0244

Cert. No.: 21TM168
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.,
Khwang 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 :
() Pornthippa Taneyakul
() Malee Butkruea
() 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.

A 0023875



Equipment : DO Meter with Sensor
Condition As-Received : Used Item
Reference : 2101-0428WSC-8
Cert. No.: 21TM168
Page: 2 of 2

Procedure Used :-
Calibration were conducted using In-house calibration procedure OP-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	2186080	201389	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: 16C100772

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (±°C)	Coverage Factor k
20.00	60	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 %.

-000-

a 1038215



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, +668 9247 2350
Website: www.scieco.co.th E-Mail: calibrate@scg.co.th

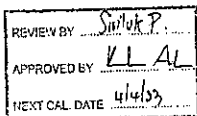


Certificate No. T212123

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., Khwang 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 : / 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.

FN-L14 117/01-02-64



Metrological Center SCI ECO Services Company Limited

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



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 :

1. 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 AS2853-1985).
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
RTD	100 ohm	29-(CH1-10)	T210118	2 February 2022
DATA LOGGER	34970A	T47	T210118	2 February 2022

3. This certificate is traceable to :

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

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour 20 Minute At 20 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By :

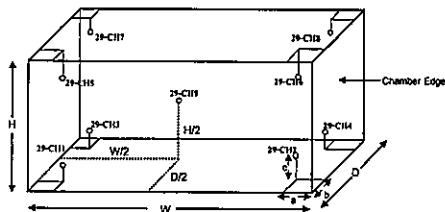
FM-L15 117/15-05-63



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-CH8 : a = 5 cm. , b = 5 cm. and c = 5 cm.
Size of Installed Standard sensor number 29-CH9 : W/2 = 70 cm./2 , H/2 = 130 cm./2 and D/2 = 55 cm./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	1.01	0.38	2.00
25.0	-	25.0	0.07	0.95	0.38	2.00

* The quoted uncertainty exclude "uniformity"

The calibration result apply only the above calibrated item.

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

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a distribution, providing a level of confidence of approximately 95 %.

Approved By:

FM-LIS 117/15-05-03



Cert.No.: 22CH199
Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Mettler Toledo
Model : Seven2Go S2
Serial No. : B617388431
ID No. : BKK_LG0004
Condition As-Received : Used Item
Received Date : 08 February 2022
Calibration Date : 10 February 2022
Reference : 2202-0244DSC-12
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khel Suan Luang,
Bangkok 10250 Thailand

REVIEW BY

APPROVED BY

NEXT CAL. DATE 10/2/25

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 : Uthen Kanikawit

Approved by :

Approved Signatory

(/) Malee Butkrues
() Sathip Meangmai
() Warakorn Lemgagrakul

Issue Date : 14 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0037920



Cert. No.: 22CH199
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 43160066 130RC092 21E1223/1 27 Apr 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 766820 23 Sep 2023
pH 6.983 CPA chem 766822 04 Sep 2022
pH 10.015 CPA chem 766824 04 Sep 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
			mV	pH		
pH Meter S/N: B617388431	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 (±)	Coverage factor k
pH Electrode S/N: 2028288	4.008	4.01	178	0.0078	2.00
	6.983	6.98	3	0.0089	2.00
	10.015	10.02	-174	0.0092	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 %.

-000-

a 1094511



Cert. No.: 22LM11
Page: 1 of 2

Certificate of Calibration

Equipment : pH Meter with Sensor
Manufacturer : Mettler Toledo
Model : Seven2Go S2
Serial No. : B617388431
ID No. : BKK_LG0004
Submitted by : ALS Laboratory Group (Thailand) Co.,Ltd.
104 Phatthanakan 40, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khel Suan Luang,
Bangkok 10250 Thailand
Location : TPA On Site Calibration Laboratory

Received Order : 8 February 2022
Calibrated Date : 11 February 2022
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
AC Line Voltage : (220 ± 22) V

Calibrated by : Preecha Hiahib

Approved by :

Approved Signatory

(/) Pormthippa Tameyakul
(/) Malee Butkrues
() Suwit Imjai

Issue Date : 18 February 2022

The Uncertainties are for a confidence probability of approximately 95%

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A 0037968



Equipment: pH Meter with Sensor
 Condition As-Received: Used Item
 Reference: 2202-0244DSC-18

Cert. No.: 22LM11
 Page: 2 of 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	2186080	2111273	22 Nov 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: 2026288

Calibration Point (°C)	Immersion Depth (mm)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty (± °C)	Coverage Factor k
20.0	120	20.003	20.2	0.197	0.16	2.00
25.0	120	25.003	25.2	0.197	0.16	2.00
30.0	120	30.004	30.3	0.296	0.16	2.00
35.0	120	35.002	35.3	0.298	0.16	2.00
40.0	120	40.002	40.3	0.298	0.16	2.00
45.0	120	45.005	45.3	0.295	0.16	2.00
50.0	120	50.005	50.3	0.295	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 %.

-000-

a 1095819

Certificate of System Qualification

ES-OQ

System ID: MY16010005
 Organization Name: ALS Laboratory Group (Thailand) Co., Ltd.
 Organization Location: 104 Phatthanakan 40 Phatthanakan Rd., Bangkok 10250

Date: September 13, 2021 5:49:11 PM
 EQP Name: Agilent/Recommended
 EQP Revision: ES.02.50
 Overall Qualification Status: Pass

Preparation

Pass

Instrument Tests

Pass

Autosampler Operation

Pass

REVIEW BY	Thitima B.
APPROVED BY	Savitree N.
NEXT CAL DATE	12 Mar 23

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

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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: G6010A
 Sample Introduction: Double pass glass cyclonic spraychamber and 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: 2009-00159

Autosampler 1

Manufacturer: Agilent Technologies
 Name: SP64
 Model Number: G8410A
 Serial Number: AU15440784

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

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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: Kanyakorn Sukphatthajareem
 Logged On User Name: phimprapha.jeeeraphong@agilent.com
 Signature Creation Date: September 13, 2021
 Reason for Signature: Executed protocol and published this original version of document

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

Page 3/5

User Name: phimpapha.jearphong
Host Name: A8BKH00338

System ID: MY16010005
Print Date: September 13, 2021 8:45:12 PM

OQHW 5100 ICP-OES ALB 08Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 8:45:59 AM	Audit	Session Created	Session	None
September 8, 2021 8:48:29 AM	Start	Configuration	Session	None
September 8, 2021 8:49:29 AM	Audit	Endtime	Licensing	User is Field Engineer and does not require an unlock code
September 8, 2021 8:50:05 AM	Audit	ExpLoaded	Session	EQP details for primary technique [E1] - F14 pHPC [PhotosPeaks/Cu/Configural on 02.00/02.00.exp] EQP File Name: [E1.02.00.exp], 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 9:07:19 AM	Start	Execution	Preparation : 5100 SVDV; Qualitative Test - No setpoints associated	None
September 8, 2021 9:34:36 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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Date: September 13, 2021 5:49:11 PM
System ID: MY16010005

Page 4 / 5

User Name: phimpapha.jearphong
Host Name: A8BKH00338

System ID: MY16010005
Print Date: September 13, 2021 8:49:12 PM

OQHW 5100 ICP-OES ALB 08Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 9:51:35 AM	Start	Execution	Autosampler Operation : Autosampler 1 - SPS4; Qualitative Test - No setpoints associated	None
September 8, 2021 9:51:38 AM	End	Execution	Autosampler Operation : Autosampler 1 - SPS4; Qualitative Test - No setpoints associated	Run Count : 1
September 8, 2021 9:51:54 AM	End	Qualification	Session	OQ
September 8, 2021 9:51:58 AM	Start	Reporting	Session	None
September 9, 2021 10:55:49 AM	Audit	AccClosed	Session	None
September 13, 2021 8:01:26 PM	Audit	AccReopened	Session	None
September 13, 2021 5:01:26 PM	Audit	SessionReloaded	Session	None
September 13, 2021 5:01:26 PM	Start	Qualification	Session	OQ
September 13, 2021 5:47:35 PM	Audit	Reporting	Session	Report Generated : Certificate

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

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Agilent CrossLab Compliance Services

Agilent
CrossLab
Compliance Services

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

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

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Signature	31
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Date: September 13, 2021 5:50:41 PM
System ID: MY16010005

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Test Summary

Purpose

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

Details	Status	Runs
Test		
Preparation : 5100 SVDV	Pass	1
Instrument Tests : 5100 SVDV	Pass	1
Autosampler Operation : Autosampler 1 - SP54	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: Agilent Recommended
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 Thilima Boonpeng
Job Title: Scientist 2, Life Sciences
Qualification Location: ICP Room

Operator Details

Name: Kanyakorn sukphetrakarn
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 nebulizer
Serial Number: MY16010005
Firmware Revision: 5385

Chiller 1

Manufacturer: Agilent Technologies
Name: Other Unspecified
Other Unspecified Name: Chiller
Model Number: Other Unspecified
Other Unspecified Model Number: G3292-80201
Serial Number: 2006-00159

Autosampler 1

Manufacturer: Agilent Technologies
Name: SP54
Model Number: G8410A
Serial Number: AU15440784

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.:

G6010A

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 Data:

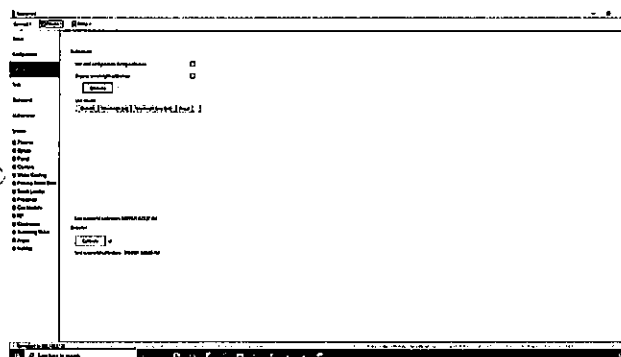
Was the detector calibration performed and completed successfully?

Date and Time:

September 8, 2021 9:07:42 AM

Host Name:

ASBKXW328



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Image Details:

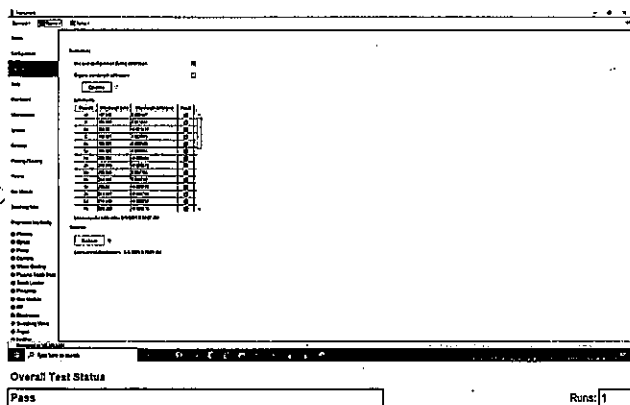
Was the instrument calibration performed and completed successfully?

Date and Time:

September 8, 2021 9:33:30 AM

Host Name:

ASBKXW328



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.:

G6010A

MY16010005

Results

Observed Result Expected Result Status

Are the Functional Tests results within acceptance criteria?

Subsystem Communications

Yes

Yes

Pass

Air Flow

Yes

Yes

Pass

Water Flow

Yes

Yes

Pass

Gas Flows

Yes

Yes

Pass

RF Generator

Yes

Yes

Pass

Camera

Yes

Yes

Pass

Optics

Yes

Yes

Pass

Are the Instrument Performance Tests results within acceptance criteria?

Resolution

Yes

Yes

Pass

Sensitivity

Yes

Yes

Pass

Precision

Yes

Yes

Pass

Overall Test Status

Pass

Runs: 1

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Autosampler Operation

Purpose

This test verifies that the autosampler operates properly.

Configuration Details

Model/Serial No.:

G9410A

AU15440764

Results

Criteria

Observed Result

Expected Result

Status

Does the autosampler successfully move to the specified location(s)?

Yes

Yes

Pass

Overall Test Status

Pass

Runs: 1

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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
EQR	Comments	General	1
EQR	General	Instrument's Test Report	5
EQR	General	Instrument's Test Report	4

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General

Document Name:

Certificate of Qualification for ACE



Agilent Compliance Engine Self Qualification

Date: September 8, 2021 10:10:10 AM

Device Serial #: EAF04572

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 console summary and are included by the actual algorithms challenged during the process. There is not a one-to-one relationship between algorithms and CE program tests because some algorithms are used by several tests and across multiple similar hardware components of the qualified system.

Technique Type	Tests Completed	Result
UV-Vis Spectrophotometer	13	Conforms
Atomic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Software	6	Conforms
Simulation 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: Kanyasara Sukprattajarn

Title Of Course: AN-CE-SS-U-010-A: ACS 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, course documentation, technical support, course 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: Kanyasara Sukprattajarn

Title Of Course: ANV-CE-ACPOES-2-008-A: Agilent 5100 ICD-0ES Support Noophyte 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, course documentation, technical support, course 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 HP-CEES HP-ACE, 1 µg/mL, 10mL
Agilent Part No: 610000010
Lot No: 06197041

Product Specifications

Analysis	Sampling Interval	CEES	Certified Conc.	Analysis	Sampling Interval	CEES	Certified Conc.
As	HP-CEES	7100-21	2.000 ± 0.005 µg/mL	As	HP-CEES	7100-21	2.000 ± 0.005 µg/mL
As	HP-CEES	7100-21	1.000 ± 0.005 µg/mL	As	HP-CEES	7100-21	1.000 ± 0.005 µg/mL
As	HP-CEES	7100-21	0.500 ± 0.005 µg/mL	As	HP-CEES	7100-21	0.500 ± 0.005 µg/mL
As	HP-CEES	7100-21	0.250 ± 0.005 µg/mL	As	HP-CEES	7100-21	0.250 ± 0.005 µg/mL
As	HP-CEES	7100-21	0.125 ± 0.005 µg/mL	As	HP-CEES	7100-21	0.125 ± 0.005 µg/mL
As	HP-CEES	7100-21	0.062 ± 0.005 µg/mL	As	HP-CEES	7100-21	0.062 ± 0.005 µg/mL
As	HP-CEES	7100-21	0.031 ± 0.005 µg/mL	As	HP-CEES	7100-21	0.031 ± 0.005 µg/mL
As	HP-CEES	7100-21	0.016 ± 0.005 µg/mL	As	HP-CEES	7100-21	0.016 ± 0.005 µg/mL
As	HP-CEES	7100-21	0.008 ± 0.005 µg/mL	As	HP-CEES	7100-21	0.008 ± 0.005 µg/mL

Shelf Life: 18 Months

Intended Use: This solution is intended for use as a certified reference material in calibration standard for laboratory wavelength calibration. It is not intended for use as a standard solution for quantitative analysis. It is not intended for use as a standard solution for quantitative analysis. It is not intended for use as a standard solution for quantitative analysis.

Stability: This solution is stable for use as a certified reference material in calibration standard for laboratory wavelength calibration. It is not intended for use as a standard solution for quantitative analysis. It is not intended for use as a standard solution for quantitative analysis. It is not intended for use as a standard solution for quantitative analysis.

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Document Name:

Certificate of Analysis Wavelength calibration solution



Period of Validity: Agilent warrants the accuracy of this solution until the expiration date shown below, provided the instructions for use are followed. Beyond the period of validity, the purchaser will be notified if this product is recalled due to a significant change in the quality of the solution.

Date of release: 8 April 2020
Date of expiration: 8 April 2021

Signature: [Signature]
Name: [Name]
Title: [Title]

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Document Name: Certificate of Analysis Wavelength calibration solution



Research Information: Refer to the Safety Data Sheet (SDS), which can be obtained at www.merck.com/research

Warning: This solution was determined to be hazardous by procedure 8 compared with the required limits of 0.5 mg/L Pb and 100 mg/L Zn. The toxic weight of the diluted solution was analyzed in order to keep quality in accord with GSP 6-13.

For further information: Please contact your subject for further information about this CBM.

- Quality Assurance: This CSMS was prepared in accordance with the following standards:
- Approved in 2011/2012 – by the Management System – Requirements (NEN/ISO 9001:2012)
 - Approved in 2017/2018 – Revised Requirements for the Competence of Personnel (NEN/ISO 9001:2015)
 - Approved in 2017/2018 – Revised Requirements for the Competence of Personnel (NEN/ISO 9001:2015)
 - Approved in 2017/2018 – Revised Requirements for the Competence of Personnel (NEN/ISO 9001:2015)

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Document Name: Certificate of Analysis Wavelength calibration solution

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Comments

Date/Time: September 13, 2021 5:27:55 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.
---------	--

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General

Document Name: Instrument's Test Report

Report Summary

Instrument Model	Agilent 81003110 BVDV ICP-OES
Instrument ID	05019AG8014A
Instrument Serial Number	MY16010008
Software Version	7.8.3.11953
Firmware Version	6395
Tested By	Katryn Korn
Test started on	9/6/2011 8:51:21 AM
Test Completed On	9/6/2011 9:56:35 AM

Read 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

Optics Test				Pass
	Radial	Axial	8VDV	
Intensity	3082179	3162090	3419298	
Wavelength	737.212	737.212	737.212	

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Document Name:

Instrument's Test Report

Element Wavelength	Specification	Wavelength
N (174.213 nm)	± 0.40	7.54
As (188.880 nm)	± 0.20	8.43
C (187.037 nm)	± 11.80	8.86
Mo (202.032 nm)	± 0.20	8.90
Cr (204.186 nm)	± 13.40	11.58
Zn (213.857 nm)	± 0.70	7.27
Pb (220.353 nm)	± 0.50	7.32
Ce (228.815 nm)	± 17.20	12.68
Ba (234.454 nm)	± 0.40	7.80
Mn (257.610 nm)	± 13.30	6.99
Mn (257.610 nm)	± 20.30	16.83
Cr (267.718 nm)	± 11.00	8.35
Cu (274.754 nm)	± 25.00	19.14
Co (277.303 nm)	± 16.20	11.75
Br (334.371 nm)	± 33.50	26.94
Ba (455.403 nm)	± 44.00	33.67
Br (460.733 nm)	± 38.00	32.34
Ba (493.408 nm)	± 36.00	28.96
Ba (493.408 nm)	± 43.00	28.49
As (493.408 nm)	± 34.00	30.91
K (766.491 nm)	± 80.00	16.42

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Document Name:

Instrument's Test Report

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.880 nm)	± 0.20	SRIR	54.8	160.1	94.9
Ba (188.880 nm)	± 0.10	SRIR	55.8	709.4	113.8
Zn (213.857 nm)	± 0.210	SRIR	2065.3	20674.4	187.9
Pb (220.353 nm)	± 0.20	SRIR	100.8	1392.4	182.2
Mn (257.610 nm)	± 0.180	SRIR	8641.7	127413.8	383.9
Al (295.152 nm)	± 0.4	SRIR	6.9	24337.0	3031.8
Ba (493.408 nm)	± 0.40	SRIR	95.1	1015418.2	10563.7
K (766.491 nm)	± 1.8	SRIR	4.4	85043.0	16331.8

Element Wavelength	Specification	Method	Ratio	Standard	Blank
As (188.880 nm)	± 0.20	SRIR	282.4	5109.5	273.5
Ba (188.880 nm)	± 0.10	SRIR	199.9	3033.2	921.0
Zn (213.857 nm)	± 0.210	SRIR	763.8	12458.9	237.0
Zn (213.857 nm)	± 0.210	SRIR	4824.0	100502.8	996.4
Cd (214.439 nm)	± 0.227	SRIR	4508.8	87892.4	375.1
Pb (220.353 nm)	± 0.220	SRIR	327.3	7853.1	480.3
Mn (257.610 nm)	± 0.025	SRIR	19005.8	632651.8	1104.7
Cr (267.718 nm)	± 0.104	SRIR	4116.3	173999.8	1781.8
Cu (274.754 nm)	± 0.18	SRIR	48.9	188303.3	3060.0
Al (295.152 nm)	± 0.2	SRIR	18.7	158532.8	8877.5
Ba (493.408 nm)	± 0.60	SRIR	168.0	374078.7	31787.5
K (766.491 nm)	± 0.40	SRIR	84.8	2836127.0	38584.8

Element Wavelength	Specification	Measured Value % RSD
As (188.880 nm)	± 0.20	1.08
Ba (188.880 nm)	± 0.20	1.38
Zn (213.857 nm)	± 1.00	0.62
Pb (220.353 nm)	± 0.20	0.72
Mn (257.610 nm)	± 1.50	0.44

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Instrument's Test Report

Al (295.152 nm)	± 1.50	0.45
Ba (493.408 nm)	± 1.50	0.48
K (766.491 nm)	± 1.80	0.24

Element Wavelength	Specification	Measured Value % RSD
As (188.880 nm)	± 1.50	0.81
Ba (188.880 nm)	± 1.50	0.98
Zn (213.857 nm)	± 1.50	0.23
Zn (213.857 nm)	± 1.50	0.28
Cd (214.439 nm)	± 1.50	0.20
Pb (220.353 nm)	± 1.30	0.47
Mn (257.610 nm)	± 1.50	0.78
Cr (267.718 nm)	± 1.50	0.30
Cu (274.754 nm)	± 1.50	0.45
Al (295.152 nm)	± 1.50	0.33
Ba (493.408 nm)	± 1.50	0.50
K (766.491 nm)	± 1.50	0.48

Report Detail

Test Run - Operator: Kanyamati S.

Subsystem Communications Test - Started

Subsystem Status

Main Power Module - Passed
Gas Control Module - Passed
RF Generator - Passed
Prep/Inject Module - Passed
Optical Camera Control Module - Passed
Purification Pump - Passed
Subsystem Communications Test Completed - Passed

Optim Test - Started

Test View Mode Interacts Status

LED Off - Passed
Shutter closed - Passed
Peak Intensity Ratio mode 3082178.14 - Passed
Shutter closed - Passed
Peak Intensity Ratio mode 55.92 - Passed
Shutter closed - Passed
Optical Argon Ratio: Calculated Value = 3.58, Factory Value = 2.80
Peak Intensity Ratio mode 3182350.45 - Passed

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Document Name:

Instrument's Test Report

Ratio: Actual Intensity Ratio (Range 0-100) = 1.03 - Passed
Peak Intensity Ratio mode 9418287.03 - Passed
Shutter closed - Passed
Optim 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 8100S110 BVDV MCP-DES
Instrument ID	08310AG8014A
Instrument Serial Number	MY16010005
Software Version	7.5.3.11953
Firmware Version	5995
Tested By	Kanyakom S.
Test started on	9/13/2021 8:33:45 PM
Test Completed On	9/13/2021 8:44:50 PM
Result Summary	
Subsystem Communications Test	Pass
Air Flow Test	Pass
Water Flow Test	Pass
Gas Flow 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
Water Flow Test	Pass
Gas Flow 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
Water Flow Test	Pass
Gas Flow 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

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Document Name: Instrument's Test Report

Gas Flow Test	
Intake Air Flow	Actual Flow: 2.71, Back Pressure: 278.73
Makeup Gas Flow	Actual Flow: 2.00, Back Pressure: 106.53
Plasma Gas Flow	Actual Flow: 18.00, Back Pressure: 17.95
RF Generator Test	Pass
RF Power Supply Test	Passed
RF Power Supply (V)	150.233
RF Oscillator Test	Passed
RF Oscillator Frequency (MHz)	25.917
Work Coil Current (A)	44.873
RF Power Supply Current (A)	1.699
Camera Test	Pass
Back Level Test	Not a Test
Photo Response Test	Passed
Optics Test	Pass
Intensity	Radial: 266933, Axial: 320947, BVDV: 3265038
WaveLength	737.212, 737.212, 737.212

Report Detail	
Tests Run - Operator: Kanyakom S.	
Subsystem Communications Test - Started	
Subsystem Status	
Main Power Module - Passed	
Gas Control Module - Passed	
RF Generator - Passed	
RF Oscillator - Passed	
Optical Camera Control Module - Passed	

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Document Name: Instrument's Test Report

Peristaltic Pump - Passed
Subsystem Communications Test Completed - Passed
Air Flow - Started
Fan Speed(N) Air Flow(relative speed) Status
32% 11 - Passed
32% 18 - 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) (R) = 0.03
Water Flow Completed - Passed
Gas Flow - Started
Channel Target Actual Pressure Failure Solve
Auxiliary Gas 0.00 2.00 N/A - Passed
Auxiliary Gas 2.00 3.00 N/A - Passed
Intake Air Gas 0.00 0.07 0.00 N/A - Passed
Intake Air Gas 0.70 0.71 0.70 N/A - Passed
Plasma Gas 0.00 1.18 N/A - Passed
Plasma Gas 18.00 17.95 N/A - Passed
Makeup Gas 0.00 2.00 N/A - Passed
Makeup Gas 2.00 2.00 N/A - Passed
Purge Gas 0.70 0.70 N/A - Passed
Purge Gas 3.70 3.70 N/A - Passed
All Channel Flow OFF - Passed
All Channel Flow OFF - Passed
Gas Flow Completed - Passed
RF Generator - Started
RF generator turned on - Passed
RF generator turned on - Passed
RF Power Supply - Set Value = 180V, Actual Value = 150.23V - Passed
RF Power Supply - Set Value = 180V, Actual Value = 150.23V - Passed
RF Oscillator - Started - Passed
RF Oscillator Frequency(MHz) = 25.92, Work Coil Current(Amps) = 44.87, RF Power Supply Current(Amps) = 2.50 - Passed
RF Oscillator stopped - Passed
RF generator turned off - Passed
RF Generator Completed - Passed
Camera Test - Started
Back level test - PASSED
Photo response test - PASSED
Camera Test Completed - Passed
Optics Test - Started
Test View Mode Intensity Status
LED ON - Passed

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Document Name: Instrument's Test Report

Plasma (Inlet) Started
Plasma gas - Passed
Waiting 5 min for plasma warm up
Shutter opened - Passed
Peak Intensity Radial mode 266933.80 - Passed
Shutter closed - Passed
Peak Intensity Axial mode 320947.25 - Passed
Shutter opened - Passed
Optical Argon Ratio: Calculated Value = 2.53, Factory Value = 2.50
Peak Intensity Axial mode 320947.25 - Passed
Radial-Axial Intensity Ratio(Range 0-100): 1.21 - Passed
Peak Intensity Simultaneous mode 3265038.45 - Passed
Shutter closed - Passed
Optics Test Completed - Passed

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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, this 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: Kanyakon Sukphrajaern
 Logged On User Name: phlmpaphe.jeeaphong@agilent.com
 Signature Creation Date: September 13, 2021
 Reason for Signature: Executed protocol and published this original version of document

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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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User Name: phlmpaphe.jeeaphong
 Hostname: ASBXK002328

System ID: MY16010006
 Print Date: September 13, 2021 6:50:44 PM

OQHW S100 ICPOES ALS 01Sep21 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 6:48:58 AM	Audit	Session Created	Session	None
September 8, 2021 6:49:59 AM	Start	Configuration	Session	None
September 8, 2021 6:49:58 AM	Audit	Entitlement	Licensing	User is Field Engineer and does not require an add-on code
September 8, 2021 6:07:08 AM	Audit	Exp/Loaded	Session	EOP details for primary technique (F1) - File path: (Protocol/Prd/Exp/Configured) suu02.000a.02.03.wal, EOP File Name: (F1.02.00.wal), EOP Name: (AgilentRecommended)
September 8, 2021 6:07:11 AM	End	Configuration	Session	None
September 8, 2021 6:07:15 AM	Start	Qualification	Session	CO
September 8, 2021 6:07:15 AM	Start	Execution	Preparation: S100 SVDV: Qualitative Test - No subjects associated	None
September 8, 2021 6:34:05 AM	End	Execution	Preparation: S100 SVDV: Qualitative Test - No subjects associated	Run Count: 1
September 8, 2021 6:34:09 AM	Start	Execution	Instrument Tests: S100 SVDV: Qualitative Test - No subjects associated	None
September 8, 2021 6:31:27 AM	End	Execution	Instrument Tests: S100 SVDV: Qualitative Test - No subjects associated	Run Count: 1

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Date: September 13, 2021 6:50:41 PM
 System ID: MY16010006

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User Name: phlmpaphe.jeeaphong
 Hostname: ASBXK002328

System ID: MY16010008
 Print Date: September 13, 2021 6:50:44 PM

OQHW S100 ICPOES ALS 01Sep21 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 8, 2021 8:51:30 AM	Start	Execution	Autosampler Operation: Autosampler 1 - SP94: Qualitative Test - No subjects associated	None
September 8, 2021 8:51:36 AM	End	Execution	Autosampler Operation: Autosampler 1 - SP94: Qualitative Test - No subjects associated	Run Count: 1
September 8, 2021 8:51:38 AM	End	Qualification	Session	CO
September 8, 2021 8:51:38 AM	Start	Reporting	Session	None
September 8, 2021 10:50:40 AM	Audit	Acc/Loaded	Session	None
September 13, 2021 6:01:26 PM	Audit	Acc/Loaded	Session	None
September 13, 2021 6:01:26 PM	Audit	Session/Loaded	Session	None
September 13, 2021 6:01:26 PM	Start	Qualification	Session	CO
September 13, 2021 6:47:55 PM	Audit	Reporting	Session	Report Generated: Certificate

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Date: September 13, 2021 6:50:41 PM
 System ID: MY16010006

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User Name: phlmpaphe.jeeaphong
 Hostname: ASBXK002328

System ID: MY16010005
 Print Date: September 13, 2021 6:50:44 PM

OQHW S100 ICPOES ALS 01Sep21 Transaction Log:

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 13, 2021 6:48:19 PM	Audit	Reporting	Session	Report Signed: Certificate PDF Name: OQHW S100 ICPOES ALS 01Sep21_20210913_Certificate_1.pdf User Name: phlmpaphe.jeeaphong@agilent.com Full Name of Signer: Kanyakon Sukphrajaern Reason for signature: Executed protocol and published this original version of document
September 13, 2021 6:48:26 PM	Audit	Reporting	Session	Report Generated: Report

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Date: September 13, 2021 6:50:41 PM
 System ID: MY16010005


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



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. : T5306A3
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 :  / Sujar Naknakred (Site Calibration Manager)
Date of Issue : 17 APR 2022

REVIEW BY : 
APPROVED BY : 
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-L12 108/30-05-57



Certificate No. T220730

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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	TN231-TN230	T210008	08 June 2022
TC	TYPE T	TN231-TN240	T210008	08 June 2022
DATA LOGGER	34970A	T149	T210008	08 June 2022

3. This certificate is traceable to :

National Institute of Metrology (Thailand) through Metrological Center (NSC-TISI-TIS (7025 CALIBRATION 0244))

4. Condition of calibrated item : good

Equipment Description :

Time Constant : 2 Hour 25 Minute At 55 °C
Fresh Air Damper : ☐ Open ☐ Min ☐ Medium ☐ Max
☐ Close
☒ Not Available

5. Adjustment :

() without adjustment (X) after adjustment

Approved By : 

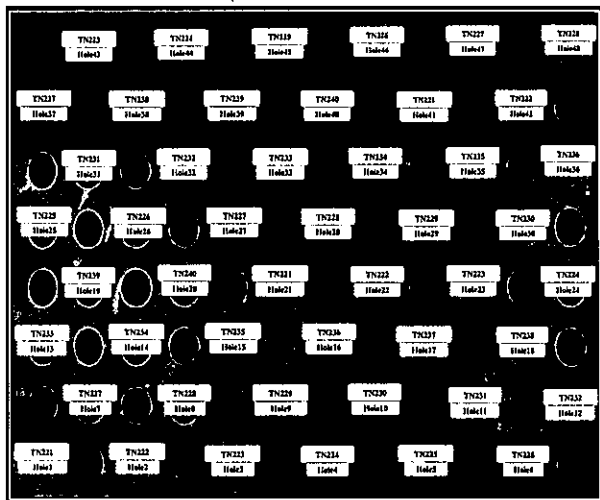
FM-L13 108/30-05-57



Certificate No. T220730

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Calibration Report



FRONT CONTROL

Approved By : 

FM-L13 108/30-05-57



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	94.03	94.20	94.26
	Min	93.07	93.26	93.51	93.66	93.82
	Average	93.33	93.54	93.78	93.93	94.09
R2 Hole7-Hole12	Max	94.59	94.79	94.63	94.55	94.82
	Min	94.05	94.23	94.08	93.97	94.26
	Average	94.32	94.52	94.36	94.26	94.54
R3 Hole13-Hole18	Max	95.03	94.54	94.78	94.84	95.06
	Min	94.46	93.98	94.20	94.28	94.49
	Average	94.74	94.26	94.49	94.56	94.78
R4 Hole19-Hole24	Max	94.89	94.82	95.73	95.85	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	Max	96.28	96.39	96.37	96.54	96.19
	Min	96.01	96.10	96.03	96.20	95.89
	Average	96.15	96.24	96.20	96.37	96.04
R6 Hole31-Hole36	Max	96.84	96.97	97.01	96.48	96.33
	Min	96.53	96.65	96.71	96.08	95.98
	Average	96.68	96.81	96.87	96.28	96.16
R7 Hole37-Hole42	Max	96.46	96.15	96.19	96.06	96.93
	Min	96.13	95.84	95.85	95.72	96.54
	Average	96.30	95.99	96.02	95.89	96.74
R8 Hole43-Hole48	Max	96.91	96.58	96.19	96.34	96.19
	Min	96.55	96.21	95.80	95.87	96.03
	Average	96.73	96.40	95.96	96.03	96.11

Approved By : 

FM-L13 108/30-05-57



Certificate No. T220730

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Calibration Report

Measurement Results		Average Standard Reading at each position (°C)					
Calibration Point		TN221	TN222	TN223	TN224	TN225	TN226
R1 Hole1-Hole6							
CAL POINT	Max	104.47	104.63	104.79	105.31	105.47	105.46
	Min	104.15	104.27	104.45	104.98	105.14	105.20
	Average	104.31	104.46	104.62	105.15	105.31	105.33
I2 Hole7-Hole12							
	Max	105.55	105.73	105.65	105.84	105.97	106.07
	Min	105.28	105.43	105.33	105.52	105.68	105.83
	Average	105.42	105.58	105.50	105.68	105.82	105.95
R3 Hole13-Hole18							
	Max	106.14	106.06	105.81	106.03	105.81	105.87
	Min	105.85	105.81	105.55	105.80	105.53	105.64
	Average	106.00	105.94	105.68	105.93	105.67	105.75
R4 Hole19-Hole24							
	Max	105.85	105.60	104.44	104.51	104.28	104.78
	Min	105.61	105.37	104.27	104.35	104.12	104.61
	Average	105.74	105.48	104.35	104.43	104.20	104.69
R5 Hole25-Hole30							
	Max	104.94	104.93	104.97	105.08	104.68	104.69
	Min	104.77	104.75	104.76	104.90	104.51	104.49
	Average	104.85	104.84	104.86	104.99	104.60	104.59
R6 Hole31-Hole36							
	Max	105.44	105.45	105.61	104.95	104.84	104.43
	Min	105.27	105.27	105.44	104.76	104.66	104.25
	Average	105.36	105.36	105.53	104.86	104.75	104.33
R7 Hole37-Hole42							
	Max	105.17	104.70	104.59	104.51	105.22	105.53
	Min	105.00	104.53	104.41	104.35	105.04	105.37
	Average	105.08	104.62	104.50	104.43	105.13	105.45
R8 Hole43-Hole48							
	Max	105.61	105.45	105.10	104.77	104.87	105.02
	Min	105.44	105.38	104.92	104.50	104.70	104.85
	Average	105.53	105.37	105.01	104.69	104.79	104.93

Approved By.

FM-L13 108/30-05-57



Certificate No. T220730

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Calibration Report

Measurement Results:

HEATING BLOCK			Temperature Distribution	
Setting (°C)	Reading (°C)		Stability (±°C)	Uncertainty (±°C)
	Min, Max	Average		
100.0	100.0, 100.4	100.1	0.29	0.83
105.0	105.0, 105.4	105.1	0.20	0.79

* The quoted uncertainty exclude " uniformity "

The calibration result apply only the above calibrated item.

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

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k which for a t -distribution, providing a level of confidence of approximately 95 %.

Approved By.

FM-L13 108/30-05-57



Agilent CrossLab Compliance

Qualification Type: ICPMS-OQ
System ID: JP15471169
EQP Name: Agilent Recommended
EQP Revision: ICPMS.02.50
EQP 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 Phattanakam 40, Suan Luang, Bangkok 10250.

REVIEW BY
APPROVED BY
NEXT CAL. DATE 29 March 2025

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Integrated Sample Introduction System (ISIS) Check : ISIS3	10
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20-Minute Stability (No Gas Mode) : G8403A	15
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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 : G6403A	Pass	1
Background (No Gas Mode) : G6403A	Pass	1
Background (Gas Mode) : G6403A	Pass	1
20-Minute Stability (No Gas Mode) : G6403A	Pass	1

Overall Qualification Status

Pass

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

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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 Phatthanakarn 40, Suan Luang, Bangkok 10250.

Local Contact Details

Name: Chaihanal Komarekul
Job Title: Manager
Qualification Location: Laboratory

Operator Details

Name: Panthap Kurassathain
Job Title: Field Service Engineer.

Date Acquisition Details

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

Customer Data System (CDS):

ICP/MS: MassHunter

Date: September 30, 2021 4:07:18 PM
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: 7800
Model Number: G6403A
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: G6411A
Type: Peristaltic pump system
Serial Number: JP15510227

Autosampler 1

Manufacturer: Agilent Technologies
Name: SPS4
Model Number: G6410A
Serial Number: AU18430722

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

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Chiller 1

Manufacturer: Agilent Technologies
Name: Chiller
Model Number: G3292A
Serial Number: 3U1810713

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

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Calculation Formulas

Purpose

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

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

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Protocol Details

Purpose

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

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

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Autosampler Check

Purpose

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

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
---------	----------	-----------------	-----------------	--------

After the self test, is probe in the home position?

Yes	Yes	Pass
-----	-----	------

As commanded, is the probe positioned at vial 2?

Yes	Yes	Pass
-----	-----	------

Setpoint Status:

Pass

Run: 1

Overall Autosampler Check Test Status

Pass

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Integrated Sample Introduction System (ISIS) Check

Purpose

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

Setpoint

Results	Criteria	Observed Result	Expected Result	Status
---------	----------	-----------------	-----------------	--------

As commanded, does the pump rotate?

Yes	Yes	Pass
-----	-----	------

As commanded, do the valves load and inject?

Yes	Yes	Pass
-----	-----	------

Setpoint Status:

Pass

Run: 1

Overall Integrated Sample Introduction System (ISIS) Check Test Status

Pass

Date: September 30, 2021 4:57:18 PM
System ID: JP15471169

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Autotune

Purpose

This test uses traceable check-out 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

Agilent Recommended:

	0.719	AMU
>=	0.65	
<=	0.80	

Status:

Pass

Peakwidth Mass 89

Agilent Recommended:

	0.750	AMU
>=	0.65	
<=	0.80	

Status:

Pass

Peakwidth Mass 205

Agilent Recommended:

	0.713	AMU
>=	0.65	
<=	0.80	

Status:

Pass

Mass Axis 7

Agilent Recommended:

	7.05	AMU
>=	6.9	
<=	7.1	

Status:

Pass

Mass Axis 89

Agilent Recommended:

	89.95	AMU
>=	89.9	
<=	89.1	

Status:

Pass

Mass Axis 205

Agilent Recommended:

	205.00	AMU
>=	204.6	
<=	205.1	

Status:

Pass

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

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Mass 7 Sensitivity No Gas

Agilent Recommended:

Status:

	84.28	Mcps/ppm
>=	125.5	
<=		

Mass 89 Sensitivity No Gas

Agilent Recommended:

Status:

	307.15	Mcps/ppm
>=	127.5	
<=		

Mass 205 Sensitivity No Gas

Agilent Recommended:

Status:

	203.77	Mcps/ppm
>=	76.6	
<=		

Mass 55 Sensitivity He

Agilent Recommended:

Status:

	28.38	Mcps/ppm
>=	23.8	
<=		

Mass 89 Sensitivity H2

Agilent Recommended:

Status:

	120.27	Mcps/ppm
>=	68	
<=		

Oxide Ratio 156/140

Agilent Recommended:

Status:

	1.047	%
>=	1.30	
<=		

Doubly Charged Species Ratio 70/140

Agilent Recommended:

Status:

	1.452	%
>=	2.3	
<=		

Setpoint Status:

Pass

Runs: 1

Overall Autotune Test Status

Pass

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

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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	6.900
cps		
<= 6.9	<= 4.6	<= 11.5
Pass	Pass	Pass

Setpoint Status:

Pass

Runs: 1

Overall Background (No Gas Mode) Test Status

Pass

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

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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:

Integration Time:

Cycles:

78	AMU
1.0	sec
20	

Measurements and Results

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

78
142.8500
cps
<= 116
Pass

Setpoint Status:

Pass

Runs: 1

Setpoint

Gas Mode: Hydrogen

Conditions

Mass:

Integration Time:

Cycles:

78	AMU
1.0	sec
20	

Measurements and Results

Mass (AMU):

Measured Value:

Agilent Recommended:

Status:

78
2.1600
cps
<= 4.6
Pass

Setpoint Status:

Pass

Runs: 1

Overall Background (Gas Mode) Test Status

Pass

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

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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, 6, 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	89	205
Stability RSD:	0.96400	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
System ID: JP15471159

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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
System ID: JP15471159

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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
EQR	General	Tune reports	22
EQR	General	Test Report	25
EQR	General	Test Report	27
EQR	General	Test Report	29

Date: September 30, 2021 4:07:18 PM
System ID: JP15471159

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General

Document Name: Certificate of System Qualification



Agilent Compliance Engine Self Qualification

Date: September 16, 2021 4:08:18 PM
Data Serial #: ACAD35CB Platform Revision: ACE.3.11

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

Technique Type	Tests Completed	Result
Acoustic Absorption	7	Conforms
Capillary Electrophoresis	10	Conforms
Dissolution	6	Conforms
Emission Spectroscopy	3	Conforms
Gas Chromatography - GCMS	17	Conforms
Gas Chromatography	29	Conforms
Gas Chromatography - GCMS	8	Conforms
ICP-MS	6	Conforms
Infrared Spectroscopy	7	Conforms
Liquid Chromatography	17	Conforms
Liquid Chromatography - LCMS	8	Conforms
Microfluidics	16	Conforms
Sample Preparation - Gas Chromatography	9	Conforms
Sample Preparation - Liquid Chromatography	6	Conforms
Supercritical Fluid Chromatography	10	Conforms
Software	6	Conforms
UV-Vis Spectrophotometer	13	Conforms

Overall Qualification Status
Conforms

Date: September 30, 2021 4:07:18 PM
System ID: JP15471159

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General

Document Name: Operator's training certificate and qualifications

Agilent Technologies

Certificate of Completion

Learner Name: Pandey, Karsasabain

Title Of Course: AN-CE-ICPMS-2-038-A: Agilent 7900 ICPMS PSE update training

Completion Date: June 7, 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 News, 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: Pandey, Karsasabain

Title Of Course: AN-CE-SS-14630-A: ACE 3.X User Update Training

Completion Date: July 7, 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 News, 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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System ID: JP15471189

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General

Document Name: Certificate of Qualification for ACE

Agilent Technologies

Certificate of Completion

Learner Name: Pandey, Karsasabain

Title Of Course: AN-CE-ICPMS-2-039-D: CrossLab Compliance Hardware Specific Delivery for Agilent ICP-MS Systems

Completion Date: October 21, 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 News, 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: Tune reports

Tune Report

Operator Name: Business Unit

AcqDate Batch: C:\Agilent\ICPMS\NewTune\Tune1

Acq Date/Time: 2021-09-30 14:40:04

Report Comment: 00 30 Sep 2021

Instrument Name: GBACSA JP15471189

[No Gas]

Stability

Time	Height	Area	Height	Area
7	1800	1423	1430	1228
8	1800	1076	1435	1250
9	1800	1077	1435	1250

Sampling Period [sec]

6.211

Integration Time [sec]

0.1

Cable/Display Charged Ratio

Cable

Display

Cable Charged

70.140 1.423 %

Display Charged

70.140 1.423 %

Resonance/MS

Time	Peak Height	Area	Height	Area
7	1800	1423	1430	1228
8	1800	1076	1435	1250
9	1800	1077	1435	1250

Integration Time [sec]

0.1

Allow when Tune [sec]

32.34

Y Axis

Linear

Tune Parameters

Parameter	Value	Parameter	Value	Parameter	Value
Flame Mode	—	Insulator Gas	1.00 L/min	Makrolon Gas	0.10 L/min
RF Power	1500 W	Cyclon Gas	—	Auxiliary Gas	0.00 L/min
RF Frequency	1.000 MHz	Nebulizer Pump	0.10-0.99	Plasma Gas	15.0 L/min
Sample Depth	9.9 mm	ASIC Temp	2.10		

Laser Parameters

Excited 1	0.1 V	Charge Lens	0.1 V	Detector	15.5 V
Excited 2	0.1 V	Cell Entrance	0.1 V	Plasma Bias	0.0 V
Charge Bias	0.1 V	Cell Bias	0.1 V		

Cell Parameters

Use Gas	No	Sol Gas Flow	—	Energy Disposition	0.0 V
He Flow	0.0 mL/min	Cell Bias	0.1 V		

1 of 3

2021-09-30 04:40 PM

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\Q0 30 Sep 2021\US HQ new\1
Analysis File: 30 HQ new batch\1m
Time Step: 01 HQ

Run	Acq. Date/Time	Data File	Sample Name	Type	Level	Duration
1	2021-09-30 15:04:18	30 HQ 1	Sample	Sample		1.0000

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2021-09-30 15:16:31

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

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Document Name: Test Report

Batch Summary Report

Analysis Table	
Sample Name	CPD
1 30 HQ	21300

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2021-09-30 15:16:31

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: D:\Agilent Services\Q0 30 Sep 2021\US HQ new\1
Analysis File: 30 HQ new batch\1m
Time Step: 01 HQ

Run	Acq. Date/Time	Data File	Sample Name	Type	Level	Duration
1	2021-09-30 15:04:18	30 HQ 1	Sample	Sample		1.0000

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2021-09-30 15:16:42

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

Batch Summary Report

Analysis Table	
Sample Name	CPD
1 30 HQ	21300

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2021-09-30 15:16:42

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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: Pandhep Kurasathain
 Logged On User Name: pandhep.kurasathain@agilent.com
 Signature Creation Date: September 30, 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 premises or representations as to its sufficiency for any specific regulatory program.

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User Name: pandhep.kurasathain System ID: JP15471169
 Hostname: ASB-KW315 Print Date: September 30, 2021 4:07:22 PM

ALS OQHV 7905 J03Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:55:07 PM	Auth	SessionCreated	Session	None
September 30, 2021 3:55:07 PM	Start	Configuration	Session	None
September 30, 2021 3:55:07 PM	Auth	EndSession	Session	User is PlaceEngineer and does not require an unlock code
September 30, 2021 3:55:07 PM	Auth	Execution	Session	EOP details for primary activities (top40) - File path: (Protocol/PhosAsph/Conf/Instrument/03_Sep21/02_96.aqs), EOP File Name: (Sample 02_96.aqs), EOP Name: (AgilentRecommend07)
September 30, 2021 3:55:04 PM	End	Configuration	Session	None
September 30, 2021 3:55:07 PM	Start	Qualification	Session	OQ
September 30, 2021 3:55:07 PM	Start	Execution	Autosampler Check : SP54:	None
September 30, 2021 3:55:03 PM	End	Execution	Autosampler Check : SP54:	Run Count : 1
September 30, 2021 3:55:04 PM	Start	Execution	Integrated Sample Introduction System (SIS) Check : (SIS):	None
September 30, 2021 3:55:04 PM	End	Execution	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: pandhep.kurasathain System ID: JP15471169
 Hostname: ASB-KW315 Print Date: September 30, 2021 4:07:22 PM

ALS OQHV 7905 J03Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 3:53:10 PM	Start	Execution	Autolink : G0403A: Autolink 1	None
September 30, 2021 3:55:08 PM	End	Execution	Autolink : G0403A: Autolink 1	Run Count : 1
September 30, 2021 3:55:12 PM	Start	Execution	Background (No Gas Mode): G0403A: No Gas Mode Background 1	None
September 30, 2021 3:55:49 PM	End	Execution	Background (No Gas Mode): G0403A: No Gas Mode Background 1	Run Count : 1
September 30, 2021 3:56:43 PM	Start	Execution	Background (Gas Mode): G0403A: Gas Mode Background Helium	None
September 30, 2021 3:56:17 PM	End	Execution	Background (Gas Mode): G0403A: Gas Mode Background Helium	Run Count : 1
September 30, 2021 3:56:19 PM	Start	Execution	Background (Gas Mode): G0403A: Gas Mode Background Hydrogen	None
September 30, 2021 3:56:39 PM	End	Execution	Background (Gas Mode): G0403A: Gas Mode Background Hydrogen	Run Count : 1
September 30, 2021 3:56:41 PM	Start	Execution	20-minute Stability (No Gas Mode): G0403A: 20-minute Stability (No Gas Mode) 1	None
September 30, 2021 3:57:22 PM	End	Execution	20-minute Stability (No Gas Mode): G0403A: 20-minute Stability (No Gas Mode) 1	Run Count : 1
September 30, 2021 3:57:34 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: pandhep.kurasathain System ID: JP15471169
 Hostname: ASB-KW315 Print Date: September 30, 2021 4:07:22 PM

ALS OQHV 7905 J03Sep21 Transaction log :

Time	Transaction State	Activity Performed	Type of Transaction	Optional Information
September 30, 2021 4:03:07 PM	Auth	Reporting	Session	Report Generated: Certificate
September 30, 2021 4:03:17 PM	Auth	Reporting	Session	Report Generated: Report
September 30, 2021 4:03:59 PM	Start	Qualification	Session	OQ
September 30, 2021 4:04:08 PM	End	Qualification	Session	OQ
September 30, 2021 4:04:08 PM	Start	Reporting	Session	None
September 30, 2021 4:04:28 PM	Auth	Reporting	Session	Report Generated: Certificate
September 30, 2021 4:04:36 PM	Auth	Reporting	Session	Report Generated: Report

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Date: September 30, 2021 4:07:18 PM
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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
5364 PHATNAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL: 0-2711-3000-34 FAX: 0-2715-2484



Certificate of Calibration

Certificate No.: 21E818
Page: 1 of 2

Equipment: pH Meter
Manufacturer: Thermo Orion
Model: EA940
Serial No.: 6983
ID No.: BKK_ENG102

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.

Condition As-Received: Used Item
Received Date: 05 March 2021
Calibration Date: 11 March 2021

Reference: 2103-0265050
Ambient Temperature: $(23 \pm 2) ^\circ\text{C}$
Relative Humidity: $(50 \pm 10) \%$

Submitted by: ALS Laboratory Group (Thailand) Co., Ltd.

104 Phatthanakan 46, Phatthanakan Rd.,
Khwaeng Phatthanakan, Khat Suan Luang,
Bangkok 10250 Thailand

Procedure used: Calibration were conducted using In-house calibration Procedure CP-E17 According to direct measurement
method with Multi-Product Calibrator.

Condition of this result of calibration

1. Reference standards Instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Multi-Product Calibrator	6500A	6440007	20E1574	07 May 2021

2. This result of calibration was made on requested at the point specified by customer.

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

4. This Certification is traceable to the International System of Unit maintained at:
- National Institute of Metrology Thailand (NIMT)

REVIEW BY	Sinuk P.
APPROVED BY	LL A
NEXT CAL. DATE	9/9/22

Calibrated by: Pongsagom Boonyasom
Issue Date: 12 March 2021

Approved Signatory:
() Phalinee Prabpalpal
(x) Nuntawee Khemchal
() Pombipha Tameyaykul

B 0255805



Cert. No.: 21E818
Page: 2 of 2

Result of calibration:- (*) Without adjustment () After adjustment

Function: DC voltage measurement Range: Autorange
Channel: 1

Standard Value	UUC* Reading	Error	Uncertainty
(mV)	(mV)	(mV)	($\pm \mu\text{V}$)
-200.0000	-200.1	-0.1	72
-100.0000	-100.1	-0.1	65
0.0000	-0.1	-0.1	58
100.0000	99.9	-0.1	65
200.0000	199.9	-0.1	72

Function: DC voltage measurement Range: Autorange
Channel: 2

Standard Value	UUC* Reading	Error	Uncertainty
(mV)	(mV)	(mV)	($\pm \mu\text{V}$)
-200.0000	-200.2	-0.2	72
-100.0000	-100.2	-0.2	65
0.0000	-0.2	-0.2	58
100.0000	99.9	-0.1	65
200.0000	199.9	-0.1	72

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

UUC* = Unit Under Calibration.

-000-

a 1045490

ภาคผนวก จ

สำเนาหนังสืออนุญาตขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน



ที่ อก ๐๓๐๔(๑)/ ๑๐ ๖ ๙

กรมโรงงานอุตสาหกรรม
ถนนพระรามที่ ๖ เขตราชเทวี
กรุงเทพมหานคร ๑๐๔๐๐

๒ ๘ มกราคม ๒๕๖๕

เรื่อง ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน

เรียน กรรมการผู้จัดการ บริษัท เอแอลเอส แล็บส์ (ประเทศไทย) จำกัด

อ้างถึง คำขอขึ้นทะเบียน/เปลี่ยนแปลงเอกสาร และขอคืนค่าธรรมเนียมห้องปฏิบัติการวิเคราะห์เอกชน
ลงวันที่ ๓๐ กรกฎาคม ๒๕๖๓

สิ่งที่ส่งมาด้วย ๑. รายชื่อผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๑ แผ่น

๒. รายชื่อเจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๙ แผ่น

๓. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๓๑ แผ่น

ตามหนังสือที่ยังถึง บริษัท เอแอลเอส แล็บส์ (ประเทศไทย) จำกัด ขอต่ออายุ
หนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน เลขทะเบียน ๖-๒๐๔ ส.๑๔
ขอพัฒนาการ ๔๐ ถนนพัฒนาการ แขวงพัฒนาการ เขตสวนหลวง กรุงเทพมหานคร
ต่อกรมโรงงานอุตสาหกรรม นั้น

กรมโรงงานอุตสาหกรรมพิจารณาแล้ว ให้บริษัท เอแอลเอส แล็บส์ (ประเทศไทย)
จำกัด ต่ออายุหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน โดยมีองค์ประกอบดังนี้

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย ตามสิ่งที่ส่งมาด้วย ๑
ข. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย ตามสิ่งที่ส่งมาด้วย ๒
ค. ขอบข่ายสารเคมีที่ได้รับขึ้นทะเบียนให้วิเคราะห์ในน้ำเสีย จำนวน ๕๕ รายการ ไม่ได้เป็น
จำนวน ๑๖๖ รายการ อากาศเสีย ๑๖ รายการ สิ่งปฏิสหรือวัสดุที่ไม่ใช่แล้ว จำนวน ๓๕ รายการ และดิน
จำนวน ๑๒๕ รายการ รวมทั้งสิ้นจำนวน ๑๖๑ รายการ ตามสิ่งที่ส่งมาด้วย ๓

หนังสือฉบับนี้จะมีผลอายุในวันที่ ๒ กันยายน ๒๕๖๖ หากประสงค์ต่ออายุหนังสือ
รับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน ให้ยื่นคำขอต่ออายุพร้อมเอกสารประกอบคำขอ
ต่อกรมโรงงานอุตสาหกรรม ภายใน ๓๐ วัน ก่อนวันสิ้นอายุของหนังสือรับขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์
เอกชน ซึ่งคำขอต่ออายุดังกล่าวจะรับได้ที่กรมโรงงานอุตสาหกรรม

จึงเรียนมาเพื่อทราบ

ขอแสดงความนับถือ

๒๒๒
(นายศิระ จันท์เจ็ด)

อธิบดีกรมส่งเสริมการค้าระหว่างประเทศ
ผู้ว่าการการค้าระหว่างประเทศ
ผู้ตรวจการแผ่นดิน
ผู้ตรวจการแผ่นดิน

กองวิจัยและเตือนภัยมลพิษโรงงาน

กลุ่มมาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์และทะเบียนห้องปฏิบัติการ

โทร. ๐ ๒๖๐๒ ๔๑๔๖ ๐ ๒๖๐๒ ๔๐๐๒

โทรสาร ๐ ๒๖๐๔ ๓๐๐๘ ๐ ๒๖๐๔ ๓๐๔๕

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เอแอลเอส แล็บส์ (ประเทศไทย) จำกัด เลขทะเบียน ๖-๒๐๔
ที่ อก ๐๓๐๔(๑)/ ลงวันที่ ๒ ๘ มกราคม ๒๕๖๕

ก. ผู้ควบคุมดูแลห้องปฏิบัติการวิเคราะห์ จำนวน ๖ ราย

๑) นางสาวยุพาพร จันท์เจ็ด

๒) นางสาวชัชชัย โกมารกุล ณ นคร

๓) นายศรายุทธ จิตราภรณ์

๔) นางสาวกนกกร เอนก

๕) นายสุริยา สอนแก้ว

๖) นายวิฑูรย์ ชุนพรัตน์

๒๒๒

(นายศิระ จันท์เจ็ด)

อธิบดีกรมส่งเสริมการค้าระหว่างประเทศ
ผู้ว่าการการค้าระหว่างประเทศ
ผู้ตรวจการแผ่นดิน
ผู้ตรวจการแผ่นดิน

เอกสารแบบฟอร์มรับรองข้อมูลทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เอนเอส แลอบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด
ที่ ออ ๐๓๑๐(๑) / ๑๐๖๕ ลงวันที่ ๒๘ มกราคม ๒๕๖๕ เลขทะเบียน ๖-๒๐๑๕

๖. เจ้าหน้าที่ประจำห้องปฏิบัติการวิเคราะห์ จำนวน ๑๖๒ ราย

- ๑) นางสาวจินดา ไชยธรรม ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๐๘
- ๒) นางสาววิรัตน์ ช้อยรัมย์ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๐๙
- ๓) นางสาวณัฐกัญญา อิมหม ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๐
- ๔) นางสาวรินพร สายเล้ง ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๕
- ๕) นางสาวนันท์ สมบูรณ์ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๖
- ๖) นางสาวศันยา เกลิมเกียรติ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๗
- ๗) นางสาวสุวิมล มงคลจิราวุฒิ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๘
- ๘) นางสาวศิริลักษณ์ พึ่งแพง ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๒๐
- ๙) นายพวงค์ จันทร์พันธ์ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๐๘
- ๑๐) นายบรรณเศรษฐ์ โกมลย์ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๑
- ๑๑) นายธินา จริยา ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๔
- ๑๒) นางสาวกสิกรินทร์ แก้วมัน ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๖
- ๑๓) นางสาวสุวิมล ชัยเรืองวุฒิ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๑๗
- ๑๔) นางสาวสุพา ธรรมการ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๒๑
- ๑๕) นางสาวปัทมา ชัยเดชอนุกุล ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๒๓
- ๑๖) นางสาวศศิธร หนูสวัสดิ์ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๒๕
- ๑๗) นางสาวสวลักษณ์ ภูมิกำพร ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๒๖
- ๑๘) นายอภิสิทธิ์ สิงหา ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๒๗
- ๑๙) นายศักดิ์สิทธิ์ ไพศาลสิทธิ์ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๒๘
- ๒๐) ว่าที่ร้อยตรีหญิง พรนิภา จำเจริญ ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๒๘
- ๒๑) นางจิตดา คำแก้ว ทะเบียนเลขที่ ๖-๒๐๑๕-๔๙๓๑
- ๒๒) นางสาวอรรณณ รักยง ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๑๕
- ๒๓) นางสาวพริตต์ แย้มกรานต์ ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๑๙
- ๒๔) นายจุลเดช วารินทร์ ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๒๐
- ๒๕) นางสาวดาญ์รัตน์ ร้องคำ ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๒๑
- ๒๖) นายนคร สุขเจริญ ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๒๒
- ๒๗) นายบัญชา นามเขตต์ ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๒๓
- ๒๘) นายพรมณ์ ศรีรัตนตร ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๒๕
- ๒๙) นายอุทัย ฤนิม ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๒๖
- ๓๐) ว่าที่ร้อยตรี เกลิมเกียรติ อมรศรีเสริม ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๒๘
- ๓๑) นางสาววิภา สร้างนา ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๒๙
- ๓๒) นายอนุพงศ์ รัตนศรีประเสริฐ ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๓๐
- ๓๓) นางสาวจุฑารัตน์ โอนสินทิยะ ทะเบียนเลขที่ ๖-๒๐๑๕-๖๑๔๖
- ๓๔) นางสาวจตุรรมณ พิมพ์ฤทธิชัย ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๗๖

(นายกระ จันทโรจน์) ๓๕) นางสาวปรางค์ทิพย์...

ผู้ให้เหตุผลรับอนุญาต/ออก ใบอนุญาตฯ
ผู้รับอนุญาต/ออกใบอนุญาตฯ
๑๕/๐๓/๒๕๖๕

- ๓๕) นางสาวปรางค์ทิพย์ กิจไพศาลศักดิ์ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๗๘
- ๓๖) นางสาวเดือนใจ ทางกลาง ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๐
- ๓๗) นางสาวจิราพร ศิริวัช ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๒
- ๓๘) นายวรารณ ภูกรักษ์ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๓
- ๓๙) นายพนม วิริยะสกิจ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๔
- ๔๐) นายอติต เบนจบ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๕
- ๔๑) นายคณิศร จันทร์พร ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๖
- ๔๒) นายอรรคพล นิยมวิทย์พาณ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๗
- ๔๓) นายภูวิช พรหมสะอาด ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๘
- ๔๔) นายธเนศ โกคำพิพัฒน์ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๘๙
- ๔๕) นายชวฤทธิ์ วงษ์จันทร์ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๙๐
- ๔๖) นายอาทิตย์ ศรีเสน ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๙๑
- ๔๗) นายเจตนิพนธ์ คงศักดิ์ไทย ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๙๒
- ๔๘) นายจรัส บุญย้ง ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๙๕
- ๔๙) นายธนชาติ ยอมก ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๙๖
- ๕๐) นายอภิวัฒน์ ทุมพู ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๙๗
- ๕๑) นางสาวสุภาวัญญา มาก ทะเบียนเลขที่ ๖-๒๐๑๕-๗๐๙๘
- ๕๒) นางสาวกัศพร ชาวสมบุญมี ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๐
- ๕๓) นางสาวอติมา บุญเพ็ญ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๑
- ๕๔) นางสาวกนกพร เข้มเพชร ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๒
- ๕๕) นางสาวหิรัญยา พงษ์สมิตี ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๓
- ๕๖) นางสาวกานิดา สุรางค์ตระกูล ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๔
- ๕๗) นางสาวมานุภาต นามวัฒน์ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๕
- ๕๘) นางสาวอุไรรัตน์ หิรัญรัมย์ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๖
- ๕๙) นายธีรวัฒน์ ปงสุข ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๗
- ๖๐) นายอติพล ยะโส ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๘
- ๖๑) นายประพนธ์ วรรณบุญ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๐๙
- ๖๒) นายชยธร พงษ์ทิพย์ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๑๐
- ๖๓) นางสาวกนกวรรณ จันทบาล ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๑๑
- ๖๔) นางสาวเกษร หล้าบุญ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๑๒
- ๖๕) นายสิทธิโชค ธงเสน ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๑๓
- ๖๖) นางศศิลาวรรณ ใจบุญ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๑๔
- ๖๗) นางสาวพรหมณิดา พุ่มคง ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๑๕
- ๖๘) นางสาวศรณีย์ ยิ่งดี ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๑๘
- ๖๙) นายบวรกร ศรีวิริยะ ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๑๙
- ๗๐) นายสุวิชา ทองอ่อน ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๒๐
- ๗๑) นายวิญญู บุญระมัย ทะเบียนเลขที่ ๖-๒๐๑๕-๗๑๒๑

(นายสมบุญ) ๗๒) นายสมบุญ...

ผู้ให้เหตุผลรับอนุญาต/ออก ใบอนุญาตฯ
ผู้รับอนุญาต/ออกใบอนุญาตฯ
๑๕/๐๓/๒๕๖๕

๓๒) นายสมบุญ ปุตรจันทร์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๕๔๔
 ๓๓) นายวิรัตน์ ไชยเมธา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๕๕๕
 ๓๔) นายณณกุล เหมพูน ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๕๖๖
 ๓๕) นายเจริญ งามอ้อ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๕๗๗
 ๓๖) นายสมโภช วันเสา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๕๘๘
 ๓๗) นายอรรี นามบุรี ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๕๙๙
 ๓๘) นายณัฐนันท์ ปานประเสริฐ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๐๐
 ๓๙) นายอัครกร จ่อสาว ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๑๑
 ๔๐) นายประเสริฐ สุระจันทร์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๒๒
 ๔๑) นายบุณดี จันทน์เนียม ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๓๓
 ๔๒) นายพิพัชร์ ทองอุณบริดา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๔๔
 ๔๓) นายเทพพล ทองสุข ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๕๕
 ๔๔) นายอนุวัฒน์ ม่วงเพชร ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๖๖
 ๔๕) นายเจตตราวุฒิ ปิตตะมะ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๗๗
 ๔๖) นายฤชณะ สายวรรณ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๘๘
 ๔๗) นายพิชัย บุญสงค์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๖๙๙
 ๔๘) นายกาญจน์ โสมวงศ์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๐๐
 ๔๙) นายสามารถ คู่มือลี ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๑๑
 ๕๐) นายสุชัย โกศรีบานะ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๒๒
 ๕๑) นายณัฐวิทย์ ศรีประเสริฐ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๓๓
 ๕๒) นายชวัลย์ นาคพรม ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๔๔
 ๕๓) นายพชรชัย ชัยพิทย ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๕๕
 ๕๔) ว่าที่ร้อยตรี ภาณุพงศ์ แสนศรี ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๖๖
 ๕๕) นายสิทธิโชค พาศิดา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๗๗
 ๕๖) นายอนาการ อีสุดา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๘๘
 ๕๗) นางสาวกรณิศา ขาดีวันชัย ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๗๙๙
 ๕๘) นางสาวพิมพ์ตะวัน มีมากุล ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๐๐
 ๕๙) นางสาวพรรัตน์ สิงห์สมบูรณ์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๑๑
 ๖๐) นางสาวชอุภา ปทุมจันทร์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๒๒
 ๖๑) นายธีรติ ทวีราช ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๓๓
 ๖๒) นายธีรวัน วัฒนวิศา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๔๔
 ๖๓) นายธีรชัย สุขเปี้ย ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๕๕
 ๖๔) นายณรณนที ต๊ะทองคำ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๖๖
 ๖๕) นายสุเทพ สมนอก ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๗๗
 ๖๖) นายทักษิณย์ อุบลศรี ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๘๘
 ๖๗) นายอมหาว นามะคุณณา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๘๙๙
 ๖๘) นายอติพงศ์ บัวแดง ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๐๐

(นายศิระ จันทร์เลิศ)
 ๑๐๙) นายมนพชัย...

ข้าพเจ้าขอรับรองว่าข้อมูลข้างต้น
 เป็นความจริงและถูกต้อง
 ผู้ว่าราชการจังหวัด...

๖๙) นายมนพชัย อุบลรัตน์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๑๑
 ๗๐) นายรัฐพล อุบลรัตน์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๒๒
 ๗๑) นายเนวินรัตน์ สาริน ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๓๓
 ๗๒) นายปิยะนัฐ พลมะศรี ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๔๔
 ๗๓) นายพงษ์ศิริ โสมเขียว ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๕๕
 ๗๔) นายพิรพัฒน์ กำคำ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๖๖
 ๗๕) นายกาญจน์ มานิตย์ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๗๗
 ๗๖) นายมงคล ผลาพิทย ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๘๘
 ๗๗) นายมนพร พุทธิศรี ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๕๙๙๙
 ๗๘) นายสิริเนห์ ทองอิน ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๐๐
 ๗๙) นายอนชา ทับสมัย ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๑๑
 ๘๐) นายอดิศักดิ์ ฝูฝะ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๒๒
 ๘๑) นายอนันต์ชัย วิสุม ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๓๓
 ๘๒) นายณัฐดนัย เจือละของ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๔๔
 ๘๓) นายวรจ ติ่นัก ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๕๕
 ๘๔) นายแสงตะวัน นะกะสัด ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๖๖
 ๘๕) นายเทพพงศ์ รัตนะ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๗๗
 ๘๖) นายสุเมธ ไชยชนะมัจ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๘๘
 ๘๗) นายวิสูตร ศรีธรรมมา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๐๙๙
 ๘๘) นายมนนการ เลือกร่อง ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๐๐
 ๘๙) นายเกษ สุทธะ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๑๑
 ๙๐) นางสาวปฐกมล รักทะเล ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๒๒
 ๙๑) นางสาวประภาภรณ์ บุตรพรม ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๓๓
 ๙๒) นางสาววิลาวัลย์ นามพรม ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๔๔
 ๙๓) นางสาวพจิราพร แสนศรีชัย ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๕๕
 ๙๔) นายไพรัชย์ เปรียมพิมาย ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๖๖
 ๙๕) นางสาวสุภาภรณ์ ทองมาก ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๗๗
 ๙๖) นางสาวธิดา จิตรสว่าง ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๘๘
 ๙๗) นางสาวนพพร เล็กผู้เขียว ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๑๙๙
 ๙๘) นางสาวกัญญา ภาณุภูมิ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๒๐๐
 ๙๙) นางสาวกัญญา คงคูณ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๒๑๑
 ๑๐๐) นางสาวไพรัชศรี ศรีภูมิ ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๒๒๒
 ๑๐๑) นางสาวทิพเนตร ญูปัญญา ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๒๓๓
 ๑๐๒) นางสาวธิดา ปานทอง ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๒๔๔
 ๑๐๓) นางสาวอริสา ทองนวล ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๒๕๕
 ๑๐๔) นางสาวอริสา หักคอง ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๒๖๖
 ๑๐๕) นางสาวอริสา หักคอง ทะเบียนเลขที่ ๖-๒๐๕-๖-๗๖๒๗๗

(นายศิระ จันทร์เลิศ)
 ๑๐๖) นางสาวสุภาภรณ์...

ข้าพเจ้าขอรับรองว่าข้อมูลข้างต้น
 เป็นความจริงและถูกต้อง
 ผู้ว่าราชการจังหวัด...

- ๑๔๖) นางสาวสุภาภรณ์ สุนทรสนาน
๑๔๗) นางสาวสุภารัตน์ นนทประสาท
๑๔๘) นางสาววิจิตร น้อมกลาง
๑๔๙) นางสาวกัญญรัตน์ ศรีนิลหา
๑๕๐) นางสาวอัญชลี คำจันทร์
๑๕๑) นายบุญฤทธิ์ เอี่ยมเทศ
๑๕๒) นายศิริวัฒน์ พานิชย์
๑๕๓) นางสาวสุภาวดี ปิ่นยุธา
๑๕๔) นางสาวพณัฐ คุณานาน
๑๕๕) นางสาวจิราเจต พงศา
๑๕๖) นางสาวกนกภรณ์ ธีระ
๑๕๗) นางสาวอารยา มัชฌิ
๑๕๘) นางสาวจิตสุภา ประเทืองสุข
๑๕๙) นางสาววิริสา ธีรยัณติธรรม
๑๖๐) นางสาววิชุดา นาคเจริญ
๑๖๑) นางสาวพนิดา ยอดอินทร์
๑๖๒) นางสาวนันทิยา จันทะสุน

- ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๔๕
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๔๖
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๔๗
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๔๘
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๔๙
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๐
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๑
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๒
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๓
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๔
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๕
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๖
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๗
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๘
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๙
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๐
ทะเบียนเลขที่ ๖-๒๐๔-๖-๒๐๕๑

๐๒๒

(นายศิริระ จันทะสุน)
ผู้อำนวยการสำนักงานศึกษาธิการ
ผู้อำนวยการสำนักงานศึกษาธิการ
ปฏิบัติราชการตามคำสั่งกระทรวงศึกษาธิการ

เอกสารแนบท้ายหนังสือรับต่ออายุขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์เอกชน
บริษัท เอลอส แลบบอราทอรี กรุ๊ป (ประเทศไทย) จำกัด เลขทะเบียน ๖-๒๐๔
ที่ อก ๐๓๑๐(๑)/ ๑ ๐ ๖ ๕ ลงวันที่ ๒๕ มกราคม ๒๕๖๕
ขอข่ายสามารถที่จะได้รับขึ้นทะเบียนจากกรมโรงงานอุตสาหกรรม จำนวน ๒๖๑ รายการ

แนบท้าย จำนวน ๕๙ รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Aldicarb	High-Performance Liquid Chromatographic Method ^(a)
2	Aldicarb Sulfone	High-Performance Liquid Chromatographic Method ^(a)
3	Aldicarb Sulfoxide	High-Performance Liquid Chromatographic Method ^(a)
4	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
5	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
6	Barium	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
7	α-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
8	β-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
9	γ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
10	γ-BHC	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
11	Biochemical Oxygen Demand	1) 5-Day BOD Test, Azide Modification Method ^(a) 2) 5-Day BOD Test, Membrane Electrode Method ^(a)
12	Carbaryl	High-Performance Liquid Chromatographic Method ^(a)
13	Carbofuran	High-Performance Liquid Chromatographic Method ^(a)
14	Cadmium	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
15	Chemical Oxygen Demand	1) Closed Reflux, Colorimetric Method ^(a) 2) Closed Reflux, Titrimetric Method ^(a)
16	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
17	Chromium	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
18	Color	ADMI Weighted-Ordinate Spectrophotometric Method

Signature
(นายศิริระ จันทะสุน)
ผู้อำนวยการสำนักงานศึกษาธิการ
และระดับห้องปฏิบัติการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
19	Copper	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
20	Cyanide	Distillation, Colorimetric Method ^(a)
21	2,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
22	4,4'-DDD	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
23	2,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
24	4,4'-DDE	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
25	2,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
26	4,4'-DDT	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
27	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
28	Endosulfan Sulfate	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
29	Endosulfan I	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
30	Endosulfan II	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
31	Endrin	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
32	Endrin Aldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
33	Formaldehyde	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
34	Free Chlorine	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a) Distillation, Colorimetric Method ^(a) 1) DPD Ferrous Titrimetric Method ^(a) 2) Iodometric Method ^(a)
35	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
36	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
37	Hexavalent Chromium	Filtration, Colorimetric Method ^(a)
38	3-Hydroxycarbofuran	High-Performance Liquid Chromatographic Method ^(a)
39	Lead	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
40	Manganese	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
41	Mercury	1) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(a) 2) Digestion, Inductively Coupled Plasma/Mass spectrometric Method ^(a)
42	Methiocarb	High-Performance Liquid Chromatographic Method ^(a)
43	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)

3444
(นางรักกัญจน์ นิตกรกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์
และระบบป้องกันภัย

44 Methomyl...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
44	Methomyl	High-Performance Liquid Chromatographic Method ^(a)
45	Nickel	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
46	Oil & Grease	1) Liquid-Liquid, Partition-Gravimetric Method ^(a) 2) Soxhlet Extraction Method ^(a)
47	Oxamyl	High-Performance Liquid Chromatographic Method ^(a)
48	Propoxur	High-Performance Liquid Chromatographic Method ^(a)
49	pH	Electrometric Method ^(a)
50	Phenols	1) Distillation, Chloroform Extraction Method ^(a) 2) Distillation, Direct Photometric Method ^(a)
51	Selenium	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
52	Sulfide	Iodometric Method ^(a)
53	Temperature	Laboratory and Field Methods ^(a)
54	Total Dissolved Solids	Dried at 180 °C ^(a)
55	Total Kjeldahl Nitrogen	Semi-Micro Kjeldahl Method ^(a)
56	Total Suspended Solids	Dried at 103-105 °C ^(a)
57	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic Method ^(a)
58	Trivalent Chromium	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ^(a)
59	Zinc	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(a)

หน้าถัดไป จำนวน 126 รายการ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
1	Acenaphthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)

3444
(นางรักกัญจน์ นิตกรกุลวิไล)
ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์ทดสอบผลิตภัณฑ์
และระบบป้องกันภัย

3 Aldrin...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
3	Aldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
4	Anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
7	Atrazine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
8	Barium	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
9	Benz(a)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
11	Benzo(b)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
12	Benzo(k)fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
13	Benzoic Acid	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
14	Benzo(a)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
15	Benzo(g,h,i)perylene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
17	Bis(2-chloroethyl)ether	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)

Signature

18 Bis(2-ethylhexyl)phthalate...

(นางวิภาดา ชัยพรกุลโต)
ผู้อำนวยการศูนย์มาตรฐานวิธีวิเคราะห์ทางพิษวิทยา
กรมอนามัย

ลำดับที่	สารเคมี	วิธีวิเคราะห์
18	Bis(2-ethylhexyl)phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
21	Butanol	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
22	Butyl Benzyl Phthalate	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(a)
23	Cadmium	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a) 1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
24	Carbazole	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
27	Chlordane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
28	p-Chloroaniline	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
29	Chlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
32	2-Chlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)

Signature

34 Chromium (III)...

(นางวิภาดา ชัยพรกุลโต)
ผู้อำนวยการศูนย์มาตรฐานวิธีวิเคราะห์ทางพิษวิทยา
กรมอนามัย

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
34	Chromium (III)	1) Digestion, Inductively Coupled Plasma Method; Colorimetric Method; Calculation ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Colorimetric Method; Calculation ^(a)
35	Chromium (VI)	Colorimetric Method ^(a)
36	Chrysene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
37	Cyanide	Distillation, Colorimetric Method ^(a)
38	2,4-D	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
39	DDD	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
40	DDE	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
41	DDT	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
42	Dibenz(a,h)anthracene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
43	Di-n-Butyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
47	3,3-Dichlorobenzidine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)

51 cis-1,2-Dichloroethylene...

สปริง
(บริษัท) จี.ที.ที. (จี.ที.ที. จำกัด)
ผู้ดำเนินการปฏิบัติการวิเคราะห์ทดสอบมลพิษ
และประเมินความเสี่ยงสุขภาพ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
53	2,4-Dichlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
57	Dieldrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
58	Diethyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
59	2,4-Dimethylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
60	2,4-Dinitrophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
61	2,4-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
62	2,6-Dinitrotoluene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
63	Di-n-Octyl Phthalate	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
64	Endosulfan	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
65	Endrin	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
66	Ethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
67	Fluoranthene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)

สปริง
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ผู้ดำเนินการปฏิบัติการวิเคราะห์ทดสอบมลพิษ
และประเมินความเสี่ยงสุขภาพ

68 Fluorene...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
68	Fluorene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
69	Heptachlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
70	Heptachlor epoxide	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
71	Hexachlorobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
72	Hexachloro-1,3-butadiene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
73	n-Hexane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
74	α-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
75	β-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
76	γ-HCH	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
77	Hexachlorocyclopentadiene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
78	Hexachloroethane	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
79	Indeno(1,2,3-cd)pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
80	Isophorone	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
81	Lead	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
82	Manganese	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
83	Mercury	1) Cold Vapor Atomic Absorption Spectrometric Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾

84 Methanol...

Signature
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กองเคมีภัณฑ์และเคมีภัณฑ์

ลำดับที่	สารเคมี	วิธีวิเคราะห์
84	Methanol	1) Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾ 2) Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
85	Methoxychlor	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
86	Methyl Bromide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
87	Methylene Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
88	2-Methylphenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
89	2-Methylnaphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
90	Methyl tert-Butyl Ether	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
91	Naphthalene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
92	Nickel	1) Digestion, Inductively Coupled Plasma Method ⁽⁴⁾ 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ⁽⁴⁾
93	Nitrobenzene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
94	N-Nitrosodiphenylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
95	N-Nitrosodi-n-Propylamine	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾
96	Polychlorinated Biphenyls - PCB 1016 - PCB 1221 - PCB 1232 - PCB 1242 - PCB 1248 - PCB 1254 - PCB 1260	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾ Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾ Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾ Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ⁽⁴⁾

Signature
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ผู้อำนวยการศูนย์การวิจัยและพัฒนา
กองเคมีภัณฑ์และเคมีภัณฑ์

97 Pentachlorophenol...

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
97	Pentachlorophenol	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
98	pH	Electrometric Method ^(a)
99	Phenanthrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
100	Phenol	1) Distillation, Direct Photometric Method ^(a) 2) Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
101	Pyrene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
102	Selenium	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
103	Silver	1) Digestion, Inductively Coupled Plasma Method ^(a) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(a)
104	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
105	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
106	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
107	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
108	Toxaphene	Liquid-Liquid Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(a)
109	TPH (C ₅ -C ₉)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ⁽¹⁾⁽²⁾⁽⁴⁾
110	TPH (C ₅ -C ₁₀)	Solvent Extraction, Gas Chromatographic Method ^{(a)(2)(4)}
111	TPH (C ₁₀ -C ₃₀)	Solvent Extraction, Gas Chromatographic Method ^{(a)(2)(4)}
112	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)
113	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(a)

114 1,1,2-Trichloroethane...

ผู้ตรวจการแผ่นดินกรุงเทพมหานคร
(นางวิภาดา บุญเลิศ) 3 Carbon Monoxide...
ผู้ตรวจการแผ่นดินกรุงเทพมหานคร
นางวิภาดา บุญเลิศ

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

หมายเหตุ: (เปลี่ยนหน่วย) จำนวน 16 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Antimony	Isokinetic, Digestion, Inductively Coupled Plasma Method ^(a)
2	Arsenic	Isokinetic, Digestion, Inductively Coupled Plasma Method ^(a)

3 Carbon Monoxide...

ผู้ตรวจการแผ่นดินกรุงเทพมหานคร
(นางวิภาดา บุญเลิศ) 3 Carbon Monoxide...
ผู้ตรวจการแผ่นดินกรุงเทพมหานคร
นางวิภาดา บุญเลิศ

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

Signature
(นางธิษฏาณันต์ อัครกุลสุวิไล)
ผู้อำนวยการกลุ่มควบคุมมลพิษทางอากาศ
กรมควบคุมมลพิษ

สิ่งบ่งชี้...

สิ่งบ่งชี้หรือวัสดุที่ใช้แล้ว จำนวน 35 รายการ

ลำดับที่	สารมลพิษ	วิธีวิเคราะห์
1	Aldrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^[1,9,25] 2) Soxhlet Extraction, Gas Chromatographic Method ^[10,22] 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^[22,31]
2	Antimony	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[1,6,16] 3) Digestion, Inductively Coupled Plasma Method ^[7,15] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,16]
3	Arsenic	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[1,6,16] 3) Digestion, Inductively Coupled Plasma Method ^[7,15] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,16]
4	Barium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[1,6,16] 3) Digestion, Inductively Coupled Plasma Method ^[7,15] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,16]
5	Beryllium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^[1,6,15] 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[1,6,16] 3) Digestion, Inductively Coupled Plasma Method ^[7,15] 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^[7,16]

Signature
(นางธิษฏาณันต์ อัครกุลสุวิไล)
ผู้อำนวยการกลุ่มควบคุมมลพิษทางอากาศ
กรมควบคุมมลพิษ

6 Cadmium...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
6	Cadmium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
7	Chlordane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.21) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(2.31)
8	Chromium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
9	Chromium (II)	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1.4.15,17) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Waste Extraction, Colorimetric Method; Calculation Method ^(1.4.15,17) 3) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7.15,17)
10	Chromium (VI)	4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7.15,16,17) 1) Waste Extraction, Colorimetric Method ^(1.4.17) 2) Alkaline Digestion, Colorimetric Method ^(1.17)

วิธีวิเคราะห์
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ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์และทดสอบ
กรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์

11 Cobalt...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
11	Cobalt	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
12	Copper	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1.4.13) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1.4.16) 3) Digestion, Inductively Coupled Plasma Method ^(7.13) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7.16)
13	2,4-D	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.21) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(2.31)
14	DDD	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.21) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(2.31)
15	DDE	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10.21) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(2.31)
16	DDT	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1.9.23)

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ผู้อำนวยการศูนย์มาตรฐานวิธีการวิเคราะห์และทดสอบ
กรมส่งเสริมการค้าระหว่างประเทศ
กระทรวงพาณิชย์

2) Soxhlet...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
17	Dieldrin	2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31) 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,25) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
18	Endrin	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,25) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
19	Heptachlor	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,25) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
20	Lead	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
21	Lindane	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,25) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
22	Mercury	1) Waste Extraction, Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ^(1,4,18)

2) Waste Extraction...

Signature
(นางสาวกัญญาภัฏ วัชรฤกษ์กุล)

ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์ทดสอบพิษ


ลำดับที่	สารเคมี	วิธีวิเคราะห์
23	Methoxychlor	2) Waste Extraction, Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ^(1,4,19) 3) Waste Extraction, Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ^(1,4,20) 4) Digestion, Cold-Vapor Atomic Absorption Spectrometric Method ⁽¹⁸⁾ 5) Thermal Decomposition Amalgamation and Atomic Absorption Spectrometric Method ⁽¹⁹⁾ 6) Digestion, Cold-Vapor Atomic Fluorescence Spectrometric Method ⁽²⁰⁾ 1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,25) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
24	Mirex	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,9,25) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,22) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(22,31)
25	Molybdenum	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
26	Nickel	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)

27 Polychlorinated...

Signature
(นางสาวกัญญาภัฏ วัชรฤกษ์กุล)


ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์ทดสอบพิษ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
27	Polychlorinated biphenyls (PCBs) - Aroclor 1016 - Aroclor 1221 - Aroclor 1232 - Aroclor 1242 - Aroclor 1248 - Aroclor 1254 - Aroclor 1260 - 2-Chlorobiphenyl - 2,3-Dichlorobiphenyl - 2,2',5'-Trichlorobiphenyl - 2,4',5'-Trichlorobiphenyl - 2,2',3,5'-Tetrachlorobiphenyl - 2,2',5,5'-Tetrachlorobiphenyl - 2,3',4,4'-Tetrachlorobiphenyl - 2,2',3,4,5'-Pentachlorobiphenyl - 2,2',4,5,5'-Pentachlorobiphenyl - 2,3,3',4',6-Pentachlorobiphenyl - 2,2',3,4,4',5'-Hexachlorobiphenyl - 2,2',3,4,5,5'-Hexachlorobiphenyl - 2,2',3,5,5',6-Hexachlorobiphenyl - 2,2',4,4',5,5'-Hexachlorobiphenyl - 2,2',3,3',4,4',5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5'-Heptachlorobiphenyl - 2,2',3,4,4',5,5',6-Heptachlorobiphenyl - 2,2',3,4',5,5',6-Heptachlorobiphenyl - 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic Method ^(1,2,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(23,31)


 (นางจิราญณ์ จิตคุมทอง)
 ผู้อำนวยการศูนย์วิจัยการวิเคราะห์สิ่งแวดล้อมพิษ

28 Pentachlorophenol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
28	Pentachlorophenol	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,2,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(23,31)
29	pH	Electrometric Method ^(29,30)
30	Selenium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
31	Silver	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16)
32	Thallium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(7,16)
33	Toxaphene	1) Waste Extraction, Separatory Funnel Liquid-Liquid Extraction, Gas Chromatographic/Mass Spectrometric Method ^(1,2,23) 2) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 3) Automated Soxhlet Extraction, Gas Chromatographic Method ^(23,31)
34	Vanadium	1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(1,4,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(1,4,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15)


 (นางจิราญณ์ จิตคุมทอง)
 ผู้อำนวยการศูนย์วิจัยการวิเคราะห์สิ่งแวดล้อมพิษ

4) Digestion...

ลำดับที่	สารเคมี	วิธีการวิเคราะห์
35	Zinc	4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16) 1) Waste Extraction, Digestion, Inductively Coupled Plasma Method ^(14,15) 2) Waste Extraction, Digestion, Inductively Coupled Plasma/Mass Spectrometric Method ^(14,16) 3) Digestion, Inductively Coupled Plasma Method ^(7,15) 4) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)

ฉบับจำนวน 125 รายการ

ลำดับที่	สารเคมี	วิธีการวิเคราะห์
1	Acenaphthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
2	Acetone	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,20)
3	Aldrin	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
4	Anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
5	Antimony	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
6	Arsenic	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
7	Atrazine	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
8	Barium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)

9 Benz(a)anthracene...

วิมล (นางวิมล วัฒนศิริกุลกิจ)

ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์ทดสอบ

ลำดับที่	สารเคมี	วิธีการวิเคราะห์
9	Benz(a)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
10	Benzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,20)
11	Benzo(b)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
12	Benzo(k)fluoranthene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
13	Benzoic acid	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
14	Benzo(a)pyrene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
15	Benzog(h,i)perylene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
16	Beryllium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
17	Bis(2-chloroethyl)ether	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
18	Bis(2-ethylhexyl)phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
19	Bromodichloromethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,20)
20	Bromoform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,20)
21	Butanol	Equilibrium Headspace, Gas Chromatographic/ Mass Spectrometric Method ^(12,20)
22	Butyl Benzyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
23	Cadmium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
24	Carbazole	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
25	Carbon Disulfide	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,20)

26 Carbon tetrachloride...

วิมล (นางวิมล วัฒนศิริกุลกิจ)

ผู้อำนวยการศูนย์ปฏิบัติการวิเคราะห์ทดสอบ

ลำดับที่	สารเคมี	วิธีวิเคราะห์
26	Carbon tetrachloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
27	Chlordane	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
28	p-Chloroaniline	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
29	Chlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
30	Chlorodibromomethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
31	Chloroform	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
32	2-Chlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
33	Chromium	1) Digestion, Inductively Coupled Plasma Method ^(7,15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7,16)
34	Chromium (II)	1) Digestion, Inductively Coupled Plasma Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,8,15,17) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method; Alkaline Digestion, Colorimetric Method; Calculation Method ^(7,8,16,17)
35	Chromium (VI)	Alkaline Digestion, Colorimetric Method ^(8,17)
36	Chrysene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
37	Cyanide	Extraction, Distillation, Colorimetric Method ^(24,27,28)
38	2,4-D	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
39	DDD	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)

40 DDE...

57 Dieldrin...

(นางธิษฏาญณ์ อัครฤกษ์กุล)
ผู้อำนวยการศูนย์วิจัยวิทยาศาสตร์และเทคโนโลยี

ลำดับที่	สารเคมี	วิธีวิเคราะห์
40	DDE	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
41	DDT	1) Soxhlet Extraction, Gas Chromatographic Method ^(10,23) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
42	Dibenz(a,h)anthracene	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
43	Di-n-Butyl Phthalate	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
44	1,2-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
45	1,3-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
46	1,4-Dichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
47	3,3-Dichlorobenzidine	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
48	1,1-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
49	1,2-Dichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
50	1,1-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
51	cis-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
52	trans-1,2-Dichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
53	2,4-Dichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25,31)
54	1,2-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
55	1,3-Dichloropropane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)
56	1,3-Dichloropropene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14,24)

57 Dieldrin...

(นางธิษฏาญณ์ อัครฤกษ์กุล)
ผู้อำนวยการศูนย์วิจัยวิทยาศาสตร์และเทคโนโลยี

ลำดับที่	สารเคมี	วิธีวิเคราะห์
101	Selenium	1) Digestion, Inductively Coupled Plasma Method ^(7.15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7.16)
102	Silver	1) Digestion, Inductively Coupled Plasma Method ^(7.15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7.16)
103	Styrene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
104	1,1,2,2-Tetrachloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
105	Tetrachloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
106	Toluene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
107	Toxaphene	1) Soxhlet Extraction, Gas Chromatographic Method ^(10.24) 2) Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25.31)
108	TPH (C ₅ -C ₈)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
109	TPH (C ₈ -C ₁₆)	1) Solvent Extraction, Gas Chromatographic Method ^(11.21) 2) Automated Soxhlet Extraction, Gas Chromatographic Method ^(21.31)
110	TPH (C ₁₆ - C ₃₅)	1) Solvent Extraction, Gas Chromatographic Method ^(11.21) 2) Automated Soxhlet Extraction, Gas Chromatographic Method ^(21.31)
111	1,2,4-Trichlorobenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
112	1,1,1-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
113	1,1,2-Trichloroethane	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
114	Trichloroethylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
115	2,4,5-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25.31)



(นางฉัตรชัย สัตย์สุวิไล)

ผู้อำนวยการศูนย์ปฏิบัติการด้านพิษภัยสิ่งแวดล้อม

116 2,4,6-Trichlorophenol...

ลำดับที่	สารเคมี	วิธีวิเคราะห์
116	2,4,6-Trichlorophenol	Automated Soxhlet Extraction, Gas Chromatographic/ Mass Spectrometric Method ^(25.31)
117	1,3,5-Trimethylbenzene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
118	Vanadium	1) Digestion, Inductively Coupled Plasma Method ^(7.15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7.16)
119	Vinyl Acetate	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
120	Vinyl Chloride	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
121	m-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
122	o-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
123	p-Xylene	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
124	Xylene (Total)	Purge and Trap, Gas Chromatographic/ Mass Spectrometric Method ^(14.24)
125	Zinc	1) Digestion, Inductively Coupled Plasma Method ^(7.15) 2) Digestion, Inductively Coupled Plasma/ Mass Spectrometric Method ^(7.16)

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และสารอันตรายในสิ่งแวดล้อม

